United States Department of Agriculture

Forest Service

2013

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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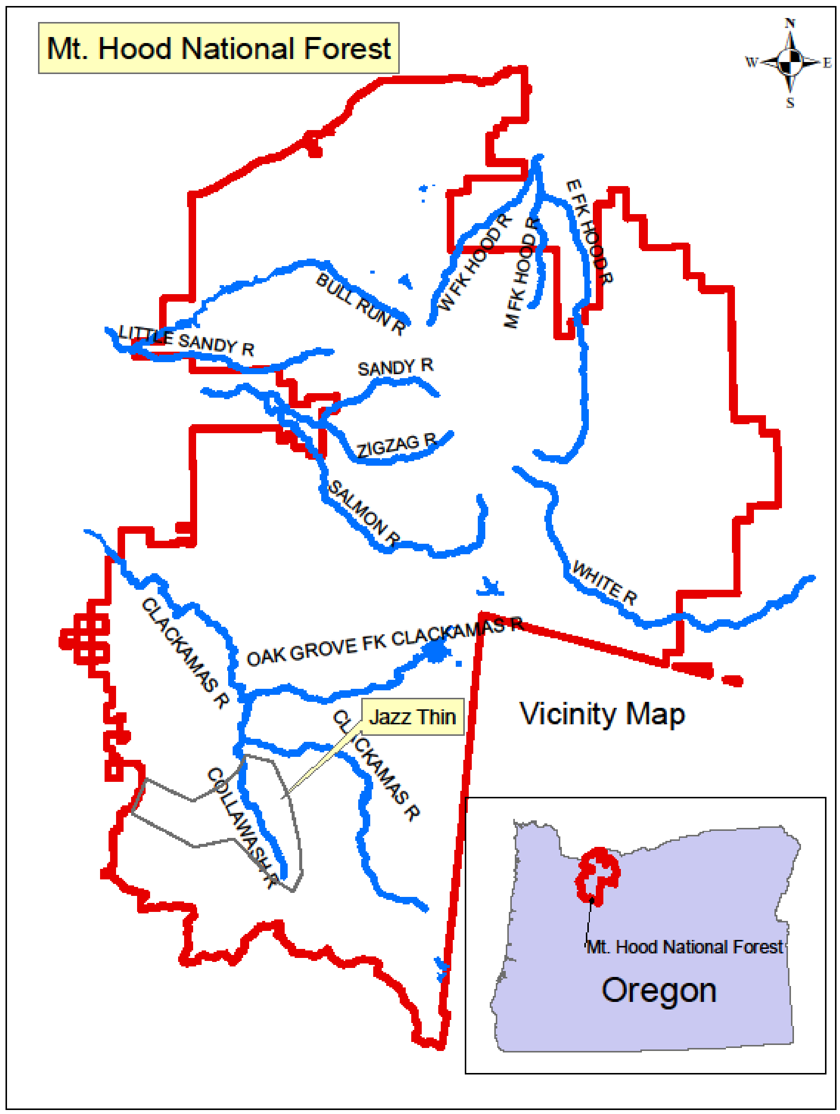
Summary

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/Hot Springs 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 related to the Jazz project.

The proposed Jazz project area is located in the Collawash Watershed; a tributary of the Clackamas River. At one time the Hot Springs Fork of the Collawash River and the rest of the Collawash were considered a separate 5th field watersheds but they have since been combined. 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 valleys 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 return intervals are relatively long because of moist conditions in most years, fires 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 solidipes*), 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. Plantations were established 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 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 eight 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 disturbance agents.

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 were relatively uniform mature forest but became fragmented by clearcuts as plantations were established. 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. Other tree species such as western hemlock, grand fir, Pacific silver fir and 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 these species throughout the stand.

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 and ground vegetation 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, and 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 products 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 who cut and remove the timber, equipment operators who repair and maintain roads, mechanics who service equipment, mill workers who process the raw materials, and craftsman who 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 following 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.

- The Forest Plan was amended by the 2005 Pacific Northwest Region Final Environmental Impact Statement for the Invasive Plant Program, hereafter referred to as the R6 2005 FEIS. The R6 2005 FEIS culminated in a Record of Decision (USDA 2005). Standards and guidelines from the 2005 FEIS are addressed in section 3.14.

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** land allocations have primary or secondary goals of maintaining healthy stands and providing forest products 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.

  - The **viewshed** land allocation is designed to provide attractive, visually appealing forest scenery. It would ensure that vegetation management practices create 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 makes recommendations for management to meet the goals of the Forest Plan.

The purpose and need is consistent with the recommendations of that analysis. The Watershed Analysis specifically recommended actions similar to the current proposed action for Jazz including:

- Variable density thinning in plantations in the matrix (page 4-5).
- Thinning plantations in riparian reserves and late-successional reserves to accelerate late-seral structure (page 4-5).
- Create perforated forest patterns (gaps) where possible (page 4-10).

This project has adopted the concepts for riparian reserve delineation described in the watershed analysis (page 4-17). 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 present 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. 6-17). The assessment specifically recommended actions to accelerate late-seral structure similar to the current proposed action for Jazz including:

- Thinning to produce large trees, or to release advanced regeneration of conifers, hardwoods or other plants.
- Killing trees to make snags and coarse woody debris.
- Developing multiple canopy layers, canopy gaps, and the development of patchy understory.

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 3.4 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. 3.4.

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 would require a National Pollution Discharge Elimination System (NPDES) permit, due to ongoing judicial proceedings. Should it be determined that a NPDES permit is required for this project, the Forest Service will comply with any applicable NPDES permitting requirements (s. 3.3.6.3).

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 is 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 is 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 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 is 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 and would be ¼ acre or smaller. 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 to leave, 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 Roads have aggregate surfacing unless noted otherwise
6300	3.7	63,200	Paved for most of length. 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	1,300	
6310	9.77	30,000	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	1,300	
6311	5.12	16,400	Repair at Cap creek funded by other contract.
6311120	0.3	1,100	
6311150	0.66	1,700	
6320	3.3	3,900	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	14,300	10 cubic yards of Spot Rock
6330014	0.2	3,500	100 cubic yards Pit Run rock
6330130	0.25	700	
6330200	0.53	1,400	

Road Number	Length (miles)	Cost $	Notes Roads have aggregate surfacing unless noted otherwise
6330240	0.33	900	
6340	7.94	27,500	115 cubic yards Spot Rock, 5 Water Bars, 1 Drain Dip, Regrade Roadway with 30 cubic yards Pit Run
6340017	0.15	400	Native surface
6340019	0.18	500	Native surface
6340140	0.97	2,500	
6340150	0.17	500	
6340164	0.3	1,700	30 cubic yards Pit Run
6340170	0.56	1,500	
6340230	0.5	1,600	
6340240	0.58	1,500	
6340290	0.81	2,200	
6341	.34	900	
6341011	0.11	1,200	
6350	4	38,600	Paved for first 3.25 miles. 200 ton AC Level & Patch, 1 Roll Poly Grid, 1 Roll Glass Grid, 15 cubic yards Spot Rock
6350120	0.63	1,600	
6350150	0.1	300	
6350160	3.78	16,600	15 cubic yards Spot Rock, 100 cubic yards Slough Removal
6350180	0.1	300	
6350200	0.25	300	Paved
6360	2.12	5,300	
6370	1.2	4,400	
6380	1.9	6,300	25 cubic yards Spot Rock
6380120	0.57	4,500	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	500	
7010019	0.25	3,000	50 cubic yards Spot Rock
7010020	0.15	1,900	30 cubic yards Spot Rock
7010120	0.82	3,700	40 cubic yards Spot Rock
7015	1.53	4,600	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 11.5 miles of existing road alignments that remained after the stands were clearcut would be reused as temporary roads and decommissioned again upon project completion. Of these 11.5 miles, 70% were previously system roads and 30% were previously temporary roads. Of these 11.5 miles, 43% were never actively decommissioned. Most of the old temporary roads were not decommissioned after clearcutting, which was a common practice at that time. 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 clearcut 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, exposed mineral soil is covered with slash or other ground cover, 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** * indicates additional notes below
6 to 14	0.73	* No longer a system road, never actively decommissioned.
10	0.06	Never was a system road, never actively decommissioned.
12&14	0.1	New construction
12	0.55	Never was a system road, never actively decommissioned.
14	0.13	No longer a system road
18	0.15	* Never was a system road, never actively decommissioned
24	0.04	No longer a system road
26	0.2	Never was a system road, never actively decommissioned
30	0.35	No longer a system road, never actively decommissioned
32	0.16	* Never was a system road, never actively decommissioned
38	0.49	Never was a system road, never actively decommissioned
34	0.04	No longer a system road
46	0.19	New construction
58	0.62	No longer a system road
64,66	0.62	* No longer a system road
64	0.18	No longer a system road, never actively decommissioned
70	0.50	* No longer a system road
74	0.54	No longer a system road, never actively decommissioned
78	0.03	Never was a system road
80	0.14	No longer a system road
84	0.05	No longer a system road
86	0.07	Never was a system road, never actively decommissioned
88	0.06	New construction
90	0.11	Never was a system road
94	0.2	No longer a system road
98	0.11	No longer a system road
100	0.15	No longer a system road, never actively decommissioned
100	0.2	Never was a system road, never actively decommissioned
104	0.1	Never was a system road, never actively decommissioned
108	0.1	Never was a system road
110	0.31	No longer a system road
112	0.43	* No longer a system road
118	0.26	* No longer a system road
118	0.29	No longer a system road, never actively decommissioned

Unit #	Temporary Roads (miles)	Notes * indicates additional notes below
118	0.15	Never was a system road
126	0.13	Never was a system road, never actively decommissioned
128	0.02	New construction
130	0.08	Never was a system road
132	0.58	* No longer a system road
132	0.16	Never was a system road
138, 140	0.94	No longer a system road
138	0.02	New construction
138	0.07	Never was a system road
144	0.45	* No longer a system road
146	0.4	* Never was a system road, never actively decommissioned
148	0.04	Never was a system road
154	0.16	* Never was a system road, never actively decommissioned
154	0.03	Never was a system road, never actively decommissioned
154	0.11	No longer a system road
156	0.11	No longer a system road
158	0.2	No longer a system road
Total New	**0.4**	
Total Old	**11.5**	

- 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.

  Because the road had not been actively decommissioned, the road was used for field reconnaissance for the project. Minor brushing and whip felling was done in order to facilitate the use of the road and avoid damage to vehicles.

  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 additional brushing and blading and 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 to divert water off the road.

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 70: This road was decommissioned in error. The 2007 Clackamas Restoration EA and Decision Notice approved the decommissioning of the end section of road 6300-185 for 0.22 mile with notes that the first section of the road was needed for thinning. However due to an oversight during contract preparation and the entire 0.96 mile was decommissioned during the early planning of the Jazz project. Approximately 0.5 mile would be reconstructed as a temporary road on this alignment to access unit 70 and decommissioned again after project implementation.

- 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. A logging systems report is in the analysis file and is incorporated by reference. It includes initial estimates of logging systems and landings.

	Estimated Acres
Ground Based	440
Skyline	939
Helicopter	209

1.4.7.1 Landings

The project also includes the use of landings. Landings are areas on or directly adjacent to roads where logs are brought to be loaded onto log trucks. Landing sizes vary based on the logging system and the types of equipment that need to be safely accommodated. For similar projects on the west side of the Forest, the following landing sizes are typical:

An average ground-based logging landing is 50-feet wide by 70-feet long; allowing room for tractors to come and go, a loader to sort logs, and room for a log deck.

An average skyline logging landing is 40-feet wide by 70-feet long; allowing room for a yarder, a loader to sort logs, and a log deck. The standard practice today is to use parallel skyline settings wherever possible. This practice results in much smaller disturbed area: no additional landing construction is needed because the landing overlaps the road prism and requires very little additional clearing. Often in the original clearcut logging, fan shaped settings were used that resulted in larger landings and greater levels of ground disturbance as corridors converge at the landing. In thinning operations, parallel skyline settings avoid this disturbance. Some landings provide access for a tractor unit on one side of a road and a skyline unit on the other side.

An average helicopter landing size is approximately 100-feet wide by 200-feet long with some additional trees removed for the flight path coming into the landing. Some service landings approximately 60-feet wide by 60-feet long are also needed where helicopters land and are refueled. Where possible, helicopter landings utilize existing openings such as rock quarries or road intersections. Since helicopters were not used for the original clearcut logging, many units that are proposed for helicopter logging today have existing skyline or ground-based landings that would not be reused.

The plantations were logged before and have existing landings that would be reused where feasible. Some existing landings have brush or small trees growing on them that would be removed.

Approximately 15 landings would be used for helicopter log landings and service landings equating to approximately 7 acres, most of which is already disturbed as part of a road or rock quarry. For tractor and skyline units, approximately 124 existing standard landings would be reused, resulting in little to no new ground disturbance, although some level of blading and reconditioning would occur on these areas, totaling approximately 9 acres. For parallel skyline landings where little or no additional ground disturbance would be required outside the road prism, approximately 112 have been used before (7 acres) and approximately 55 have not been used before (3.5 acres). Most of the disturbance in parallel skyline landings already exists within the road prism. Approximately 6 new standard size landings would need to be constructed (1/2 acre). In total, landings would occupy about 27 acres, with most of the disturbance occurring within road prisms or other created openings that remain on the landscape from past timber management activities.

The final landing locations and sizes are approved by contract administrators using the project design criteria (PDC). The PDCs include minimum spacing away from streams and post harvest restoration.

1.4.8 Unit Table

Unit #	Acres	Unit #	Acres	Unit #	Acres
2	2	58	28	108	39
4	5	60	27	110	27
6	2	62	33	112	21
8	15	64	33	114	23
10	7	66	9	116	29
12	51	68	13	118	67
14	13	69	14	120	12
16	9	70	33	122	48
18	17	72	4	124	45
20	3	74	38	126	47
22	1	76	13	128	41
24	11	78	24	130	65
26	32	80	60	132	50
28	33	82	28	134	46
30	38	83	27	136	3
32	27	84	24	137	2
34	38	86	32	138	37
36	32	88	23	140	34
38	25	90	25	142	2

Unit #	Acres	Unit #	Acres	Unit #	Acres
40	31	92	4	144	28
42	5	94	18	146	46
44	22	96	3	148	25
46	24	98	17	150	7
48	21	100	47	152	2
50	31	101	1	154	39
52	39	102	2	156	38
54	27	104	45	158	7
56	8	106	29		2,053

1.4.9 Project 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. Some of these practices are a project-specific implementation of the National Core BMP Technical Guide (USDA 2012) to minimize impacts to water quality. Effectiveness is addressed in s. 3.3.6. The National Core BMP Program was developed to improve agency performance and accountability in managing water quality consistent with the Federal Clean Water Act (CWA) and State water quality programs, and represents the best available science regarding best management practices. The 2012 Technical Guide (USDA 2012) is incorporated by reference and detailed in the BMP checklist in the project file.

1. **Seasonal restrictions**

1A. **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

National Core BMP Technical Guide - Veg 2, Veg 4, and Veg 7.

1B. **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.

1C. **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.*

1D. **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 no 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.*

   4A1. 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. National Core BMP Technical Guide - Plan 3 and Veg 3.

   4A2. 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. See B5. National Core BMP Technical Guide - Plan 3 and Veg 3.

4A3. 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. See PDC #9 for additional information on stream buffers.

	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.

National Core BMP Technical Guide - Plan 3 and Veg 3.

4A4. 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. National Core BMP Technical Guide - Plan 3, Veg 2 and Veg 3.

4A5. 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. National Core BMP Technical Guide – Road 3, Road 4, Road 5, Road 6, Road 7, Veg 2, Veg 3, Veg 4, Veg 6 and Veg 7.

4B. Tree Felling

4B1. 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). National Core BMP Technical Guide - Plan 3 and Veg 3.

4B2. Thinning within the riparian reserve on perennial streams would occur; however, approximately 50% canopy closure would remain in this treated zone. National Core BMP Technical Guide - Plan 3 and Veg 3.

4B3. 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. National Core BMP Technical Guide - Plan 3, AqEco 2, Veg 3, Veg 4 and Veg 5.

4B4. Felling in riparian reserves would not create openings greater than 1/4 acre in size. National Core BMP Technical Guide - Veg 3.

4B5. 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. National Core BMP Technical Guide - Plan 3 and Veg 3.

4C. Yarding

4C1. 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. National Core BMP Technical Guide - Plan 3, AqEco 2, Veg 2, Veg 3, Veg 4 and Veg 5.

4C2. 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. National Core BMP Technical Guide - Plan 3, AqEco 2, Veg 2, Veg 3, and Veg 5.

4C3. 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). National Core BMP Technical Guide - Plan 3, AqEco 2, Veg 3, and Veg 5.

4C4. The use of ground based yarding and felling equipment is prohibited on slopes exceeding 35%, within riparian reserves. National Core BMP Technical Guide - Plan 3, Veg 2, Veg 3, and Veg 4.

4C5. 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. National Core BMP Technical Guide - Plan 3, Veg 2, Veg 3, and Veg 6.

4C6. 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. National Core BMP Technical Guide - Plan 3, Veg 2, Veg 3, and Veg 6.

4C7. Landings planned for use in the wet season, may need to be surfaced with aggregate material, dependent upon soil moisture conditions. National Core BMP Technical Guide - Veg 2, Veg 3, Veg 6 and Veg 7.

4C8. 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. National Core BMP Technical Guide - Plan 3, Veg 2, Veg 3, Veg 4 and Veg 6.

4C9. 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. National Core BMP Technical Guide - Plan 3, Veg 2, Veg 3, and Veg 4.

4C10. Where feasible, harvesters would place logging slash in their path. National Core BMP Technical Guide - Veg 2, Veg 3, and Veg 4.

4D. Temporary Road and Landing Construction and Reconstruction

4D1. Construction of new temporary roads or landings within 500 feet of LFH or within 200 feet of any other stream, would not occur. National Core BMP Technical Guide - Plan 3, Road 1, Road 5, Veg 2, Veg 3 and Veg 6.

4D2. 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. National Core BMP Technical Guide - Plan 3, AqEco 2, Road 1, Road 5, Road 7, Veg 3.

4D3. 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%. National Core BMP Technical Guide - Plan 3, Road 1, Road 5, Veg 2, and Veg 3.

4D4. 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). National Core BMP Technical Guide - Road 5, Veg 2, Veg 3 and Veg 7.

4D5. 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). National Core BMP Technical Guide - Plan 3, AqEco 2, Road 1, Road 5, Veg 2, and Veg 3.

4D6. Cross drains discharge to stable vegetated slopes where the outflow would quickly infiltrate the soil and not develop a channel to a stream. National Core BMP Technical Guide - Plan 3, AqEco 2, Road 1, Road 5, Veg 2, and Veg 3.

4D7. When constructing or reconstructing roads, the width of the compacted surface and ditch line would not be wider than 24 feet except at landings. National Core BMP Technical Guide - Road 5 and Veg 1.

4D8. 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. National Core BMP Technical Guide - AqEco 2, Road 5, Veg 2, Veg 3 and Veg 6.

4E. System Road Renovation, Reconstruction, and Maintenance

4E1. Limit scheduled soil disturbing renovation and reconstruction activities to the dry season, unless the road segment has no hydrologic connection. National Core BMP Technical Guide - AqEco 2, Road 3, Veg 2, and Veg 3.

4E2. No Road renovation or reconstruction would occur within 200 feet of LFH. National Core BMP Technical Guide – Plan 3, AqEco 2, Road 3, Road 4, Veg 2, and Veg 3.

4E3. 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. National Core BMP Technical Guide –Road 3, Road 4 and Veg 3.

4E4. 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. National Core BMP Technical Guide –AqEco 2, Road 3, Road 4, Veg 2, and Veg 3.

4E5. 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. National Core BMP Technical Guide – AqEco 2, Road 4, Veg 2, and Veg 3.

4E6. 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. National Core BMP Technical Guide – Plan 3, AqEco 2, Road 4, Veg 2, and Veg 3.

4E7. 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. National Core BMP Technical Guide –AqEco 2, Road 3, Road 4, Veg 2, and Veg 3.

4E8. 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. National Core BMP Technical Guide –AqEco 2, Road 4, Road 7 and Veg 3.

4E9. Close and waterbar native surfaced roads prior to the wet season and between operating seasons to prevent use and reduce erosion. National Core BMP Technical Guide –Road 1, Road 4, Road 6, Veg 2, and Veg 3.

4E10. 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. National Core BMP Technical Guide – AqEco 2, Road 1, Road 3, Road 4, Road 6, Veg 2, and Veg 3.

4F. Timber Transport

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

4F1. Avoid haul routes that require travel over unstable road segments, if road use or failure would result in sediment delivery to any stream. National Core BMP Technical Guide – AqEco 2, Road 1, Road 4 and Veg 3.

4F2. 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. National Core BMP Technical Guide – AqEco 2, Road 1, Road 4, Veg 2, Veg 3 and Veg 7.

Dry Season Haul:
4F3. 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.
National Core BMP Technical Guide – AqEco 2, Road 1, Road 4, Veg 2, and Veg 3.

Wet Season Haul:
4F5. Timber transport is not allowed on native surfaced roads during the wet season. National Core BMP Technical Guide – Road 1, Road 4, Veg 2, Veg 3 and Veg 7.

4F6. 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.
National Core BMP Technical Guide – Plan 3, AqEco 2, Road 1, Road 3, Road 4, Road 7, Veg 2, Veg 3 and Veg 7.

5. **Other Logging Systems and Roads**

5A. Adjacent to stream protection buffers there would be additional restrictions for certain ground-based equipment. Only low impact harvesting equipment such as mechanical harvesters would be allowed within 150 feet of listed fish habitat, or within 100 feet of other perennial streams, or within 80 feet of intermittent streams. Distances are measured slope distance in the direction of the slope aspect. Exceptions may be made for the use of existing skid trails where recommended by the unit fisheries biologist or hydrologist. National Core BMP Technical Guide – Plan 3, Veg 2, Veg 3, Veg 4 and Veg 5.

5B. **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.
National Core BMP Technical Guide – Veg 2 and Veg 4.

5C. **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. National Core BMP Technical Guide – Veg 2 and Veg 4.

5D. **Rutting** - Rutting within skid trails should not exceed 12 inches in depth over more than 10 percent of a designated skid trail system. National Core BMP Technical Guide – Veg 2 and Veg 4.

5E. **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. National Core BMP Technical Guide – Road 1, Road 5, Veg 2 and Veg 6.

5F. **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. National Core BMP Technical Guide – Road 5, Road 6, Veg 2 and Veg 3.

5G. **Snowplowing** - If snowplowing occurs; the operator would be required to obtain a snow plowing permit that details how snow would be removed in a manner which protects the transportation resource and all other adjacent or connected resources. Upon completion of snowplowing, windrows and snow berms would be removed or breached to avoid accumulation or channelization of snow melt on the road. Breaching would avoid the discharge of water from the road into streams or onto erosive slopes. Any loss of roadway surfacing materials as a result of snowplowing operations would be replaced in kind by the operator. The operator would repair or replace any roadway structures that are damaged as a result of snowplowing operations. National Core BMP Technical Guide – Road 8 and Veg 7.

5H. **Spill Prevention** - An approved Spill Prevention Control and Containment Plan (SPCCP) would be created, which describes measures to prevent or reduce impacts from potential spills. The SPCCP would include a description of the hazardous materials that would be used; and a spill containment kit would be located on-site. All trucks used for refueling would carry a hazardous material recovery kit. All vehicles and machinery would be free of petroleum leaks. Any leaks that occur would be immediately repaired. Power equipment would be refueled at least 150 feet from water bodies to prevent direct delivery of contaminants into a water body. If local site conditions do not allow for a 150-foot setback, then refueling would be as far away as possible from the water body. For all immobile equipment, absorbent pads would be used. All petroleum products being transported or stored would be in approved containers meeting Occupational Safety and Health Administration standards and Oregon Department of Transportation. All vehicles hauling more than 300 gallons of fuel would have an approved communication system with which to report accidental spills. Any contaminated soil, vegetation or debris must be removed from National Forest System lands and disposed of in accordance with state laws. National Core BMP Technical Guide – Road 10.

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. *Forest Plan standard and guideline FW-025.*

   Native plant materials collected locally 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.*
National Core BMP Technical Guide – Veg 2, Veg 3, Veg 4, Veg 5 and Veg 6.

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. To minimize impact to water temperature, the following **minimum stream buffers** would be applied to all perennial streams:

Average Tree Height	Hill Slope < 30%	Hill Slope 30 to 60%	Hill slope > 60%
60 to 100 feet	50 feet	55 feet	60 feet
100 to 140 feet	70 feet	75 feet	85 feet

   Where different buffers are prescribed for listed fish (PDC # 4.A3), the wider buffer would be applied. Stand exam data is used to determine average tree height for each unit. Distances are measured slope distance. National Core BMP Technical Guide – Plan 3 and Veg 3.

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 come 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.

Firewood would be made available to the public at landings where feasible.

1.4.11 Monitoring

1.4.11.1 Project Level Monitoring

Prior to and during implementation, a multi-stage process is used on the Forest to ensure that a project is implemented as planned. Before beginning the on-the-ground presale process, which includes layout of the units, designating the trees to retain, and cruising the timber, the Presale Forestry Technicians and Presale Crew members meet with the Interdisciplinary Team (IDT) to transition to the implementation phase of the project. Resource specialists identify any resource concerns in individual units or highlight any key project design criteria on a unit-by-unit basis. After the presale work is completed, the project moves into the appraisal and contract preparation phase. One of the first steps in the process is to complete the Contract Project Design & Implementation Crosswalk Form. The purpose of the crosswalk is to ensure that all components of the NEPA Decision, including the project design criteria and terms and conditions from consultation, are incorporated into the contract. For each required component of the NEPA decision, the crosswalk identifies how and what stage in the process the component will be addressed (e.g., presale, contract, sale administration, post contract monitoring). The information generated from the crosswalk process is used to guide the contract preparation process and to identify any issues that need to be addressed by resource specialists. The crosswalk is usually prepared by the primary person responsible for developing the appraisal and contract, and signed by the District Ranger.

Prior to advertisement, a final review is conducted to ensure that the contract is prepared with the proper contract provisions and language; the project design criteria are properly inserted and contractually enforceable; and, the contract and appraisal meets Forest Service Handbook, Forest Service Manual and Stewardship Guide (where applicable) regulations and direction. This final review may be informal or may be formalized in a Forest-level review or “Plan-in-Hand”. “Plan-in-Hand” reviews are randomly selected and may or may not include Jazz. The goal of this formal review is to monitor and evaluate forest resource management prescriptions, to measure compliance with goals and objectives, and to make adjustments when needed. The "Plan-in-Hand" review is summarized in a letter to the Forest Supervisor which is included in the final appraisal/contract packet.

During implementation, the Sale Administrator in conjunction with the Forest Service Representative and Contracting Officer are responsible to ensure that the contract is administered properly throughout all stages of implementation. The sale administration team monitors compliance with the contract which contains the provision for resource protection, including but not limited to: seasonal restrictions, snags and coarse woody debris retention, stream protection, erosion prevention, soil protection, road closure and protection of historical sites. The Sale Administrator records observations demonstrating compliance as well as any concerns/issues on inspection reports that are signed by both the Forest Service and Purchaser Representative. The inspection reports would also document any resolutions that have been identified. As needed during the implementation process, the sale administration team may request a resource specialist or Line Officer to come for a field visit to discuss a resource issue that has been identified. Also, a resource specialist may visit a project without a formal request to conduct monitoring and to make sure that the project is being implemented as directed by the NEPA decision.

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.

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 project design criteria should be included;
- 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 (CSP) in 2009; a process that built on years of collaboration on similar thinning projects dating back to 2004. The CSP is a collaborative group that describes itself as "*a group of diverse stakeholders dedicated to restoring ecological function of the Clackamas River Basin while benefiting local economies.*" CSP meetings are open to the public.

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.

The appeal process after decisions are reached is an additional form of public involvement. In August of 2012, a Decision Notice and Finding of No Significant Impact for the Jazz Thinning were issued and three appeals were received. An informal appeal disposition meeting was held with most of the discussion focusing on water quality, but no resolution was reached. However, through those discussions some issues arose that warranted further consideration and that decision was withdrawn. As a result of those discussions, additional information and clarification regarding best management practices, sedimentation, erosion, and hydrologic connectivity was added to the EA.

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 of formulating fully developed alternatives. The following highlights some of the concerns raised by the public:

1.6.1.1 Temporary Roads: Comments from several sources received from the public during the 30-day comment period raised a concern about the reopening of old road alignments and the construction of new temporary roads. They stated that 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)."*

Public comments stated that once a decision is made to decommission a road that it should never be used again. Some public commenters stated that if trees or other vegetation begin to grow in a road it should not be used again but that recovery should be allowed to continue.

In order to avoid any potentially undesirable impacts to aquatic resources, new temporary roads were 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, 36, 40, 60, 116, 150 and 152) that were not included in the proposed action 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.

The reuse of existing alignments is consistent with Forest Service policy as described in Forest Service Manual 7703.22:

> "Motor vehicle use off designated roads, trails, and areas may be authorized by a contract, easement, special use permit, or other written authorization issued under federal law or regulation (36 CFR 212.51(a)(8); FSM 7716.2). This option may be particularly desirable when motor vehicle use off the designated system is associated with a single event or other authorized uses, such as grazing, vegetation management, and hazardous fuels reduction."

Recent road decommissioning EAs have discussed the potential for reuse of decommissioned roads. For example the Clackamas Road Decommissioning for Habitat Restoration (Increment 2) EA, indicated that "thinning may or may not be feasible without reopening the roads" (page 104), and that "Any new road construction or a future change to the status of decommissioned roads would require analysis through the NEPA process including public participation and evaluation of environmental effects" (page 105). And the Clackamas Road Decommissioning for Habitat Restoration (Increment 1) EA, indicated that "It is possible that a decommissioned road may need to be reopened or reconstructed. They would be opened, used for the project and restored again (page 47)." In recent years, the Forest has pursued a strategy of decommissioning roads that were not likely to be needed in 5 or 10 years (based on landform risk), but were likely to be needed again in 6 or 11 years instead of keeping them on the transportation system as closed system roads (Appendix B of the Clackamas Road Decommissioning for Habitat Restoration (Increment 2) EA).

Even though many individuals and groups stated that decommissioned roads should never be used again and that roads in general cause inappropriate environmental impact, there is no basis to eliminate all road reconstruction without regard for site-specific circumstances such as road length, landform, proximity to streams, the intensity of actual decommissioning, cost to open and decommission, the impacts of alternate access means and the benefits of variable density thinning. The 0.4 mile of new temporary road construction is estimated to impact less than one acre of ground, while the 11.5 miles of reconstruction would re-disturb about 20 acres of ground along existing road alignments; all temporary roads would be decommissioned and covered with slash or other effective ground cover after use. The environmental impact of reusing existing road alignments has been evaluated and found to be minimal. Sections 1.4.6.2&3 discuss the details for these roads and section 3.3.3 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. 3.3.7 & s. 3.4.8) and the project would be consistent with the Aquatic Conservation Strategy (s. 3.4.8.1). Some of the requested detail can be found in section 3.12.7. For these reasons, this concern is not considered a key issue.

1.6.1.2 Decadence (dead trees, down logs and trees with disease): Comments raised a concern about decadence and recent scientific findings. They stated that 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 stated 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 shown 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. 3.4.8.1). Wood recruited into streams would occur over time at sufficient levels, primarily from the stream protection buffers (s. 3.4.4.1). 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. 3.4.6).

Even though many individuals and groups stated that decadence is important and that thinning creates unacceptable impacts, the analysis shows sufficient levels of decadence across the landscape (s. 3.8.2.4). For these reasons, this concern is not considered a key issue.

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. 3.4.4.2; 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. 3.4.6). 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).

Even though one commenter stated that these land allocations should not be thinned because of unacceptable impacts, there is no basis to eliminate all thinning in these areas without regard for site-specific circumstances. The proposed action with project design criteria was developed considering site-specific factors. The analysis shows the benefits outweigh impacts. For these reasons, this concern is not considered a key issue.

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 patches of mature forest. This concern is not considered a key issue because the prescriptions are consistent with management direction and would achieve the purpose and need.

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, and as such, is not considered a key issue. 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 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 where no thinning would occur that also provide a similar function. In some areas half of the plantation acreage is in protection buffers, which exceeds the suggested 15% retention by commenters. 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, incorporates comments to include skips and meets the purpose and need.

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).

Even though some commenters stated that skips should be increased, there is no basis for the suggested 15% or any other "one size fits all" scheme for skips without regard for site-specific circumstances. The proposed action would have different levels of skips depending on factors present in each unit. For these reasons, this concern is not considered a key issue.

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 (outside of protection buffers) 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 for gaps (s. 1.4.2 & s. 3.4.4.1). 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. 3.4.6). Most wood recruited into streams would come from the riparian protection buffers (s. 3.4.4.1).

Even though it was expressed through public comment that gaps should not be created in riparian reserves, there is no basis for this without regard for site-specific circumstances, as evidenced by recent research (s. 3.4.4.1). The proposed action would have gaps where appropriate depending on factors present in each unit. For these reasons, this concern is not considered a key issue.

1.6.1.8 Earthflows: Comments suggested no new skid trails, landings or temporary roads 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 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. 3.6.7).

The proposed action requires the use of existing skid trails where they are not hydrologically connected. Existing temporary roads and landings on earthflows would be reused where appropriate. The analysis shows that trees are expected to grow well into the future without impact to the stability of earthflows (s. 3.5.6.2). For these reasons, this concern is not considered a key issue.

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 were found to be minimal (s. 3.6.7).

Even though some commenters stated that the EA should have more fully developed alternatives, the Forest Supervisor examined all of the comments received, incorporated many of the comments into the design of the proposed action, and considered many options for achieving the purpose and need and decided that the suggestions did not warrant fully developed alternatives (s. 2.3). When examining the requests for additional alternatives, it became clear that some commenters were actually advocating for the No Action Alternative. For example, Bark has suggested alternatives that would eliminate road reconstruction, LSRs, Riparian Reserves, and earthflows. If considered as an alternative, the remaining acres would not be economically viable. There would only remain approximately 100 acres (or 5% of the proposed action) and these remaining acres would not likely be viable by themselves because they would not have sufficient value to cover the costs of necessary road repairs along the haul routes. While Bark has asked for full development of additional alternatives it is clear that they advocate for No Action. The No Action Alternative was fully developed. For these reasons, this concern is not considered a key issue.

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 likely be a dramatic increase in the population of Douglas-fir bark beetles (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 approximately 150 felled trees per acre 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 proposed practice also has no funding source. The commenter suggested that the savings associated with not building roads, landings or skid trails could potentially be used to cover the cost of felling the trees. The Forest does not have funding to pay for road, landing or skid trail construction; this work is accomplished by logging contractors in exchange for the value of the trees they remove. At this time there is no known source of funding for this type of work and as such, it is not feasible to implement.

Even though a commenter stated that LSRs should be managed this way, there is no basis to justify such a practice and it is infeasible. For these reasons this concern is not considered a key issue.

1.6.1.11 Monitoring of Best Management Practices (BMPs): Comments suggested that practices for minimizing effects to water quality are not monitored. They suggest that BMPs are not being followed and that they can't be relied on to assert that effects to water quality would be low.

Between the time of the preliminary assessment and this document, there have been some additional refinements and clarifications regarding monitoring (s. 1.4.11, s. 1.6.1.11, & s. 3.3.6).

The National Best Management Practices for Water Quality Management on National Forest System Lands, Volume 1: National Core BMP Technical Guide (USDA 2012) directs a nationally consistent strategy for considering suggested practices and refining them into project level Project Design Criteria (PDCs) based on local conditions and local experience. These BMPs are considered to be the best available science regarding protection of water quality and are an update to the 1988 BMPs that have been used by the Forest since their inception and that were used during Forest planning.

While PDCs are developed because they are thought to be appropriate practices to minimize effects, they do not eliminate all effects nor are they thresholds of significance. The ability to implement and effectiveness of the group of PDCs designed to minimize impact to water quality are addressed in the hydrology report which is incorporated by reference. It generally found that the practices as a whole would likely result in achieving water quality goals under the Clean Water Act (s. 3.3.6).

The Forest has professional resource specialists (including soil scientists, hydrologists, fisheries biologists and geologists), with a wide range of experience implementing and monitoring water quality on similar projects. These specialists participate in both the planning of a project, its development into contract language, and eventual implementation. Section 1.4.11.1 describes this process and the monitoring that occurs to assure that projects are implemented as planned. Sometimes this monitoring is formally documented or is found in sale administrators' inspection reports, but often the monitoring is informal with little documentation unless a problem is encountered that needs to be addressed further. Whether formal or informal, monitoring allows professionals to gain experience. This experience along with staying current on research and scientific literature allows resource professionals to complete the adaptive management feedback loop as the next project is planned with current information.

Forest-wide monitoring of water quality occurs as discussed in section 3.3.6.1. While this monitoring is often not specific to any given project, it does indicate whether BMPs are functioning as expected at the landscape scale. Recent monitoring has indicated a trend of improving riparian and aquatic conditions across the Forest (documented in the water quality and hydrology specialist report).

Past monitoring of implementation and effectiveness of best management practices completed on the Clackamas River Ranger District indicated 85% of best management practices were implemented as planned and 94% of best management practices were effective at avoiding impacts to water quality (s. 3.3.6).

Recently, the Forest has been participating in a national effort to devise BMP survey protocols and field forms. Specialists asked to participate picked a few areas to visit in the field to test the forms and protocols. This practice was invaluable to the developers as they have modified the forms, instructions and protocol based on this experience. These practice sessions were not randomly selected, were not peer reviewed or reported back to line officers for discussion and in that sense do not constitute formal monitoring. When the national monitoring program is finalized, this project and all others on the Forest would be included in a pool of projects to randomly sample. Projects and BMPs would be randomly selected for implementation and effectiveness monitoring that involves standardized forms, techniques, and reporting so that with adaptive management, the Forest can continue the trend of improving riparian and aquatic conditions.

These clarifications regarding monitoring were added to address the concern that some commenters had about practices for minimizing effects to water quality. This concern has been addressed and incorporated into the project design, and is not considered a key issue.

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 provides 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). Approximately 5 miles of non-system roads with 1 perennial stream crossing, 3 intermittent stream crossings, and 8 seeps were never actively decommissioned and would remain unrestored. Ongoing activities, including current thinning projects, limited system road maintenance, ongoing road decommissioning, and recreation activities would continue to occur (s 3.0.2).

2.2 Alternative B - Proposed Action

This alternative is described in section 1.4. To briefly summarize, the Forest proposes a thinning project in plantations ranging in age from 30 to 60 years old. The purpose is to increase the health and growth of trees; to enhance diversity within riparian reserves, late-successional reserves and matrix lands; and to provide forest products to the local economy. Approximately 2,053 acres of plantations are included. It is estimated that approximately 1,588 acres would actually be thinned after accounting for stream protection buffers and other subtractions. Variable density thinning methods would be used that include the creation of skips, gaps, heavy thins and snags. The proposed action also includes 67 miles of road repair and maintenance on system roads. Approximately 11.5 miles of existing road alignments would be reused as temporary roads and decommissioned upon project completion. Approximately 0.4 mile of new temporary roads would be constructed and decommissioned upon project completion.

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 sections further elaborate:

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).

This option was considered. During development of the proposed action the potential for reconstructing more roads than are included in Alternative B, was considered (s. 3.12). These were the roads that access units 16, 20, 28, 36, 40, 60, 116, 150 and 152. These roads were considered and eliminated from the proposed action due to aquatic risk and cost issues. Approximately six miles of road were considered but eliminated and logging systems were changed to helicopter. Even though helicopter logging is very expensive, it was thought that when mixed with the remaining lower-cost units, the project would still be viable. Section 2.3.5 has additional discussion of helicopter feasibility.

With the proposed action, new temporary roads were 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.

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. 3.3.3). The proposed road construction and reconstruction would be consistent with Forest Plan standards and guidelines and the Aquatic Conservation Strategy.

The option of not reconstructing any roads would affect approximately half of the project acres. Some comments suggested deleting all harvest that is not accessible from existing roads while other comments suggested deleting the road reconstruction with no comment about the option to helicopter log the units that have no existing road access at the edge of the unit. Either way, changing this many units to helicopter would result in a project that is not economically viable. It may also make the units currently planned for helicopter unviable because the mix of traditional harvest methods would not be sufficient to cover the high costs of helicopter logging and the cost of road repairs along haul routes. This option was considered but not fully developed because without the ability to implement the project, the purpose and need cannot be met.

The Forest also considered an intermediate option that would eliminate some but not all of the road reconstruction. This option was not fully developed because the Forest already eliminated six miles of reconstruction based on aquatic risks posed by those roads during the development of the proposed action. Public comments also did not suggest viable intermediate options. During the appeal resolution discussions for the first decision for this project, an option was offered up by the Forest for discussion but it was rejected by the appellants. The option that was offered during the appeal disposition discussion involved eliminating the road reconstruction that accesses units 32, 64, 118, 144 and 146 which add up to 1.94 miles of road reconstruction. The option involved helicopter logging the portions of these units not accessible from existing roads. Of the road segments that access these units, approximately one mile was never actually actively decommissioned. The proposed action would reuse these roads and decommission them upon completion. This option was considered but not fully developed because no one has advocated for it and because the effects of rebuilding and decommissioning these roads were found to be minimal.

2.3.2 Several suggestions received during public comment involved increasing the levels of decadence (s. 1.6.1.2, s. 1.6.1.6, s. 1.6.1.9 & s. 1.6.1.10).

These options were considered. 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 shown 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. 3.4.8.1). Wood recruited into streams would occur over time at sufficient levels, primarily from the stream protection buffers (s. 3.4.4.1). 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. 3.4.6).

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).

In LSRs, 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 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 options of leaving greater levels of decadence, leaving more skips and cutting trees in the LSR and leaving them on the ground were considered but not fully developed because the analysis shows sufficient levels of decadence across the landscape (s. 3.8.2.4) and the likely bark beetle activity would result in stands that would not meet the purpose and need.

2.3.3 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 was considered. 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. 3.3.7, s. 3.7.6 & s. 3.5.6.5), and was determined to not likely adversely affect listed fish or spotted owls (s. 3.4.6 & s. 3.7.5.2).

Commenters suggested this option and eliminating road reconstruction as described in s. 2.3.1 above. These combined ideas would result in eliminating 95% of the proposed thinning. Additionally, these commenters didn’t actually identify any thinning units they supported. These desired outcomes are fully evaluated with the No Action

Alternative. Because of its similarities to the no action alternative, this option was considered but not fully developed.

2.3.4 One suggestion was to use the LSR 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 necessarily emphasized 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 patches of mature forest.

This option was considered but not fully developed.

2.3.5 The Forest considered the option of eliminating all helicopter logging due to the high cost of this logging system.

The economic viability of helicopter logging is marginal given the value of the timber and the high cost of jet fuel. The proposed action involves approximately 209 acres of helicopter logging: the roads that lead to these units were examined for reconstruction but the costs and resource impacts were considered too great to reconstruct the roads to use ground-based or skyline systems. The accomplishment of these marginal helicopter units relies on the fluctuations of the timber market and the cost of jet fuel at the time of bidding.

The Forest acting alone cannot achieve the thinning to meet the purpose and need. 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. For this work to be achieved the value of the timber needs to exceed costs. The Forest has considerable experience packaging high cost portions of a project with lower cost portions to gain operational efficiency and to develop a project that is likely to receive bids. Even though the proposed action identifies these 209 acres for helicopter systems, there is a chance that they may not happen if economic factors change that are difficult to predict. The option of an alternative with no helicopter logging was considered but not fully developed because the impacts were found to be minimal. The volatility of changes to economic factors related to helicopter viability happens much faster than the Forest's ability to respond with new NEPA documentation. One of the aspects of the proposed action is to identify helicopter opportunities to be better positioned to respond when market conditions are favorable.

Public comments question the need for the road reconstruction associated with the proposed action (s. 1.6.1.1 & s. 2.3.1). Section 3.12.7 contains an assessment of individual road segments. If the option of eliminating roads were to be developed, the units with no road access could be deleted or converted to helicopter (s. 1.6.1.1).

The option of not reconstructing any roads would affect approximately half of the project acres. Changing this many units to helicopter would result in a project that is not economically viable. It may also make the units currently planned for helicopter unviable because the mix of traditional harvest methods would not be sufficient to cover the high costs of helicopter logging and the cost of repair along haul routes. This option was considered but not fully developed because the impact of the road work was found to be minimal and that if the thinning was not viable, the purpose and need would not be met.

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
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.

	Alternative A - No Action	Alternative B - Proposed 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		
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.

	Alternative A - No Action	Alternative B - Proposed Action
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).
Range of alternatives (s. 1.6.1.9)	The No-Action Alternative was fully developed.	Several alternatives were considered (s. 2.3.1 to s. 2.3.5).
Restoration alternative (s. 1.6.1.10)	No trees would be felled and left on site in LSRs.	This is not a viable alternative and would not meet the purpose and need.
Monitoring of Best Management Practices (s. 1.6.1.11)	No monitoring would be conducted.	Monitoring would occur (s. 1.4.11.1 & s. 3.3.6).
Effects Summary		
Water Temperature (s. 3.3.2)	No change	Not measurable. Uses stream protection buffers.
Sediment (s. 3.3.3)	No change	Project design criteria (PDCs) minimize erosion and sedimentation.
Water Quantity (s. 3.3.4.4)	No change	Little change, meets S&Gs
Fisheries ESA Listed Fish Habitat (s. 3.4.6)	No Effect	May Affect, Not Likely to Adversely Affect
Fisheries MSA Essential Fish Habitat (s. 3.4.6)	No Adverse Affect	No Adverse Affect
Aquatic Sensitive and Survey&Manage (s. 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

	Alternative A - No Action	Alternative B - Proposed Action
Management Indicator Species – Fish (s. 3.4.7)	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. 3.4.8.1)	Would not enhance late-successional characteristics of riparian reserves.	Meets ACS Objectives. Would enhance late-successional characteristics of riparian reserves.
Geologic Stability (s. 3.5)	No change	Landslide prone areas are avoided. Earthflows are hydrologically recovered. Meets S&Gs.
Soil Erosion (s. 3.6.4)	No change	Very small risk with PDCs
Soil Disturbance (s. 3.6.5)	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. 3.6.6)	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.
Invasive Species (s. 3.14)	No change. Eight 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 Forest has been planning and implementing the decommissioning of roads. In the Collawash watershed, approximately 74 miles of roads were decommissioned in the last decade and 123 miles have recently been approved for decommissioning some of which has already been completed.

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. There are several recent and ongoing thinning projects in the Collawash watershed including Day, Hot, Fan, Pin and Pink that may be included in the analysis depending on the analysis area for each resource. There are also several thinning units within the Collawash watershed from previous EAs that have not yet been awarded: these are considered foreseeable future actions and may be included in the analysis depending on the analysis area for each resource.

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 which are incorporated by reference.

When the plantations were established, 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 tight spacing in the interior of stands are protected from the wind and often do not develop strong stems or roots. Trees that grow at wide spacing and in windy areas can develop resistance to wind by growing strong stems and strong, spreading root systems.

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 rot 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. For the purpose of this analysis, a tree size threshold of 20 inches in diameter is displayed because it is thought to be the minimum size at which stands begin to exhibit late-successional conditions or characteristics.

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.

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.

Overcrowded stands cannot defend themselves very well against damaging agents such as insects and disease. The loss of vigor is a direct result of increased stress and overall poor health related to overcrowding. Factors such as limited sap production can promote conditions for insect entry and colonization and the lack of diseases resistance decreases the ability to fight against infection.

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.

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).

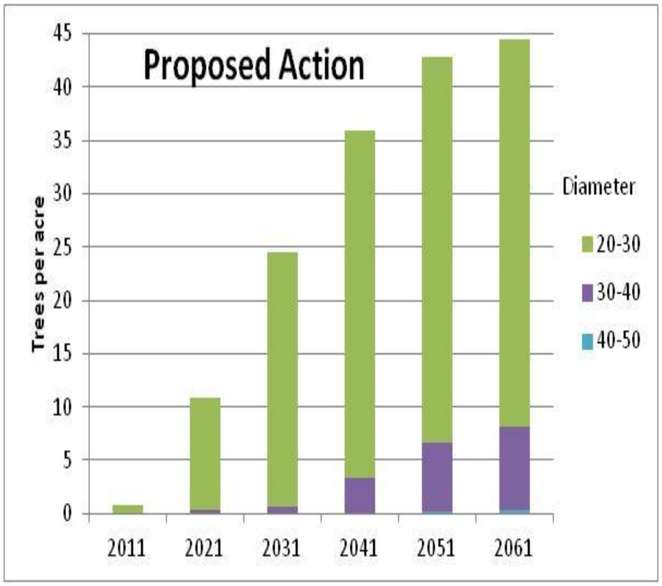
Thinning provides growing space, which gives the trees with the best competitive advantage the opportunity to take advantage of this growing space for the longest practical time, fully utilizing the ability of the trees to expand their crowns into the growing room provided by the removal of neighboring 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.

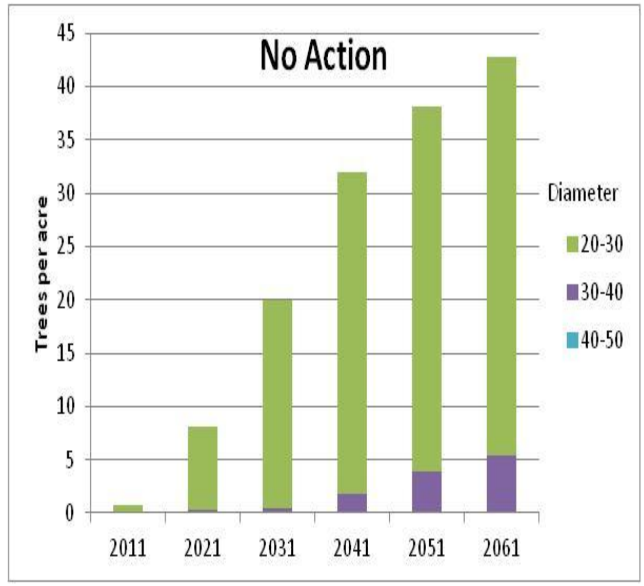
Stands in the matrix would be thinned to improve stand growth, individual tree growth and to provide variability. The thinning prescription would employ a range of relative densities from 20 to 30. (This range corresponds to approximately 80 and 120 square feet of basal area.) These prescriptions would 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 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. Thinning associated with the proposed action creates larger trees sooner compared to no action.





3.1.5 Cumulative Effects – Health and Growth

The effects of thinning on stand growth and productivity are generally experienced or expressed within the thinned stands; therefore the analysis area for cumulative effects would be the unit boundaries. The time scale for cumulative effects analysis is quite long: some impacts from 30 to 60 years ago when stands were clearcut remain today, and alterations made during thinning have the potential to benefit health and growth 100 or more years into the future. 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, 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.

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 which is incorporated by reference.

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 beneficially and adversely. 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

Plantations in the project area are relatively dense with one canopy layer (see s. 3.1). The clearcuts were planted primarily with Douglas-fir in the lower elevations; in some areas other species such as noble fir were planted. Other tree species such as western hemlock, grand fir, Pacific silver fir and 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. Some horizontal variability exists in some plantations from the down wood remaining following regeneration harvest and small gaps that are being created by root disease.

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. It would take 15 years longer to get a similar quantity of trees larger than 30 inches diameter compared to the proposed action (s. 3.1.4). However, it would take much longer for stands to acquire multi-stories canopy and the vertical and horizontal heterogeneity compared to the proposed action.

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 discussed in research by Dodson, Carey, Chan and Tappeiner (Dodson 2012) (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 additions 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 varied 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.

There are several elements of diversity considered here with both short and long-term implications; it is possible to affect one element beneficially while affecting others adversely. With the proposed action, variable density thinning would be implemented to achieve vertical and horizontal structure. The result would be a reduction in levels of small snags and down logs in the short term compared to no action. The proposed action would create some snags and down logs now and would result in large trees in the future (s. 3.1.4), which would eventually become snags, although it is recognized that mortality rates would take longer to be realized given that the overall health of the stands would be improved by thinning. In comparison, the No-Action Alternative is projected to have a large number of small snags and down wood as a result of overcrowding in both the short and long term. Large snag and down log levels are slightly higher with no action because thinning provides growing space which increases tree health. 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	Variable density thinning would occur on approximately 1,588 acres. Since the areas left untreated are also important to diversity, a total of 2,053 acres of plantations would be altered to enhance diversity.
Change in tree species composition	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 – resulting 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 abundance of ground vegetation and species richness	Plants on the forest floor would remain unchanged.	More sunlight to forest floor would increase abundance of plants such as forage species.
Change in presence of vertical canopy	Stands would primarily remain single story stands with small gaps created by natural disturbances.	Gaps and heavy thins would naturally regenerate primarily with shade-tolerant trees resulting in a two storied stand. (Up to 10% gaps and up to 10%

layers		heavy thins). Some ingrowth would also occur throughout stands 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 more 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 in abundance and size of 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 of larger sized snags and down wood are slightly less compared to no action, although future snags are likely to be larger than what would occur under no action due to increased growth rates (s 3.1.4).

3.2.6 Cumulative Effects

The effects of thinning on stand diversity are generally felt only inside the thinned stands; therefore the analysis area for cumulative effects is the unit boundary. Other sections of this document contain discussions of landscape scale diversity such as effects to wildlife habitat in section 3.8. The time scale for cumulative effects analysis is quite long: impacts from 30 to 60 years ago when stands were clearcut are still felt today, and changes made during thinning have the potential to benefit and impact elements of diversity 100 or more years into the future. The existing condition and the changes projected above include past actions as they have affected stand diversity including road construction, 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 or directly adjacent to them 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, cumulative effects for stand-level diversity would not occur, as the effects of this action are limited to direct and indirect effects and no other project overlaps in time or space to contribute to a cumulative effect. Variable density thinning with skips and gaps is intended to enhance stand-level diversity. While there would be some change to certain decadence elements, cumulative impacts are not likely to occur.

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 WATER QUALITY & HYDROLOGY

This section summarizes the water quality and hydrology report which is incorporated by reference. Fish and other aquatic species are discussed in section 3.4. Water quality is an emphasis for this watershed because it has key habitat for threatened fish species and it is also part of a much larger watershed that is used for domestic drinking water.

The project is located in the Collawash River 5th field watershed containing both the Collawash River, and the Hot Springs Fork of the Collawash River. There are five sixth field subwatersheds in the project area. 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 Project Area has 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 include timber harvest and road building. 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 clearcut 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.

Plantations are overstocked with relatively uniform tree size and distribution, have low species diversity, and have low habitat value. 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.

3.3.1 Existing Condition, Direct and Indirect Effects Summary

For this project, the following actions have the potential to affect water quality or quantity: tree felling, road maintenance, road construction and reconstruction, 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.

3.3.2 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.

The State of Oregon has water temperature standards for core cold water habitat and salmon and steelhead spawning uses.

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 Total Maximum Daily Load (TMDL) 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 in the Collawash Watershed, where a TMDL for water temperature in the Willamette Basin has been approved by the EPA.

The Forest developed a Water Quality Restoration Plan (WQRP) to serve as the TMDL Implementation Plan for the Willamette Basin TMDL. Under the WQRP the protection and recovery of water quality depends on implementation of the Forest Plan as amended. Key to this strategy are the standards and guidelines and the Aquatic Conservation Strategy (ACS) objectives for the protection, restoration, and active management of riparian areas.

The project's potential effect on stream temperature has been assessed by discussing the efficacy of project design criteria, based on 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. Prior to 1980, the removal of streamside vegetation while clearcutting was a standard practice throughout the watershed. 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 riparian reserves. Regrowth of riparian vegetation is expected to result in a gradual reduction in stream temperatures in the watershed. Stream temperature data in the Fisheries Biological Assessment show relatively stable stream temperatures. The stands proposed for thinning are relatively dense and provide shade for adjacent streams.

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 were estimated to be needed that would cross perennial streams. Most of these involve attaching cables on the far side of a stream to gain appropriate lift to suspend logs but do not involve yarding logs from one side of the stream to the other. It is estimated that five or fewer corridors would actually yard logs across a stream with full suspension. The other corridors would not require trees to be felled in the protection buffer and therefore would not affect shade. Where trees are yarded in a skyline corridor, a width of approximately 12 feet is typically cleared between the trunks of trees to allow for safe operations. Where these trees are felled in the protection buffer they would be left on site. Because the crowns of the remaining trees are not removed, the branches overhang this 12-foot strip resulting in very little actual open canopy for sunlight to reach a stream. It is estimated that a total of approximately 1/10 of an acre of protection buffer would be opened up on five skyline corridors. Given the context and intensity of this impact, there could be a small negative effect to water temperature at the site-specific scale. 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 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 2012). 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 would range from 50 to 85 feet depending on the ground slope and the height of trees.

Project design would result in buffers for perennial streams that range from 50 to 100 feet. 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 and comply with the TMDL strategy.

Stream protection buffers applied to the intermittent 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. The estimated 22 yarding corridors over intermittent streams would disturb less than 1/2 acre of canopy cover. 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.

The ability of streamside buffers to protect against increases in water temperature was demonstrated in a study by Groom in 2011. A replicated before-after-control-impact study was used to test the effectiveness of the State of Oregon's riparian protection measures at minimizing increases in summer stream temperature associated with timber harvest (Groom, 2011). The study was conducted at 15 state forest sites in the Oregon Coast Range. Sites were situated along streams dominated by Douglas-fir and red alder, 50–70 years old. Riparian protection measures included a no-cut buffer 25 feet wide adjacent to the stream, and partial harvest from 25 to 100 feet from the stream. Overall, no changes in maximum temperatures were observed. The riparian buffers for Jazz Thin would be much wider than in this study so it would be expected that there would be no impact to summer stream temperatures associated with the implementation of Jazz Thin.

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

No Action

With no action there would be no change to water temperature because there would be no loss of forest canopy. 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.

3.3.3 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, 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. Sediment was estimated using methodologies from the Washington Road Surface Erosion Model WARSEM (Dubé 2004).

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

3.3.3.1 Methodology - WARSEM

Sediment was estimated using methodologies from the Washington Road Surface Erosion Model WARSEM (Dubé 2004). WARSEM is a tool that allows users to calculate average annual road surface erosion and sediment delivery to channels in a standardized manner. The model can be applied on a variety of scales, ranging from a single road segment to all roads within a watershed or road planning unit. The results of this model and a detailed description of the methodology are included in the hydrology report which is incorporated by reference and summarized below.

This model was selected because:

- It allows for standardized calculations of road surface erosion
- Geology, climate, and management practices from Washington are similar to those in the project area
- It has the ability to determine reduction in sediment delivery resulting from applying Best Management Practices (BMPs) to road segments

Presentation of the WARSEM model results are intended to provide a means of comparing existing conditions with the proposed project utilizing the same assumptions and to give a comparison in broad terms of natural and management related sediment yields within the Collawash Watershed. The WARSEM manual states: It is appropriate to look at the relative differences in erosion estimates when comparing watershed areas or road segments, but the sediment values in tons/year should always be regarded as estimates not absolute values. Any predicted runoff or erosion value--by any model--will be, at best, within plus or minus 50 percent of the true value. Erosion rates are highly variable, and the models predict only a single value. Replicated research has shown that observed erosion values vary widely for identical plots, and for the same plot from year to year (Elliot 1994; Elliot 1995; Tysdal 1999).

3.3.3.2 Existing Condition

Natural background levels of sediment are estimated using sediment delivery rates from undisturbed forested areas in an area classified as an unstable zone in the H.J. Andrews Experimental Forest (Swanson 1975). Sediment delivery from landslides is estimated to be approximately 29,000 tons of material delivered per year (using a conversion of 1 ton per cubic yard). The Forest Geologist indicated that this would be an appropriate estimate of background sediment levels for the Collawash Watershed.

Subwatershed	Natural Background Sediment from Slides (tons per year)
East Fork Collawash River	2,902
Elk Lake Creek	4,420
Farm Creek-Collawash River	6,874
Happy Creek-Collawash River	5,310
Lower Hot Springs Fork Collawash River	5,849
Nohorn Creek	2,050
Upper Hot Springs Fork Collawash River	1,520
Grand Total	28,925

Recent wildland fires in the Bull of the Woods Wilderness and the Blister Creek area initiated from lightning storms are considered within the range of natural variability for the fire regimes in this watershed. The fires have added another natural source of sediment in the watershed. Recent wildfires include: 2007 Blister (303 ac), 2008 Lenore (298 ac), 2010 View Lake (2,760 ac) and 2011 Mother Load (2,740) for a total of 6,101 acres.

Based on estimates from the Burned Area Emergency Rehabilitation (BAER) reports for individual fires, it is estimated that approximately 156,443 tons of sediment was delivered to the stream system in the Collawash Watershed in the first winter after each fire. Since these fires were spread out between 2007 and 2011, this level was not input all at once.

Subwatershed	Total Wildland Fire Sediment (delivery after fire event in tons)
East Fork Collawash River	0
Elk Lake Creek	74,555
Farm Creek-Collawash River	0
Happy Creek-Collawash River	18,881
Lower Hot Springs Fork Collawash River	55,807
Nohorn Creek	0
Upper Hot Springs Fork Collawash River	7,199
Grand Total	156,443

Another source of sediment to surface water in the area is the road network. Roads in many upland areas of the Pacific Northwest are the most important source of management-accelerated delivery of sediment to anadromous fish habitats. The sediment contribution to streams from roads is often much greater than that from all other land management activities combined, including log skidding and yarding. In similar landscapes, road related landsliding, surface erosion and stream channel diversions frequently deliver large quantities of sediment to steams, both chronically and catastrophically during large storms. Roads may have unavoidable effects on streams, no matter how well they are located, designed or maintained. Many older roads with poor locations and inadequate drainage control and maintenance pose high risks of erosion and sedimentation of stream habitats (USDA 1993). In the Collawash Watershed, the highest risk roads have already been decommissioned (s. 3.3.5.2).

The WARSEM methodology was used to estimate that approximately 1,711 tons of sediment is likely delivered each year to the stream system in the Collawash Watershed.

Subwatershed	Sediment Delivery from Roads (tons per year)
East Fork Collawash River	197
Elk Lake Creek	3
Farm Creek-Collawash River	503
Happy Creek-Collawash River	221
Lower Hot Springs Fork Collawash River	380
Nohorn Creek	343
Upper Hot Springs Fork Collawash River	65
Grand Total	1,711

3.3.3.3 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 temporarily re-open approximately 11.5 miles of old road alignments 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 (s. 1.4.6.3). These roads would be obliterated after project completion.

Existing landings would be reused where appropriate (s. 1.4.7.1). Existing and new landings would occupy about 27 acres, most of which is already disturbed or within the road prism. Landings outside of existing system roads would be decommissioned and covered with slash or other effective ground cover along with the temporary road (s. 3.6.4).

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 runoff. 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 covered with slash or other effective ground cover 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.

Road maintenance prior to log haul would help maintain the design drainage of the road surface which reduces the potential for larger sediment inputs that eventually may enter stream courses. This includes the placement of new aggregate surfacing where necessary, blading, removing debris, brushing out encroaching vegetation, removing berms, and ditch and culvert inlet cleanout where needed. Aggregate road surfacing can minimize the amount of fine sediment from road surfaces entering streams following log haul, especially during and following rainfall events. Based on road surfacing factors from the WARSEM model going from a pitrun or worn gravel surface to a competent gravel surface would result in a 60% reduction in erosion from the road surface if all other factors stay the same.

PDCs to 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 can reduce sediment delivery by 25% (WARSEM).

Decompacting the road surface and associated landings during decommissioning or obliteration activities loosens the soil, making it more likely to be mobilized during the first significant runoff 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 project design criteria that minimize erosion, these effects are expected to be of a limited extent and duration.

Decommissioned roads and associated landings would be covered with slash, woody debris or straw (s. 1.4.6.2 & s. 1.4.9.6). Effective ground cover essentially reduces the potential for erosion (s. 3.6.4). Effective ground cover is provided by slash and straw. Eventually grass, shrubs and small trees would begin to grow on the road and landing surfaces. Project design criteria and associated BMPs for road decommissioning would reduce the risk of sediment entering streams. 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.

Sediment yield associated with the temporary roads was estimated using the WARSEM methodology.

Subwatershed	Increased Sediment Yield associated with Temporary Roads (tons)
East Fork Collawash River	0.0
Elk Lake Creek	0.0
Farm Creek-Collawash River	12.9
Happy Creek-Collawash River	0.3
Lower Hot Springs Fork Collawash River	5.9
Nohorn Creek	0.0
Upper Hot Springs Fork Collawash River	0.0
Grand Total	19.1

These figures represent the increase in sediment yield compared to the No-action Alternative. The increased sediment yield was modeled for the year of activity. This sediment would be temporary because the roads would be decommissioned and covered with slash and other effective ground cover. The assumption for modeling was that all roads would be used in the same year; however it is more likely that the impact would be spread out over approximately five years. For any given road, the reconstruction, use and decommissioning would occur in one season.

The table below displays the existing condition for sediment estimated from various sources and compares that with the estimated sediment from temporary road reconstruction.

Subwatershed	Natural Background from Slides (tons per year)	Total Wildland Fires (delivery after fire event in tons)*	Existing Road System (tons per year)	Temporary Roads (tons per year the year of activity)**
East Fork Collawash River	2,902	0	197	0
Elk Lake Creek	4,420	74,555	3	0
Farm Creek-Collawash River	6,874	0	503	13
Happy Creek-Collawash River	5,310	18,881	221	0
Lower Hot Springs Fork Collawash River	5,849	55,807	380	6
Nohorn Creek	2,050	0	343	0
Upper Hot Springs Fork Collawash River	1,520	7,199	65	0
Grand Total	28,925	156,443	1,711	19

*Modeled sediment yield for wildfires is for the first winter after the fire. Since these fires were spread out between 2007 and 2011, this level was not input all at once.
**Sediment for temporary roads would decrease after roads are decommissioned and covered with slash or other effective ground cover.

The levels of sediment associated with temporary road construction and use represent an increase of 0.01% over the existing condition for the watershed. This level would not likely be detectable at the subwatershed or watershed scale. Under natural conditions the stream channels in this area have developed to process large amounts of sediment and the Collawash/Hot Springs Watershed Analysis (USDA 1995) states: small boulders and cobbles make up most of the channel substrate, with high gradients responsible for the flushing of finer sediments.

The temporary roads would be decommissioned and covered with effective ground cover such as slash or mulch immediately following completion of harvest operations to help reduce compaction, increase infiltration rates, minimize surface erosion, and re-establish natural drainage patterns. Decompacting the road surface during decommissioning 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, or sufficient ground cover (such as mulch and woody debris) is provided. Since there would be 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. These projects may cause a short-term degradation of water quality due to sediment input and turbidity. Stream bank condition and habitat substrate may also be adversely affected in the short term. This would be a short-term effect since turbid conditions would dissipate soon after the in-stream work phase was completed, generally in a few hours.

<u>Harvest Activities (felling and yarding)</u>

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 runoff. 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 or 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 be put in place by October 1 of each year (s. 1.4.9) and 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 the PDCs would result in a non-measureable amount of sediment being delivered to streams.

The ability of PDCs to reduce erosion and sediment delivery is documented in Effectiveness Of Timber Harvest Practices For Controlling Sediment Related Water Quality Impacts (Rashin 2006). In this study, the authors looked at 21 harvest sites that had a variety of treatments ranging from no buffers to buffers up to 66 meters (216.5 feet) wide. They found that "Of 157 individual erosion features determined to deliver sediment to streams during either the first or second year following timber harvest, 94% were located within 10 m (33 feet) of the stream. Conversely, 74% of the 248 erosion features with no evidence of sediment delivery were greater than 10 m from streams. The sediment routing survey results indicate that when erosion is initiated by ground disturbing activities within 10 m (slope distance) of a stream, delivery of sediment was more likely than not." Other studies also support the effectiveness of mitigating sediment delivery by maintaining a buffered area adjacent to surface water. Lakel and others (2010) looked at the effectiveness of a variety of treated and untreated buffers in trapping sediment adjacent to timber harvest units. They concluded that streamside management zones (buffers) between 25 and 100 feet were effective in trapping sediment before it could enter streams. These streamside management zones consisted of both treated and untreated areas. The study also found that thinning within buffers was an appropriate forest management tool, "because the practice did not significantly increase erosion".

Other studies also support the effectiveness of mitigating sediment delivery by maintaining a buffered area adjacent to surface water. Burroughs and King (1989) found that 80% of sediment reaching streams from roads in the first year after construction came from the fill slope of the road. (Most of the temporary road reconstruction associated with Jazz would not have new raw road fill slopes but would utilize the existing alignment with fully vegetated road fills.) They also found that transport distances and obstructions between the fill slopes and streams influenced the amount and likelihood of eroded material reaching these streams. Burroughs and King found that windrowed fill slopes, which would act very similar to unharvested Riparian Reserves in that there would be obstructions to flow, had an average travel distance of 3.8 feet for eroded material, and a maximum travel distance of 33 feet. Similar results were documented by Packer (1967). He found that "the most important factors that affect the distance that sediment moves are the spacing between down slope obstructions and an interaction between this spacing and the kind of obstruction." He found that logs, rocks, and trees or stumps were the second, third, and fourth most effective materials in reducing sediment movement distances below roads. Travel distances were similar to those reported by Burroughs and King.

Comments submitted on the EA and with the 2012 appeal cite studies that show BMPs are not effective in reducing the potential for sediment to reach streams. GLEC, 2008 presented a national assessment of forest roads and their relationship to water quality impairment and included an assessment of BMP effectiveness. That report recognizes both the successes and failures of BMPs in preventing sediment from reaching streams. It also recognizes that the majority of the problem areas are associated with relatively few roads. Guiding principles for BMPs are listed in the report; many of those principles are now incorporated into the 2012 National BMP Technical Guide and are elaborated as project design criteria for this project.

Design criteria that include undisturbed vegetative buffers along perennial and intermittent streams, with an additional buffer where only low-impact harvesting equipment would be allowed, use of erosion control (e.g. erosion control blankets, straw wattles, waterbars etc.) where necessary, and lower impact road maintenance techniques (leaving vegetated buffer strips in ditchlines near streams) would substantially reduce the amount of sediment reaching the streams from this work. Burroughs and King (1989) reported that measures such as erosion control blankets alone could reduce sediment production by 80 to 90%. This in conjunction with other measures such as minimizing the amount of ground disturbance and seeding these areas would further decrease the chance of short-term direct and indirect sediment production. With these design criteria, new temporary roads, landings, skid trails, yarding corridors, road maintenance, and road repair work are expected to have minimal effect on sedimentation.

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 runoff are asphalt or durable crushed rock. Road use on native surfaced roads 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 (PDC 4F5). In periods of high rain-fall, 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 enter streams. Road maintenance and repair would have a beneficial effect on slope stability and 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.

It is recognized that regardless of PDCs and BMPs, it is probable that timber and rock haul would introduce some limited sediment into ditch lines and some streams during operations. Stream protection buffers and other PDCs would ensure that sediment delivery to streams would be minor (PDCs 4F1 – 4F6).

3.3.3.4 No Action

With no action there would be no change to water quality because there would be no ground disturbance or loss of forest canopy and there would be no potential for any increase in surface erosion or sedimentation.

With no action, some 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.

Approximately 5 miles of non-system roads (created during the initial clearcut harvest) that cross 4 stream and 8 seeps were never actively decommissioned and would remain unrestored. Additional road maintenance would not be performed on 67 miles of road and road repairs would not be made. Due to insufficient budgets to deal with these issues, there is the potential for continued chronic inputs of sediment from these sources to continue as roads deteriorate.

3.3.4 Hydrology

3.3.4.1 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

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- Properly Functioning
Lower Hot Springs Fork Collawash River	1.2	1.0	1.9	1.0	1.3 – Properly Functioning
East Fork Collawash River	1.4	1.0	1.8	1.0	1.4 – Properly Functioning
Happy Creek-Collawash River	1.6	1.0	1.9	1.0	1.4– Properly Functioning
Farm Creek-Collawash River	1.7	1.0	2.1	1.0	1.5 – Properly Functioning

3.3.4.2 Aggregate Recovery Percentage (ARP) Methodology

The elements of the proposed action that would affect snow accumulation and melt dynamics associated peak streamflows and hydrologic recovery include thinning, creating gaps, 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 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. Approximately 209 acres of thinning units from other EAs remain that have not yet been contracted. It is foreseeable that these thinning units would be contracted in the near future. While it is likely that there may be other 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.

3.3.4.3 Existing Condition - Hydrology

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	95.4%
Blister	87.4%
Dutch	85.0%
Hot Springs Tribs (Cat, Sand, Pink, Pin, Rock and Ferry Creeks)	90.6%
Skin	86.3%
Lower Nohorn	84.6%
Lower Lower Collawash (Cap, Sluice and Slide Creeks)	92.9%
Upper Lower Collawash (Paste and Peat Creeks)	93.4%
Farm	85.5%
Buckeye	94.7%
Happy	95.9%
Upper Collawash (Blitzen, Russ, Ochre, Jazz, Dunno)	86.8%
East Fork Collawash (Ogre, Round, Gyp and Cachebox)	90.0%

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.

3.3.4.4 Direct and Indirect Effects

<u>Proposed Action</u>

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.

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%

3.3.4.5 Stream Drainage Network Extension Methodology

Changes in hydrologic processes that control infiltration and the flow of surface and subsurface water are dominated by the effects of forest roads. The relatively impermeable surfaces of roads cause surface runoff that bypasses longer, slower subsurface flow routes. Where roads are insloped to a ditch, the ditch extends the drainage network, collects surface water from the road surface and subsurface water intercepted by roadcuts, and transports this water quickly to streams. These changes in hydrologic processes are assessed by estimating the extension of the stream drainage network associated with roads.

Based on research on two basins in the Western Cascades of Oregon, 57% of the road length is connected to the stream network by surface flowpaths including roadside ditches and gullies below road drainage culverts (Wemple, 1996).

Water generated on the road prism can enter the natural stream channel network in a variety of ways (http://www.stream.fs.fed.us/news/streamnt/jul00/jul00_2.htm):

- Inboard ditches delivering runoff to a stream at a road-stream crossing
- Inboard ditches delivering runoff to a cross drain (culvert, dip, waterbar, etc.) where sufficient discharge is available to create a gully or sediment plume that extends to a stream channel
- Other cross-drainage features, such as waterbars or dips, that discharge sufficient water to create a gully and/or sediment plume that extends to a stream channel
- Roads sufficiently close to streams so that the fillslope encroaches on the stream, such as at road-stream crossings

- Landslide scars on the road-fill that expose bedrock and create a surface flow path to an adjacent channel.

For this analysis the key process of concern is associated with inboard ditches delivering runoff to a stream where a road intercepts the stream.

The increase in channel length due to the inboard ditch was calculated as the length of the ditch directly connected to the stream up to the next ditch relief structure.

3.3.4.6 Stream Drainage Network Extension

Roads within the analysis area were examined to determine if the drainage network would be expanded from one or two directions. If the road grade dips into and rises out of the crossing the channel network would be expanded in two directions. If the road grades away from the stream crossing in one direction the channel network would be expanded in one direction. Most of the roads in the analysis area meet the second criterion and expand the stream network in one direction. Based on experience with road decommissioning across the forest it was assumed that the average ditch relief culverts were spaced 350 feet apart.

The following table shows the current condition for the road network and the likely increase with the proposed action.

Subwatershed	Current Condition	Condition after Implementation	Increase*
East Fork Collawash River	3.8%	3.8%	0.0%
Elk Lake Creek	0.0%	0.0%	0.0%
Farm Creek-Collawash River	8.2%	8.4%	0.2%
Happy Creek-Collawash River	4.4%	4.4%	0.0%
Lower Hot Springs Fork Collawash River	7.2%	7.3%	0.1%
Nohorn Creek	7.2%	7.2%	0.0%
Upper Hot Springs Fork Collawash River	2.0%	2.0%	0.0%

*This increase is temporary because the temporary roads that would be reconstructed would be decommissioned upon project completion.

It is generally accepted that based on considerations of gage and measurement error at high-flow events, a minimum detectable change in peak flow (detection limit) of ±10 percent for site-scale analysis. Percentage changes in peak flow that fall in this range are within the experimental and analytical error of flow measurement and cannot be ascribed as a treatment effect (Grant, 2008). There are no subwatersheds in the project area above the 10% threshold of concern for this process.

In a study on the effects of forest roads on peak streamflows (LaMarche and Lettenmaier, 2001) in the western slope of the Cascade Range in southwestern

Washington, forest roads alone were predicted to have increased the mean annual flood in the subcatchments from 2.2 to 9.5 percent, and from 2.9 to 12.2 percent for the ten-year event. The largest increases associated with forest roads (without harvest) were roughly equivalent to those predicted for harvest, without roads. The predicted increases in floods due to roads generally increase with flood return period, while vegetation effects decrease. The effects of roads and harvest on peak flows at the subcatchment and catchment levels are essentially independent, and the combined effects on peak flows are therefore roughly additive.

The longevity of changes in hydrologic processes resulting from forest roads is as permanent as the road. Until a road is removed and natural drainage patterns are restored, the road would likely continue to affect the routing of water through watersheds. Modeling studies suggest an approximate doubling of the percentage change in peak flows attributed to harvest alone when road construction is included in the model (Grant, 2008).

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 even when considering the doubling effect of stream drainage network extension.

The following table shows that there would be very slight reductions in stream channel network extension associated with decommissioning of existing road alignments that would be used as temporary roads then decommissioned.

Subwatershed	Decrease in stream drainage extension
East Fork Collawash River	0.0%
Elk Lake Creek	0.0%
Farm Creek-Collawash River	0.2%
Happy Creek-Collawash River	0.0%
Lower Hot Springs Fork Collawash River	0.1%
Nohorn Creek	0.0%
Upper Hot Springs Fork Collawash River	0.0%

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 7^{th} field drainages in the Jazz Project area are 80 to 95% hydrologically recovered. Under the no action alternative, hydrologic 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.

3.3.5 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. Past actions are included and are discussed in the existing condition sections above.

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. This area was selected to ensure that all the sixth field watersheds associated with the project are addressed. This area encompasses 97,494 acres. 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. Some impacts are considered permanent with little or no 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. 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 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.

The table below provides a qualitative summary of potential cumulative watershed effects. It shows existing and potential projects that were considered in this cumulative effects analysis, the effects from those projects that may result in cumulative effects, whether or not these projects overlap in time and space, and an assessment if a cumulative effect is expected. Findings of this summary are supported by the analysis above which utilizes pertinent research, design features and applicable management standards and guidelines. Past actions are included above in the discussion of existing conditions and are not restated here unless there are ongoing maintenance issues.

Project	Potential Effects	Overlap in Time	Space	Measurable Effect?	Extent, Detectable?
Forest Service Vegetation Treatment Activities Planned or Underway. This includes recent and ongoing thinning projects including Day (61 ac), Hot (269), Fan (209 ac), Pin (401 ac), and Pink (188 ac) for a total of 1,128 acres; and thinning units within the Collawash watershed from previous EAs that have not yet been awarded that add up to approximately 209 acres.	Coarse and Fine Sediment	Yes	Yes	No	There may be an overlap in timing of these projects with the Jazz Thin Project; any minor suspended sediment would not be measurable due to implementation of design criteria, conformance with existing standards and guidelines on both the existing projects and the Jazz Thin Project.
	Stream Temperature	Yes	Yes	No	Vegetation treatment projects conform to the Biological Assessment for the project or the Northwest Forest Plan Stream Temperature Sufficiency document to protect stream shade. The Jazz Thin Project would maintain the primary shade zone so there should be no increase in stream temperature from this project.
	Water Quantity	Yes	Yes	No	No cumulative water quantity effects due to design criteria implementation, conformance with existing standards and guidelines and natural recovery on both the existing projects and the Jazz Thin Project. ARP analysis details a slight reduction in hydrologic recovery of areas when these sales are added in however the hydrologic recovery is well above that where impacts to peak streamflows would be expected.
Hazard Trees	Coarse and Fine Sediment	Yes	Yes	No	There may be very small amounts of sediment delivered to the stream system over widely scattered areas associated with deposition of fine sediment into road ditchlines that are connected to the stream system during storm events. Any widely scattered small increases in fine sediment would not be detectable at the 6th or 5th field watershed scale.
	Stream Temperature	Yes	Yes	No	Reductions of stream shade are reasonably certain to occur in a small number of areas scattered throughout the action area where multiple shade-producing trees are removed within 150 feet of perennial streams, causing minor increases in water temperatures at the reach scale. Any widely scattered small increases in stream temperature would not be detectable at the 5th or 6th field watershed scale.

	Water Quantity	Yes	Yes	No	Hazard trees are widely scattered so their removal would not impact ARP values because canopy cover of stands would be minimally impacted.
Road Decommissioning, 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.	Coarse and Fine Sediment	Yes	Yes	Possible	Associated with this activity localized, short-lived increases in fine sediment in stream substrates or along channel margins may occur. However, road decommissioning activities are likely to reduce chronic sediment inputs from roads over the long term. Any widely scattered small increases in fine sediment would not be detectable at the 6th or 5th field watershed scale.
	Stream Temperature	Yes	Yes	No	With road decommissioning activities there are potential increases in stream temperature widely scattered over time and space associated with the removal of culverts and bridges at stream crossings and the subsequent exposure of the stream to solar radiation. Any widely scattered small increases in stream temperature would not be detectable at the 6th or 5th field watershed scale.
	Water Quantity	Yes	Yes	No	Basin-scale studies in the Oregon Cascades suggest that a high degree of integration between the road drainage system and the channel network can increase peak flows. Road decommissioning activities are designed to reduce the road stream connectivity and associated peak streamflows associated with this connectivity.
Ongoing Road Maintenance Activities	Coarse and Fine Sediment	Yes	Yes	Possible	Associated with this activity localized, short-lived increases in fine sediment in stream substrates or along channel margins may occur. However, proper road maintenance is likely to reduce chronic sediment inputs from roads over the long term. Any widely scattered small increases in fine sediment would not be detectable at the 6th or 5th field watershed scale.
	Stream Temperature	Yes	Yes	No	With road maintenance activities there are potential increases in stream temperature widely scattered over time and space associated with road brushing. Any widely scattered small increases in stream temperature would not be detectable at the 6th or 5th field watershed scale.
	Water Quantity	Yes	Yes	No	No effects anticipated associated with this activity.

BPA Power Line Corridor Maintenance	Coarse and Fine Sediment	Yes	Yes	Possible	There is the potential for widely scattered and small amounts of sediment to be delivered to the stream system associated with the use of secondary roads and power line maintenance. Any widely scattered small increases in fine sediment would not be detectable at the 6th or 5th field watershed scale.
	Stream Temperature	Yes	Yes	No	There is the potential to raise average and maximum stream temperatures for short reaches of streams. Any widely scattered small increases in stream temperature would not be detectable at the 5th or 6th field watershed scale.
	Water Quantity	Yes	Yes	No	No effects anticipated associated with this project. The power line corridor is maintained in an early-seral condition impacting ARP values, however these value are well below the level where impacts to peak streamflows would be expected.
Recreation Site, Trail, and Administrative Structure Maintenance and Associated Public Use	Coarse and Fine Sediment	Yes	Yes	Possible	The heavy use of certain recreation sites along streambanks is likely to result in bank erosion, delivery of sediment, and increased channel width. Any widely scattered small increases in fine sediment would not be detectable at the 5th or 6th field watershed scale.
	Stream Temperature	Yes	Yes	Possible	Depending on site specific conditions, the combination of suppressed vegetation and increased width/depth ratios for heavily used streamside recreation sites are likely to increase stream water temperatures for heavily used streamside at the scale of the stream reach. Any widely scattered small increases in stream temperature would not be detectable at the 5th or 6th field watershed scale.
	Water Quantity	Yes	Yes	No	No effects anticipated associated with this activity.
Recent wildfires including: 2010 View Lake (2,760 ac), 2008 Lenore (298 ac) 2011 Mother Load (2,740) and 2007 Blister Fire (303 ac) for a total of 6,101 acres	Coarse and Fine Sediment	Yes	Yes	Possible	For the first three years following wildfires hillslope erosion and associated sediment yield is elevated. The median rate of sediment yield associated with wildfires in the cumulative effects analysis area is estimated at 23 tons per acre for the first year after the fire with about ½ that yield the second season after the fire.

	Stream Temperature	Yes	Yes	Possible	When riparian (streamside) vegetation is removed by fire, the stream surface is exposed to direct solar radiation, and stream temperatures increase. In addition changes in stream channel form (wider and shallower streams) associated with increased peak stream flows and increased sediment yield from burned areas have the potential to expose the stream channel to more direct solar radiation.
	Water Quantity	Yes	Yes	Possible	On the average peak stream flows increase by about 20 percent in a burned area. Recent fires in the Collawash Watershed have burned approximately 6% of the watershed area. Burned area contribution to increased peak stream flows are addressed using the ARP methodology.
Fish habitat restoration projects including log, boulder and gravel placement in streams using heavy equipment.	Coarse and Fine Sediment	Yes	Yes	Possible	Heavy equipment traverses the area between the road access point and the river. Short-term sediment inputs would likely occur until the erosion control methods of mulch and grass seed become effective. Projects are expected to have a long-term benefit to aquatic species.
	Stream Temperature	Yes	Yes	No	This project has the potential to impact stream temperature by directly impacting stream shade during physical manipulating the stream channels and exposing water to solar radiation.
	Water Quantity	Yes	Yes	No	No effects anticipated associated with this activity.

3.3.5.1 Cumulative Effects – Water Temperature

Stream buffers were found sufficient to prevent any increase in water temperature (s. 3.3.2). Across the watershed, shade along streams impacted by past regeneration harvest is increasing as trees and vegetation adjacent to streams continues to grow. Other recent and ongoing actions have been designed to protect shade. Road decommissioning projects and fish habitat restoration projects provide improvements to riparian conditions and gradually increasing shade as vegetation grows.

The recent wildfires have impacted some shade along streams. In some areas, the intensity of burning was lower adjacent to streams due to increased humidity and vegetation is beginning to resprout and provide shade. No salvage occurred, so the dead standing snags continue to provide some shade.

Because the stream buffers for Jazz Thin were found sufficient to prevent any increase in water temperature, there would not likely be any substantial or measurable cumulative effect.

3.3.5.2 Cumulative Effects – Sediment

Fires and past management actions including logging and road construction are incorporated in the discussion of existing conditions (s. 3.3.3.2). Management-related sediment production and delivery comes primarily from the road system (s. 3.3.3.2).

Since the initiation of the Northwest Forest Plan, many factors have contributed to a trend of stable or improving stream habitat conditions on the Forest (s. 3.4.7). Harvest levels since the Northwest Forest Plan have been well below the level projected. Recent projects 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, dispersed recreation are not creating measureable impacts to streams or aquatic resources at the subwatershed or watershed scale.

In recent years, road decommissioning has occurred and more is planned. Approximately 74 miles of the highest risk roads were decommissioned in the last decade and 123 miles have recently been approved for decommissioning some of which has already been completed. 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 projects use a similar set of PDCs to protect water quality. The Jazz project when added to all the management actions in the past 10 years and all of the planned projects not yet completed affect between 0.5% and 7% of the riparian reserves of the various 6th field watersheds.

The recent or ongoing projects (Day, Hot, Fan, Pin and Pink) and the thinning units from previous EAs that have not yet been awarded combined have approximately 1.8 miles of temporary road reconstruction, use and decommissioning. Because the direct effect of the proposed action's 12 miles of temporary roads would result in a 0.01% change in sediment over base-line conditions, it is unlikely that an additional 1.8 miles of reconstruction spread out over several years and spread out over the entire watershed would cumulatively result in measurable quantities of sediment.

Temporary road reconstruction, logging and log haul associated with this project (with project design criteria implemented) have the potential to introduce a very limited amount of sediment to the stream system. The cumulative effects of this project when added to other past actions and fires as well as foreseeable and ongoing actions would not likely be substantial or contribute to a downward trend for water quality for the species that reside in local streams or downstream rivers because the quantities of sediment introduced from this project would be small compared to the overall sediment load for the drainage.

3.3.5.3 Cumulative Effects – Water Quantity

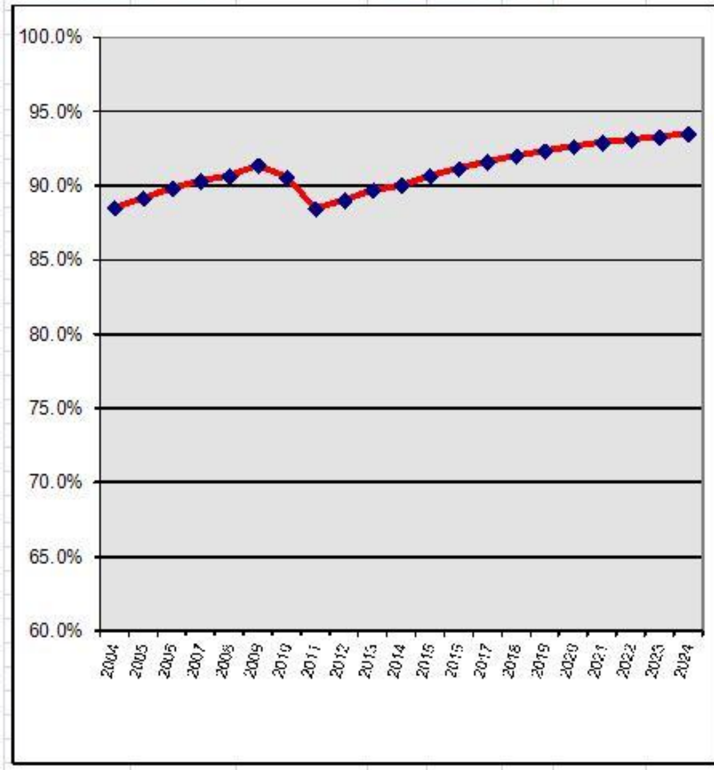
The Collawash Watershed is used here as the analysis area for cumulative effects. The time frame used to include or exclude actions varies by the type of action. Some impacts are considered permanent with no modeled recovery including permanent roads, quarries and the power line right-of way. Some impacts 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 recent and ongoing thinning projects within the Collawash watershed that are included in the analysis of cumulative effects. Even though portions of the wildfires are above the typical rain-on-snow threshold of 4200 feet, the entire acreage is included in the analysis. 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 2014 which is the earliest likely harvest date. The graph does not show a downward dip in the line in 2014 because all of the many plantations in the watershed are growing at a rate faster than the impact caused by Jazz.

ARP in Collawash Watershed, 2004 to 2024



Subwatershed	99Total Collawash
	refresh
Impacts after 2000	
	8
	2000
Sale Name	Regen Acres
(blank)	
Jane	
B F Salvage	
Hot	
Roman	
jazz	
Blister Fire	
Lenore Fire	
View Lake Fire	
Mother Lode Fire	
Fan_Pink_Pin_day	
Decoy II, Bonanza III	
rotor2	
Grand Total	
2014	90.0%
2015	90.7%
2016	91.2%
2017	91.6%
2018	92.0%
2019	92.4%
2020	92.7%
2021	92.9%
2022	93.1%
2023	93.3%
2024	93.5%

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.

3.3.5.4 Summary

Stream Temperature – No detrimental cumulative effects are expected to water temperature due design criteria designed to maintain existing primary shade vegetation adjacent to streams. As described in the direct and indirect effects section, this project would maintain existing water temperatures.

Sediment – The impact of temporary road reconstruction, use and decommissioning on sediment is estimated at 19 tons. This level would not likely be measurable given the context of a watershed with an estimated 29,000 tons per year from natural landslide sources and 1,700 tons per year from the existing road system. The short-term sediment input from temporary roads is relatively low compared to the input of

156,000 tons estimated to have entered streams between 2007 and 2011 from wildfires. The levels of sediment associated with temporary road construction and use represent an increase of 0.01% over the existing condition for the watershed. This level would not likely be detectable at the subwatershed or watershed scale. Under natural conditions the stream channels in this area have developed to process large amounts of sediment. Project design criteria would limit sediment delivery to a very small amount. No detrimental cumulative effects are expected.

Water Quantity – This project along with other projects in the watersheds were included in the Aggregate Recovery Percentage (ARP) Methodology calculations. Watershed Impact Area calculations were found to be well within the parameters of the Forest Plan standards and guidelines. Since the effects of vegetation removal through harvest and roads are considered independent from each other and they are roughly additive they are integrated when assessing management effects on peak streamflows within a watershed. The integrated effects of the independent processes on water quality were considered and since the cumulative impact of vegetation removal associated with all activities is minimal, there are no substantive cumulative effects anticipated for water quantity.

3.3.6 Compliance with the Clean Water Act

The Forest has the responsibility to implement the Clean Water Act (CWA), and to protect and restore the quality of public waters. Protecting water quality is addressed in several sections of the CWA including sections 303, 313, and 319. Best Management Practices (BMPs) (USDA 2012) are used to meet water quality standards (or water quality goals and objectives) under Section 319. The purpose of BMPs is to avoid, minimize, or mitigate adverse effects to soil, water quality, and in-stream riparian resources that may result from project activities.

Current statewide Water Quality Standards for the State of Oregon state: "Pursuant to Memoranda of Agreement with the U.S. Forest Service and the Bureau of Land Management, water quality standards are expected to be met through the development and implementation of water quality restoration plans, best management practices and aquatic conservation strategies. Where a Federal Agency is a Designated Management Agency by the Department, implementation of these plans, practices and strategies is deemed compliance with this Division." (USDA 1999).

Site-specific Water Quality Best Management Practices, with the express purpose of limiting non-point source water pollution, are incorporated into the proposed action and associated project design criteria for this project.

BMPs were originally compiled from Forest Service manuals, handbooks, contract and permit provisions, and policy statements. BMPs were further refined to address recommendations in General Water Quality Best Management Practices, Pacific

Northwest Region, November 1988. Finally BMPs were refined to meet National Best Management Practices for Water Quality Management on National Forest System Lands - Volume 1: National Core BMP Technical Guide (USDA 2012).

Additionally, for this project recommendations from consultation with the National Marine Fisheries Service were incorporated into PDCs to ensure that the proposed actions would not result in adverse effects on listed fish.

The following is an excerpt from the National Best Management Practices for Water Quality Management on National Forest System Lands, Volume 1: National Core BMP Technical Guide (USDA 2012):

> The National Core BMPs are deliberately general and nonprescriptive. Although some impacts may be thought of as characteristic of a management activity, the actual potential for a land use or management activity to impact water quality depends on:
>
> 1. The physical, biologic, meteorological, and hydrologic environment where the activity takes place (e.g., topography, physiography, precipitation, stream type, channel density, soil type, and vegetative cover).
> 2. The type of activity imposed on a given environment and the proximity of the activity area to surface waters.
> 3. The magnitude, intensity, duration, and timing of the activity.
> 4. The State designated beneficial uses of the water in proximity to the management activity and their relative sensitivity to the potential impacts associated with the activity.
>
> These four factors vary throughout the lands administered by the Forest Service. It follows then, that the extent and kind of potential water quality impacts from activities on NFS lands are variable, as are the most appropriate mitigation and pollution control measures. No solution, prescription, method, or technique is best for all circumstances.
>
> The National Core BMPs cannot include all possible practices or techniques to address the range of conditions and situations on all NFS lands. Each BMP has a list of recommended practices that should be used, as appropriate or when required, to meet the objective of the BMP. Not all recommended practices will be applicable in all settings, and there may be other practices not listed in the BMP that would work as well, or better, to meet the BMP objective in a given situation. The specific practices or methods to be applied to a particular project should be determined based on site evaluation, past experience, monitoring results, new techniques based on new research literature, and other requirements. State BMPs, Forest Service regional guidance, land management plans, BMP monitoring information, and professional judgment should be used to develop site-specific BMP prescriptions.

BMPs are used to minimize the impacts of management activities on 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.

The Interdisciplinary Team has examined the applicable general National Core BMPs and developed more specific and prescriptive Project Design Criteria (PDCs) to implement the intent of the BMPs (s. 1.4.9). The team members and their professional experience and qualifications are documented in section 4.4.

Some of the PDCs are standard practices and others were tailored specifically for this project based on site-specific conditions. They were developed based on many years of experience and an understanding of recent research. The team evaluated the PDCs and rated their "ability to implement" and "effectiveness." This analysis is in the hydrology specialist report and is incorporated by reference. The analysis found that the PDCs had a moderate to high ability to implement and a moderate to high level of expected effectiveness, meaning that all practices would be implemented and effective at least 75% of the time. Past monitoring on the Clackamas River Ranger District indicated that PDCs were implemented as planned on 85% of the samples and were effective at avoiding impacts to water quality on 94% of the samples (See the water quality specialist report which summarizes data found in the Forest's annual monitoring reports available on the Forest's web site.)

3.3.6.1 Forest-Wide Monitoring

In an effort to support the Clean Water Act, the Forest conducts a variety of monitoring and inventory programs to determine status of meeting state water quality standards as well as other regulatory and agency requirements. In an average year, approximately 75 sites are monitored for water temperature throughout the Forest. In addition, other water quality monitoring occurs at various locations throughout the Forest. This could be turbidity monitoring, in-stream sediment sampling, water chemical sampling, or surveys of physical stream conditions. Currently, approximately 25 miles of physical stream habitat is surveyed every year and to date approximately 1,200 miles of stream have been surveyed. Some of the information collected during these surveys includes the number of pools and riffles, amount of large wood, riparian area condition and types, and numbers of fish and other aquatic organisms. This data is compiled and summarized in Forest Monitoring Reports available on the Forest's web site. The effectiveness of the techniques included as PDCs in this project and on the projects that have been implemented in recent years has been validated because Forest-wide monitoring has shown an ongoing trend of improving conditions for water quality. The PDCs in this project have been refined where appropriate based on past monitoring to make them more implementable and more effective.

3.3.6.2 Project Level Monitoring

Prior to and during implementation, a multi-stage process is used on the Forest to ensure that a project is implemented as planned. The ability to implement the techniques included as PDCs is moderate to high because of the multiple checks described in section 1.4.11.1.

3.3.6.3 Stormwater Runoff Permits

At this time it is uncertain whether this project would 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.

3.3.7 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 9%, which would clearly meet the standard and guideline.

FW-64

This standard and guideline indicates a maximum watershed impact area of 35% at the drainage scale for lands available for vegetative manipulation and as detailed below, is not exceeded as a result of this project.

Drainage Name	Proposed Action 2014 - Watershed Impact Area
Panzy	4.4%
Blister	12.4%
Dutch	13.3%
Hot Springs Tribs	9.4%
Skin	12.5%
Lower Nohorn	14.6%
Lower Lower Collawash	7.1%
Upper Lower Collawash	7.4%
Farm	13.4%
Buckeye	5.4%
Happy	4.8%
Upper Collawash	12.9%
East Fork Collawash	8.8%

FW-65
This standard and guideline indicates a maximum threshold of concern of 18% for certain special emphasis watersheds, and as detailed below, would not be exceeded by this project.

Name	Proposed Action 2014 - Watershed Impact Area
Panzy	4.4%
Blister	12.4%
Hot Springs Tribs *	10.1%
Upper Collawash Tribs**	9.4%

*Includes Cat, Sand, Pink, Dutch, Thunder, Pin, Rock and Ferry Creeks.
**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 FISHERIES

This section summarizes the Fisheries Biological Assessment and Biological Evaluation and the fisheries report which are incorporated by reference. Fisheries issues such as sediment and water temperature are already discussed in the water quality section (s. 3.3) and are only repeated here where needed to add clarification.

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.

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 watershed 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 watershed 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 has 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 also been altered by road building.

Past clearcut 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.

3.4.1 Management Indicator Species

See section 3.4.7 for discussion of effects.

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.

3.4.2 Federally Listed Species

See section 3.4.6 for discussion of effects.

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. The nearest thinning unit is 200 feet from LCR steelhead streams.

Upper Willamette River Chinook (Oncorhynchus tshawytscha) 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. The nearest thinning unit is 200 feet from UWR Chinook streams.

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. The nearest thinning unit is 200 feet from LCR coho streams.

3.4.3 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:

See section 3.4.6 for discussion of effects.

Barrren Juga (Juga hemphilli hemphilli) aquatic snail
The barren juga is found at low elevation large springs and small-medium streams with a level bottom and a stable gravel substrate and fast-flowing, unpolluted highly-oxygenated cold water. All samples have been taken from the Columbia River Gorge area east of the Willamette River. It is highly unlikely that barren juga would be found in Action Area.

Dalles Juga (Juga hemphilli dallesensis) aquatic snail
The Dalles juga is found at low elevation large springs and small-medium streams with a stable gravel substrate and fast-flowing, unpolluted, highly-oxygenated cold water. The Dalles juga has been found in Mill Creek and the central and eastern Columbia River Gorge from Hood River to the Dalles, in Hood River and Wasco

Counties, Oregon and Skamania County, Washington. It is highly unlikely that Dalles juga would be found in Action Area.

Purple-lipped Juga (Juga hemphilli maupinensis) aquatic snail
The purple-lipped juga is found at low-elevation large streams in well-oxygenated and minimally impacted gravel-cobble (mostly basalt) riffles in cold water. The species was once widespread in the Deschutes River Basin and may have been present in Forest tributaries. Current samples have only been collected from the lower Deschutes River. It is highly unlikely that purple-lipped juga would be found in Action Area.

Scott's Apatanian Caddisfly (Allomvia scotti) aquatic insect
Habitat for the Scott's apatanian caddisfly larvae is low to high elevation; cold, pure, well-oxygenated water in springs, and small creeks. It may occur in the Action Area within approximately 50 feet of thinning units.

Caddisfly (No common name) (Namamyia plutonisi) aquatic insect
This caddisfly tends to be found associated with small streams in densely forested old-growth or mature-forest watersheds. The Action Area has a mix of mature forest and plantations therefore this species may be present within approximately 50 feet of thinning units.

3.4.4 Existing Condition, Direct and Indirect Effects Summary

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 fisheries resources. 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, affecting stream bank stability, and overall health of the riparian reserves. Stands would be denser, less diverse (structurally), have smaller diameter trees, and have 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

For this proposed project, the following actions have the potential to affect aquatic species or their habitats: tree felling, road maintenance, road construction and reconstruction, 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, future in-channel large wood recruitment and riparian vegetation.

3.4.4.1 Wood Recruitment

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, and by trees falling from adjacent riparian areas. 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. Where riparian areas were logged as part of a clearcut in the past, there is reduced potential for large woody debris recruitment into associated streams. In these areas, small woody debris currently plays an important role.

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-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 in-stream 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 in-stream 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.

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.

3.4.4.2 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.

3.4.4.3 Water Temperature and Sediment

Water temperature is addressed in section 3.3.2 and sediment is addressed in section 3.3.3.

Project design criteria provide sufficient protection to streamside shade to minimize changes to stream temperature.

As detailed in the hydrology section, it is likely that some sediment, primarily from roads would reach 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.

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.

3.4.5 Cumulative Effects

See additional discussion of cumulative effects in section 3.3.5. The same analysis area and time frames are used for impacts to fish.

Since the initiation of the Northwest Forest Plan, many factors have contributed to a trend of stable or improving stream habitat conditions on the Forest (s. 3.4.7). Harvest levels since the Northwest Forest Plan have been well below the level projected. Recent projects 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, 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 benefit from the removal of impediments to fish movement, to the potential movement of instream wood and to riparian vegetation. The proposed action and other thinning projects would improve stream and riparian conditions by moving the stands toward late-successional conditions. Other ongoing thinning projects use a similar set of PDCs to protect water quality.

The wildfires that have occurred in the watershed in recent years have likely impacted fish (s. 3.3.5). Only a portion of the View Lake Fire came close to LFH, but all of the fires affected habitat for other resident fish and other aquatic organisms. The fires burned some riparian vegetation which has already begun the process of regrowth but it also created vast quantities of snags which will eventually fall providing a much needed pulse of large woody debris into the stream systems.

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 wood recruitment and riparian vegetation because of protections provided by project design criteria including stream protection buffers. While there are likely some short-term cumulative effects related to wood recruitment and riparian vegetation, 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. 3.3.5.3). This project and all of the other ongoing projects were found to not likely to adversely affect listed fish or their critical habitat (s. 3.4.6). For these reasons cumulative effects would not be substantial.

3.4.6 Effects to Listed Species

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. The analysis found little impact, and that disturbance would be localized and of short duration. The PDCs were found to be sufficient to minimize effects to water quality. The effects determination for this project is **"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 Bull Trout

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 upstream 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** 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 project design criteria including stream protection buffers are sufficient to provide for the habitat needs of aquatic mollusks and insect larvae.

The barren juga, Dalles juga, and purple-lipped juga (s. 3.4.3) are not likely to occur in the streams or springs in the project area. Because of the protections provided to all streams and springs and the low likelihood of presence, the project would have **no impact** to these species.

The two caddisflies (s. 3.4.3) may occur in streams and springs in the project area. The discussion above for fish and water quality in terms of direct, indirect and cumulative effects, particularly the discussions about sediment (s. 3.3.3) serve to document effects to these species. The project design criteria including stream protection buffers are sufficient to provide for the habitat needs of this species.

The project **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 temporary road and landing reconstruction. 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.

3.4.7 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. 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.

3.4.8 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.

The project is consistent with the standards and guidelines that address Best Management Practices FW-055 to 059.

3.4.8.1 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. 3.4.4).

Portions of the effects analysis in this document in sections 3.3 and 3.4 focus on key parameters or indicators that make up elements of the nine Aquatic Conservation Strategy objectives, and form the rationale of the project's ability to maintain or restore these indicators. 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. The Fisheries Biological Assessment which is incorporated by reference has a detailed discussion on each of these indicators. A summary of the findings for each objective follows this table.

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

ACS Objective 1 - Watershed and Landscape-Scale Features

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

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 with low levels of diversity. Past clearcutting and road construction have also reduced pool and margin habitat in streams, reduced aquatic cover habitat, and removed or delayed future recruitment of large down wood, large snags, and live trees. Large wood loss also resulted in loss of habitat connectivity for species like mollusks and salamanders that use logs that span from streams to uplands areas.

The project would accelerate the restoration of late-successional conditions and reduce fragmentation. Riparian prescriptions would restore plantations by creating diversity and complexity in largely homogenous tree plantations. Stream protection buffers provide in-stream woody debris recruitment. The proposed action provides a balance between the maintenance of existing habitat for aquatic and terrestrial riparian species, populations, and communities, primarily through protection buffers, with opportunities to develop landscape scale restoration as multiple plantations moved toward late-successional conditions thereby improving the distribution, diversity and complexity typical of landscape features that developed under natural conditions. Over time, as late-successional conditions are restored in riparian reserves, missing elements such as large woody debris complexity both at the stream and landscape scales would be restored.

For these reasons, the objective of maintaining and restoring watershed and landscape-scale features would be met for this project.

ACS Objective 2 - Connectivity Within and Between Watersheds

Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.

Connectivity in the project area has been affected by the construction of roads and clearcutting in riparian areas. Some roads follow river bottoms and have narrowed the flood plain and removed riparian vegetation, contributing to increased stream temperature, and accelerated flow causing bank erosion. Connectivity has also been disrupted by roads that cross streams with culverts impassable to aquatic organisms. Roads and clearcuts in riparian areas have also broken some connections for dispersal of terrestrial riparian dependent species such as salamanders. In recent years, road decommissioning and the replacement of certain culverts has removed some of these barriers.

In the project area, a network of riparian reserves covers rivers, streams, springs, ponds and wetlands and the land adjacent to them. Due to climatic and geologic factors, this watershed has a relatively dense network of streams, springs and wet areas all providing for spatial connectivity for aquatic and riparian dependent species. Maintenance of natural flow paths on the landscape and within the project area assure temporal connectivity.

New temporary road construction would not cross streams or follow streams closely. Roads that are constructed or reconstructed would be temporary and would be decommissioned after use to restore spatial and temporal connectivity. Stream temperature, current wood recruitment and undisturbed terrestrial dispersal corridors would be maintained in the short term by protection buffers adjacent to streams. Riparian treatment prescriptions would restore plantations in the long term by accelerating the creation of missing diversity and complexity elements including large diameter trees, skips, gaps and down wood. As these and other riparian reserve plantations are enhanced across the watershed, aquatic connectivity and late-successional connectivity would be restored more rapidly. The project would actively decommission five miles of old road alignments that were never actively decommissioned. These have four stream crossings and eight seep intercepts. As they are decommissioned, spatial and temporal connectivity at the site scale would be restored to more natural flowpaths.

For these reasons, the objective of maintaining and restoring connectivity within and between watersheds would be met for this project.

ACS Objective 3 - Physical Integrity

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

The physical integrity of aquatic systems has been affected by the construction of roads and clearcutting in riparian areas. Some roads follow river bottoms and have narrowed the flood plain and removed riparian vegetation, contributing to accelerated flow causing bank erosion.

Stream protection buffers and road use restrictions during the wet season and other PDCs would minimize erosion and changes to stream shorelines, banks and bottom configurations and maintain the integrity of stream channels. New temporary road construction would not cross streams or follow streams closely. Roads that are constructed or reconstructed would be temporary and would be decommissioned after use. Stream crossings on these roads would be restored to their original bank and bottom configurations. System road repairs and maintenance have PDCs to protect the physical integrity of the aquatic system. The project would actively decommission five miles of old road alignments that were never actively decommissioned. These have four stream crossings and eight seep intercepts. As they are decommissioned and restored to their original bank and bottom configurations, the physical integrity of these streams would be enhanced. Changes in peak streamflows associated with vegetation manipulation and roads were assessed and it was determined that peak flows would not likely cause stream channel destabilization or impacts to the physical integrity of the aquatic system.

For these reasons, the objective of maintaining and restoring physical integrity of aquatic systems would be met for this project.

ACS Objective 4 - Water Quality

Maintain and restore water quality necessary to support healthy riparian, aquatic and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

Temperature and sediment in the project area have been affected by the construction of roads and clearcutting in riparian areas. Both are gradually improving as roads are decommissioned and as riparian vegetation grows and provides shade.

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. The project would actively decommission five miles of old road alignments that were never actively decommissioned. These have four stream crossings and eight seep intercepts. As they are decommissioned and restored, water quality would improve. Stream protection buffers would maintain stream temperatures and filter out sediment where timber harvest is taking place.
PDCs for logging and road construction and maintenance would insure that project activities minimize sediment delivery. There would be some short-term localized increases in sediment delivery associated with temporary roads and other actions, however the level of sediment is very low compared to the natural background sediment level in the watershed. The short-term sediment impacts associated with the temporary roads would also be spread out in time and space. The analysis of aquatic species found that the biological, physical and chemical aspects of water quality were within the range needed to support survival, growth, reproduction and migration.

For these reasons, the objective of maintaining and restoring water quality would be met for this project.

ACS Objective 5 - Sediment Regimes

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

Even though this watershed has a history of natural erosion process through landslides and debris flows, human activities such as road construction have changed the frequency and timing of erosion processes. Road decommissioning efforts have already restored the highest risk road segments.

Peak stream flows were examined by assessing the effect of vegetation manipulation and roads on peak stream flows individually and in combination and it was determined that implementation of the project would not impact the timing, volume, rate or character of sediment input, storage or transport. The watershed has recovered hydrologically as trees in plantations grow. Implementation of project activities including thinning mid-aged stands and repairing, reconstructing and decommission associated roads are not anticipated to have any impact on base stream flows. The project would actively decommission five miles of old road alignments that were never actively decommissioned. These have four stream crossings and eight seep intercepts. As they are decommissioned, a more natural sediment regime would result at those locations.

The project would implement 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 and maintenance would result in a road system that minimizes sedimentation.

For these reasons, the objective of maintaining and restoring sediment regimes would be met for this project.

ACS Objective 6 - In-Stream Flows

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

The project area is prone to rain on snow events. Past road construction and regeneration timber harvest caused some drainages to exceed hydrologic recovery standards. The trend in recent years has been toward full recovery as plantations grow. Compared to regeneration harvest, thinning has much less effect on hydrologic flow patterns and the potential for increased peak streamflows.

Peak stream flows were examined by assessing the effect of vegetation manipulation and roads on peak stream flows individually and in combination and it was determined that implementation of the project would not impact the timing, magnitude, duration or spatial distribution of in-stream flows. Hydrologic recovery would continue to improve, and the in-stream flow regime, including the magnitude of flows would be maintained. The watershed would continue hydrologic recovery beyond the minimum levels identified in the Forest Plan and benefits to in-stream habitat for fish and other aquatic organisms would continue. The project would actively decommission five miles of old road alignments that were never actively decommissioned. These have four stream crossings and eight seep intercepts. As they are decommissioned, improvements to sediment, nutrient and wood routing would occur at those locations. Implementation of project activities including thinning and repairing, reconstructing and decommission associated roads are not likely to have any impact on base stream flows. Protection buffers would provide shade and riparian vegetation sufficient to prevent reduced flows during low flow periods.

For these reasons, the objective of maintaining and restoring in-stream flows would be met for this project.

ACS Objective 7 - Floodplain Inundation

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

The timing, variability and duration of floodplain inundation and water table elevation in some meadows and wetlands have been altered by past clearcutting and the removal of large wood in streams over the past 50 years. Riparian reserves overlay and surround streams, wetlands, and wet meadows.

Protection buffers adjacent to streams, seeps, springs, ponds, meadows and wetlands would provide a source of small woody debris recruitment. Over time, wood recruited to streams would add complexity and slow flow as meanders and pools are created. By physically protecting these areas and by also protecting the timing, magnitude, duration and spatial distribution of peak, high, and low flows as described in Objective #6, the timing and duration of floodplain inundation and water table elevation in meadows and wetlands would be maintained. The watershed would continue hydrologic recovery beyond the minimum levels identified in the Forest Plan as young plantations grow, resulting in long-term restoration of floodplain habitats and water tables.

For these reasons, the objective of maintaining and restoring flood plain inundation and water talbes would be met for this project.

ACS Objective 8 - Species Composition and Structural Diversity of Plant Communities

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 coarse woody debris sufficient to sustain physical complexity and stability.

Past regeneration harvest has changed both the species composition and structure in riparian reserves. Stands are dominated by dense, mid-serial Douglas-fir plantations.

Thinning in even-age Douglas-fir plantations in riparian reserves would diversify and restore native tree composition including retention of minor tree species. This project would promote the recruitment of structurally diverse plant communities by protecting areas of unique diversity such as wetlands, and by variable density thinning with skips 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. Protection buffers along streams would provide for short-term wood recruitment needs. Thinned riparian reserves would promote the growth of trees and over the long term, provide sufficient large woody debris for uplands, riparian areas, and stream communities.

For these reasons, the objective of maintaining and restoring species composition and structural diversity of plant communities would be met for this project.

ACS Objective 9 - Well-Distributed Populations of Native Species

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

Past regeneration harvest and road construction has changed both the species composition and structure in riparian reserves. Aquatic species were affected by removal of shade, increases in sedimentation from road construction and the blockage of movement by culverts. Some key aquatic species have become rare, and some unwanted plant species have flourished and are outcompeting desired species. There is an ongoing trend of improving watershed conditions as trees and vegetation regrow, as roads are decommissioned and as uniform riparian vegetation is made more diverse.

Thinning prescriptions would retain minor native tree species and would restore uniform plantations to a more diverse mix of native species and accelerate attainment of late-successional characteristics. Design criteria address measures to minimize the spread of invasive plants and to use native species for erosion control. Protection buffers along streams would provide for short-term wood recruitment needs and provide shade to minimize impacts to invertebrate and vertebrate aquatic and riparian-dependent species. Thinned riparian reserves would promote the growth of native trees and over the long term, provide sufficient large woody debris which benefits a wide range of native plant and animal species. A more diverse arrangement of large wood and native plants in riparian reserves and along streams would host native invertebrate, and riparian dependent species for the improved health of the aquatic and riparian system.

For these reasons, the objective of maintaining and restoring well-distributed populations of native species would be met for this project.

3.5 GEOLOGIC STABILITY

This section summarizes the stability specialist report which is incorporated by reference. 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. It also contains areas that are quite stable as well as dormant earthflows. 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. After the 1996 storm there were new cracks that developed and these cracks gradually became larger over 2-3 years and then stopped. Total movement was about 1-3 inches. Dormant earthflows typically have movement rates of between zero and six inches per century depending on their location and the intensity of storms. 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 0.4 mile of new 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 or present actions; no reasonably foreseeable future actions would occur that would impact slope stability.

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. Some thinning units from other EAs remain that have not yet been contracted. It is foreseeable that these thinning units would be contracted in the near future. 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 ongoing thinning projects and some thinning units from other EAs within the Collawash watershed that are included in the analysis of cumulative effects because portions of them touch earthflows. The analysis includes harvest before, 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	94.8%
Cat	97.0%
Farm	96.7%
Happy High	95.0%
Happy Moderate	96.6%
Ochre	94.2%
Panzy	95.5%
Paste	96.4%
Peat	96.3%
Pink High	95.5%
Pink Moderate	85.1%
Sluice	97.3%

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 2014
Blitzen	High	90%	94.4%
Cat	High	90%	96.8%
Farm	Moderate	75%	95.9%
Happy	High	90%	92.9%
Happy	Moderate	75%	96.0%
Ochre	Moderate	75%	93.4%
Panzy	Moderate	75%	94.2%
Paste	Moderate	75%	92.2%
Peat	High	90%	94.2%
Pink	High	90%	94.9%
Pink	Moderate	75%	85.5%
Sluice	High	90%	96.6%

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 which are incorporated by reference.

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

3.6.1 Measures

For this analysis three measures are used to assess impacts; erosion, soil disturbance and organic matter. Forest Plan standards and guidelines that address these measures are in section 3.6.7.

Erosion
Surface soil erosion is loss of topsoil due to forces such as raindrop impact, overland

flow, snow and ice melt, wind, and gravity. It occurs most readily when effective vegetative cover and litter is removed or does not exist. 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 section 3.3.3. The erosion hazard rating is based on bare surface soil properties that affect detachability, such as climate, slope gradient and length, soil texture and structure, permeability of the surface soil, and hydrologic characteristics of the soil and bedrock materials. Management ratings for erosion risk, 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.

3.6.2 Methodology and Background Information

Soil distribution is complex across the watersheds where this analysis area is located. Sixteen soil types are mapped within the Jazz proposed thinning units. 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 and field visits. 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.

Soil Types and Geographic Locations in the Planning Area

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

Pyroclastic - 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– non earthflow – 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).

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.

3.6.2.1 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					
329	Moderately Stable	Moderate	Moderate-High	Moderate	High

3.6.2.2 Assessment of Existing Condition –

The extent of existing 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.

Existing conditions for the three soil measures are addressed in each section below.

3.6.3 Effects Analysis

3.6.3.1 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 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. Sediment that may result from these actions is addressed in other sections. Some actions are specifically designed to benefit soil productivity including the creation of down logs, road decommissioning, and decompacting temporary roads and landings.

Approximate acreage by yarding system is at s. 1.4.7. Landings are addressed at s. 1.4.7.1. 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. The treatment of temporary roads after use is at s. 1.4.6.2.

The analysis also considers the design criteria 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.

3.6.3.2 Cumulative Effects Parameters

The analysis areas for soil productivity for cumulative effects are the thinning units. These are appropriate boundaries because actions outside the unit boundaries would have little or no affect to soil productivity within the units, and the actions within the unit boundaries would have little or no affect to soil productivity elsewhere. In terms of the time scale, timber harvest and road construction that has occurred since the 1950s has created soil impacts that remain today.

The existing condition described in the analysis below incorporates all past actions that have occurred within the analysis areas. There are no other ownerships to consider within the analysis areas and 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.

This analysis focuses on soil productivity within the thinning units. No attempt has been made to quantify soil productivity at the landscape scale. The Forest Plan has standards and guidelines and land allocations that have addressed the larger scale situation. Recent wildfires in the watershed were not in or adjacent to thinning units.

Actions that have occurred within the soil analysis areas that may generate cumulative effects to soil involve past and proposed logging, site prep, fuel treatment, road construction/reconstruction and road restoration activities. All proposed thinning units were previously clearcut logged from the 1950s to the 1970s. The following table shows a general rating of measures of magnitude, extent, and duration of impacts.

3.6.3.3

Past and Proposed Actions	Past Actions clearcuts	Proposed Actions - thinning	Magnitude of Impact	Extent of unit with detrimental Impacts	Duration of Impact
Logging Activities					
-felling - harvester		X	low	high	long term (>50 yrs)
-yarding -skidtrails	X	X	high	high	long term (>50 yrs)
-cable - high lead	X		mod	low-mod	long term (>50 yrs)
-cable - skyline	X	X	low	low	long term (>50 yrs)

Past and Proposed Actions	Past Actions clearcuts	Proposed Actions - thinning	Magnitude of Impact	Extent of unit with detrimental Impacts	Duration of Impact
-helicopter		X	low	low	short term
-landings-	X	X	high	low	short term if decompacted
-temporary road construction	X	X	high	low	short term - decompacted
-temporary road reconstruction		X	high	low	short term - decompacted
Site Prep / Fuel Treatments					
-broadcast burning	X		low	low	long term (>50 yrs)
-machine piling	X		high	high	long term (>50 yrs)
-windrowing	X		high	high	long term (>50 yrs)
-burning landing piles		X	high	low	long term (>50 yrs)
Restoration Activities					
-decompact temp roads	X	X	high	low	long term (>50 yrs)
-erosion control activities	X	X	high	low	long term (>50 yrs)

These elements are included in a spread sheet in the analysis file that calculates existing, direct and cumulative impacts; it is incorporated by reference.

3.6.4 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. Subsoil erosion potential varies from slight to severe on weathered pyroclastic soils, and from moderate to high on glacial soils. Refer to the table in 3.6.2.1 for erosion hazard risk ratings for individual soil mapping units. Ground cover can be used as an indication of erosion risk. All of the units have well above 90% groundcover, which means that erosion risks are low to non-existent. 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, and can decrease water quality (see s. 3.3 and 3.4). Other negative effects occur such as decreased air quality from silt size soil particles carried in the atmosphere.

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. As the amount of bare or bare and compacted soil increases, so does the risk of soil movement. Erosion would not occur where duff and other effective ground cover is retained.

Bare soil would be exposed as logs are dragged on and machines travel over the ground surface. Approximately 64 acres of roads, skid trails and landings would be constructed or reconstructed. Most of this acreage has already been disturbed but currently has effective ground cover except for the portions of landings on existing system roads. Approximately 19 acres of bare skyline yarding corridors would occur. A total of 83 acres would have potential increased erosion as a result of thinning activities. If left bare, disturbed areas, particularly where slopes are greater than 25%, may become potential chronic sources of sediment. Effective ground cover such as slash or mulch would minimize erosion (s. 1.4.6.2 & s. 1.4.9.6). Slash and mulch are considered effective in the short term as ground cover until vegetation in the form of grass, shrubs or trees become established either from direct reseeding or through natural seeding.

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.

There are a few units on which erosion risk is higher. Downhill skyline yarding is proposed on portions of (units 34, 44, 80 and 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 that would occur after harvest and prior to the wet weather season (generally October 1st).

Actual resource damage (erosion and/or sedimentation) is dependent on weather events that provide the energy to move soil material from one location to another. In order to diminish this risk while soils are exposed, certain erosion control techniques which limit the amount of soil exposure, or which re-establish ground cover after soil is exposed, are included to lessen erosive energies. The use of PDCs for stream protection buffers, designated skid trails, and establishing effective ground cover by applying logging slash or seed, fertilizer, and straw mulch on the disturbed soils reduce erosion features and disturbance, and results in a low potential for soil to be moved to streams.

By maintaining proper amounts of protective groundcover, the risk of erosion is extremely small.

Cumulative Effects – Erosion

The table at s. 3.6.3.3 lists the actions that have generated cumulative effects within the soil analysis areas. In areas of past ground disturbing activities, groundcover protecting the soil surface from erosional influences has increased over time and is now widespread. Existing surface erosion is mainly confined to exposed soil on unpaved road surfaces, road cutbanks and ditches.

The thinning projects would result in a temporary reduction in effective ground cover on primary skidtrails, landings, yarding corridors, and to a lesser extent on ground between primary skidtrails, temporarily increasing the probability of increased erosion levels within the unit boundaries. Utilizing the design criteria, all stands proposed for treatments are expected to have sufficient effective ground cover following ground disturbing activities resulting in little effect to erosion from the proposed action combined with past actions because sufficient ground cover would be applied or retained. Stream channels would be protected with buffers that would mitigate against soil reaching the streams. The longer term effect would be a re-establishment of effective ground cover and reduction in erosion.

The road decommissioning projects would have a beneficial effect on long-term erosion rates and water quality. These projects would increase infiltration capacity of the roadbeds resulting in a reduction in overland flow, establishment of effective ground cover on the road surfaces and allow for revegetation (3.6.4).

The cumulative effects of the proposed actions when combined with past actions would not be substantial and trees and other vegetation are expected to continue growing and developing at appropriate rates.

3.6.5 Soil Disturbance

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).

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, is 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 clearcut 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 12% to 22%. 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 25%. It is estimated that all units previously harvested with ground-based equipment and skyline or other cable systems exceed 8% detrimental soil condition, and 14 units exceed 15% detrimental soil condition.

Direct and Indirect Effects

Alternative A – No Action

No further losses or gains in soil productivity in the short term or long term are expected with this alternative. Detrimental conditions in the units would remain. No change in soil productivity due to logging related compaction and displacement would occur. Existing temporary logging roads and landings would not be used or restored, and would likely remain in a detrimental condition for the foreseeable future. Detrimental soil compaction and displacement would remain localized to existing system and temporary roads, skidtrails and landings.

In the long term, percent disturbed soil condition would slowly decline as compacted areas move toward recovery due to physical and biological processes, but the rate would largely be dependant on root growth of vegetation, the resilience of the soil, and the intensity of the disturbance.

Soil displacement on skid trails would last a long time because soil formation is a slow process, on the order of hundreds of years or more.

Alternative B – Proposed Action

Changes to disturbed soil condition were estimated. Existing landings, temporary roads, and skid trails would be reused where feasible.

A net increase in disturbed soil condition is predicted where more skid trails, yarding corridors, landings and roads would be constructed than already exist. This increase is expected to stay below 7% on ground based units due to spacing of designated skidtrails at 150' apart, but on many units, where a large number of skidtrails are existing from the original clearcut entry and would be reused, the increase may be lower, at 3-4%. On skyline units, the increase is estimated at 2% to 3%, and on helicopter units at 1%. The range of estimated changes in detrimental condition created by the proposed action is shown in the table below. The estimated percent area of detrimental soil condition in each of the treatment units can be found in the analysis file.

There would be no accompanying measureable decrease in site productivity in the units. Decompaction and establishment of effective ground cover on landings and temporary roads would initiate recovery of productivity and increase soil water storage.

Cumulative Effects – Soil Disturbance

The table at s. 3.6.3.3 lists the actions that have generated cumulative effects within the soil analysis areas. The table below shows a summary of effects from past actions, the estimated effects from the proposed action, and the cumulative effects of the past plus proposed actions. Unit data is in a spread sheet in the analysis file and is incorporated by reference.

Past Actions	Direct Effect Proposed Action	Cumulative Effect
9% to 25%	-4% to 6% *	9.5% to 25%

*some units have a negative number because restoration of compacted roads and landings results in a net reduction of compacted soils.

The following units would continue to exceed 15% detrimental soil condition after treatment: 2, 4, 8, 16, 18, 20, 22, 24, 32, 34, 36, 40, 42, 44, 52, 60, 62, 68, 69, 72, 76, 78, 80, 82, 83, 88, 90, 92, 94, 96, 98, 100, 101, 114, 116, 118, 120, 122, 124, 126, 128, 130, 134, 140, 142, 144, 146, 148, 150, 152, 154, 156, and 158.

Even though many of the units have relatively high levels of detrimental soil condition there is no obvious visible symptom in the amount or quality of vegetation currently within these units. Detrimental soil condition is built on the premise that soil damage negatively affects vegetative growth by reducing site productivity caused by a reduction of soil water and nutrients. It might be expected that a stand with 30% detrimental soil conditions would have visible signs of stressed trees. Yet this is not the case; all units are growing well as demonstrated by stand exams and exhibit no reduction in site productivity (s. 1.2.1.3 & s. 3.1). There are a few factors that may explain this:

- The shape and distribution of the damage is usually long and linear and not concentrated. There may be sufficient undamaged growing space spread out between the old skid trails to support the stand of trees we see today.

- The local climate of the area is very conducive to high levels of vegetative production, and it is possible that the high measured level of detrimental soil impact does not affect site productivity as much as it would in drier areas.

- While soil impacts are long lasting, there is a gradual continuum of recovery that may be underestimated.

The cumulative effects of the proposed actions when combined with past actions would not be substantial and trees and other vegetation are expected to continue growing and developing at appropriate rates.

3.6.6 Organic Matter

Existing Condition

Compaction, puddling, displacement, erosion and severe burning of soils have the potential to affect individuals and populations of soil organisms including mycorrhizal fungi, soil dwelling arthropods, nematodes and bacteria. Loss of organisms occurs through direct destruction from equipment operations and from loss of habitat or substrate. These losses are usually localized to the area of forest floor and/or topsoil disturbance, e.g. a skid trail. All proposed thinning units have been logged previously, and therefore have localized changes of soil organism communities at disturbance sites where organic matter was removed or moved.

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.

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). Over time, these stands would eventually produce substantial quantities of small woody debris.

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. Two to seven trees per acre would be felled or girdled to create coarse woody debris. Partially rotted down logs left from the previous clearcut may be degraded if moved or run over by ground-based equipment.

Duff disturbance would be minimized where full suspension yarding occurs in skyline and helicopter operations, where designated and existing skid trails are used in ground-based yarding operations, and where harvesters travel over slash mats when traveling away from designated skidtrails. 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 83 acres of soil exposed during mechanical felling, yarding and road construction and reconstruction operations.

Road decommissioning projects would increase soil organic matter within roadbeds where the road surfaces are decompacted and course woody debris is placed within the road prism.

Cumulative Effects – Organic Matter

The table at s. 3.6.3.3 lists the actions that have the potential to contribute to cumulative effects within the soil analysis areas.

In the analysis area, previous timber harvest, fuel treatment, and road construction activities have resulted in reduced duff and large woody debris levels, and a probable change in soil organism communities in disturbed areas. Even though many of the units have low levels of large woody debris, there is no obvious visible symptom in the amount or quality of vegetation currently within these units. It might be expected that a stand with low levels of large woody debris would have visible signs of stressed trees. Yet this is not the case; all units are growing well as demonstrated by stand exams and exhibit no reduction in site productivity (s. 1.2.1.3 & s. 3.1). However, large down logs are important for other reasons besides this relatively short-term assessment of tree growth. Decomposition of large wood recycles nutrients over a very long time period, contributes to soil structure, slows evaporation of soil moisture during dry periods, and maintains a moist environment and food source for a large variety of soil organisms. It is also an important contributor to biological carbon sequestration and habitat for species such as mollusks and salamanders. The reduction of large wood by clearcutting and site preparation treatments in the past has had and will continue to have long-term implications for these ecological processes.

The cumulative effect of additional disturbance from the proposed action added to the existing condition would slightly increase displacement of organic material on exposed soils, increase numbers of coarse woody debris logs the size of thinned material, and reduce the decay cycle timeframe of rotting down logs that are moved or run over by equipment. A sufficient tonnage of branches and down logs left after harvest is completed is expected to remain on site to provide for organic matter input to the ecosystem once all activities are complete. Based on previous experience with similar stands, approximately 27 tons per acre of debris would be retained in the units (s. 1.4.10) which is a sufficient level in west side forests to maintain long-term productivity (s. 3.6.7).

The cumulative effects of the proposed actions when combined with past actions would not be substantial and trees and other vegetation are expected to continue growing and developing at appropriate rates.

3.6.7 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 or similar 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 (>25 tons/acre) 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 in their current condition. 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 in their current condition. 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) 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.

The project is covered by multiple consultation efforts:

- The first consultation is documented in a Letter of Concurrence, written by the U.S. Fish & Wildlife Service and dated February 02, 2010 (reference 13420-2010-F-0157) (USDI 2010). (In this 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.)

- The second consultation is documented in a Letter of Concurrence, written by the U.S. Fish & Wildlife Service and dated May 17, 2011 (reference 13420-2011-I-0135) (USDI 2011). (This second programmatic 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.)

- The third consultation is documented in a Biological Opinion written by the U.S. Fish & Wildlife Service and dated February 20, 2013 (reference 01EOFW00-2013-F-0089) (USDI 2013). (This third project level consultation was made necessary due to the changes to critical habitat. A Biological Assessment was prepared to initiate this consultation. This biological opinion also amended the above letters of concurrence to extend their implementation dates to December 31, 2015.)

These documents and the specialist report are incorporated by reference and summarized below.

The USDI Fish and Wildlife Service revised critical habitat for the northern spotted owl (USDI 2012). The proposed Jazz project includes 2,052 acres of critical habitat (all of the thinning units).

The northern spotted owl recovery plan (USDI 2011 p. 19) recommends that "*In moist forests managed for spotted owl habitat, land managers should implement silvicultural techniques in plantations, overstocked stands and modified younger stands to accelerate the development of structural complexity and biological diversity that will benefit spotted owl recovery."* The Designation of Revised Critical Habitat for the Northern Spotted Owl (USDI 2012) recommends, on the basis of extensive scientific analysis, that areas identified as critical habitat should be subject to active management, including logging, in order to produce desired stand characteristics.

3.7.2 <u>Habitat Methodology & Existing Condition</u>

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. This involves units 28, 34, 40 and 48.

Log-hauling on open roads is not expected to have adverse effects 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 Critical Habitat – All of the proposed units are located in the 2012 delineation of critical habitat. The USFWS has identified dispersal habitat as a Primary Constituent Elements (PCE) necessary for spotted owl recovery. The inclusion of heavy thinning patches to enhance diversity would remove dispersal habitat and therefore the USFWS has indicated that this treatment **may affect and is likely to adversely affect 2012 spotted owl critical habitat** in the short term (USDI 2013). This effects determination is based on thinning below 40% canopy cover. Heavy thinning would cause a substantial delay in the stand's re-growth to dispersal habitat. This effect would be temporary because over time the residual trees would grow and canopy cover would again be over 40% and the resulting stands would be more diverse. Most of the proposed thinning is not heavy thinning patches but is considered moderate to light thinning. In these areas the USFWS has indicated that thinning would maintain habitat functionality and **may affect but is not likely to adversely affect** 2012 spotted owl critical habitat and is expected to result in a long-term beneficial effect (USDI 2013).

The Biological Opinion (USDI 2013) also found that:

- the short-term impacts have been minimized and reconciled with long-term ecosystem restoration goals to avoid adverse modification;
- the project is consistent with the 2011 Recovery Plan and the Northwest Forest Plan;
- the project implements science-based, active vegetation management to restore forest health;
- the short-term impacts are limited in scope and would not preclude critical habitat from contributing to the survival and recovery of the spotted owl;
- there are no known cumulative effects;
- and that the project is not likely to destroy or adversely modify critical habitat.

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 (USDI 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, 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 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 project **may affect, but is not likely to adversely affect** the northern spotted owl in terms of 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 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.

The Collawash watershed is used as the analysis area boundary for cumulative effects analysis. The effect of logging on suitable habitat is long lasting. However this analysis focuses primarily on dispersal habitat which has regrown in the plantations and even after heavy thinning would become dispersal habitat again as trees grow. All past actions that have impacted habitat are considered in the analysis. There are five recent and 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 (269), Fan (209 ac), Pin (401 ac), and Pink (188 ac) for a total of 1,128 acres. There are also several thinning units within the Collawash watershed from previous EAs that have not yet been awarded that add up to approximately 209 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 and found them to not be substantial at the time they made their effects determinations. 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. The following units are all or partly in the LSR: 22,24,26,28,30,32,34,36, 38,40,54,56,60,62,64,66,68,70,74,78,82,110,112,120,122,124 and 126. 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.

Diversity is the distribution and abundance of different native plant and animal communities and species (s. 1.2.1.4 & s. 3.2). 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 species. At the stand scale other elements become more relevant such as tree species composition, snag abundance or the number of canopy layers.

Both human actions and natural processes or events have the potential to alter wildlife diversity. Some actions or natural processes or events may seem to benefit one aspect of diversity and a suite of species while at the same time be detrimental to other 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.

At a landscape scale, the logging that created the plantations fragmented mature forest stands. Prior to the 1950s, the forests in the project area were relatively uniform mature forest but became 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.

In the past, thinning focused primarily on tree growth and productivity and resulted in continued uniformity. The proposed action however involves variable-density thinning with skips and gaps to provide for greater diversity. 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. There would be a temporary increase in forage for deer and elk. 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 and small mammals. Many species such as spotted owls, 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 may result in short-term impacts to some species but in the long term, many wildlife species would benefit as stands and landscapes become more diverse.

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
Beller's ground beetle	No habitat (bogs)	No Impact
California Shield-backed Bug	No habitat (prairie and balds)	No Impact
Western Bumble Bee	No habitat (flowering plants in openings)	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 butterflies use dwarf mistletoe for their primary habitat. There would be some removal of hemlock with dwarf mistletoe. The only dwarf mistletoe present in the area is species specific to hemlock trees. In these plantations, hemlock trees have limited distribution because they were not planted and they occur primarily along the stand edges where they seeded in from hemlock trees outside the plantations. Similarly the dwarf mistletoe that occurs on the hemlock trees has seeded in from infected trees outside the plantations. In 2006, Raymond Davis estimated that there were approximately 206,000 acres on the Forest with potential habitat for western hemlock dwarf mistletoe and Johnson's hairstreak butterfly (Davis Personal Communication 2013). 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 Salamanders utilize cold rocky streams for most of their life cycle. There is potential habitat for these salamanders in streams adjacent to the proposed thinning units. For Cope's Giant Salamander to occur the rock has to be non-abrasive, and the stream gradient high, with no silt embedding the cobble substrate, and the water has to be cold. There is some potential for this species to occur in the Collawash watershed (Char Corkran Personal Communication). The project design criteria for stream protections would minimize impacts to the viability this species.

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.

Cumulative effects analysis for sensitive and survey and manage species use the Collawash watershed. All past actions such as logging and road construction are considered along with ongoing and planned thinning. The ongoing thinning projects add up to 1,128 acres and there are also several thinning units within the Collawash watershed from previous EAs that have not yet been awarded that add up to approximately 209 acres. There are also a series of road decommissioning projects: some recently completed and some that are yet to be implemented. Several wildfires have occurred within the analysis 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. The ongoing and planned actions in the project area involve plantation thinning which were found to have little effect on sensitive species because they do not involve harvest of mature trees and have protections for riparian and aquatic resources. Based on this analysis, all of these cumulative actions are not likely to cause a trend to federal listing or loss of viability to the 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 6^{th} 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.

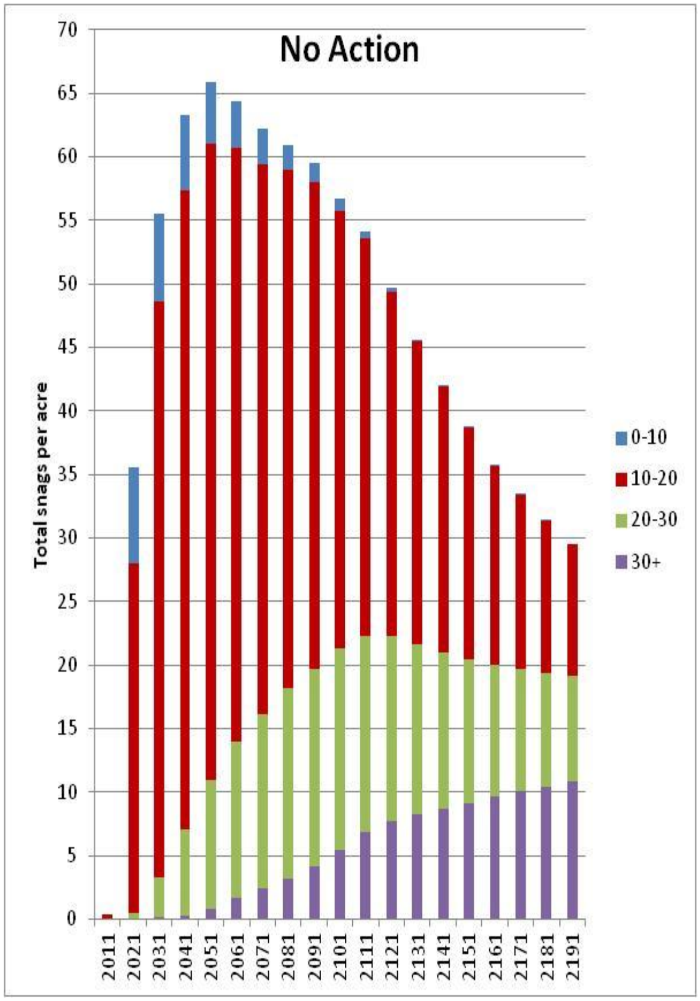
Tolerance levels in DecAID are broken into 30, 50 and 80th percentiles that represent the likelihood that a species such as pileated woodpecker would use land with a given level of snags. The analysis for the Collawash watershed for pileated woodpecker shows that for large snags - over half of the watershed 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

No Action

Most of the plantation acreage that is more than 100 feet or so from an open road 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.

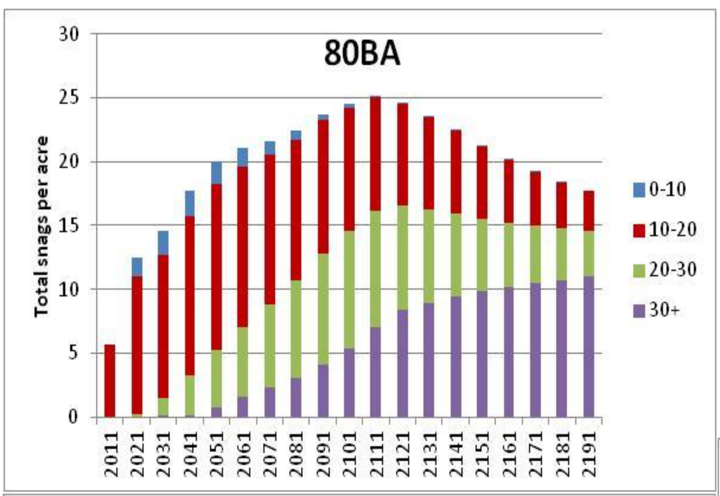
This chart shows the projected level of snags over time in the plantations. There would be an abundance of snags in the 10 to 20 inch diameter range.

Proposed Action

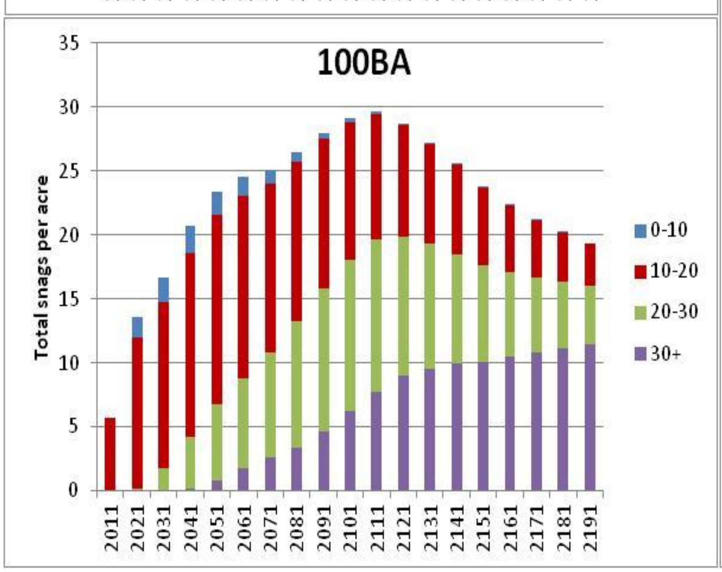
The following actions have the potential to affect snags and down logs. Since snags may be hazardous some of them may be felled adjacent to operations such as tree felling, landing use, skidding, road use, road construction, road repair, road closure and log haul. Existing down logs may be disturbed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

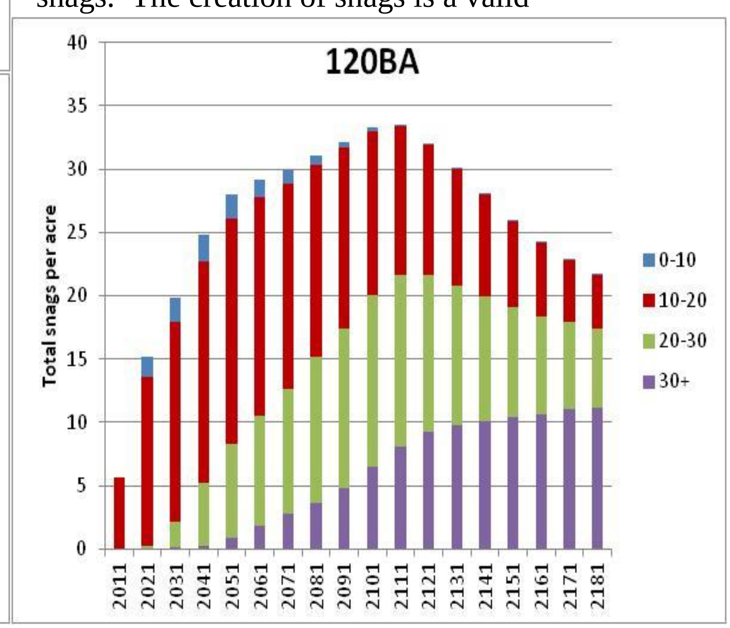
Currently the plantations contain small snags. Some of the small snags are difficult to retain during logging and road construction because of their inherent instability and danger. It is likely that some snags would need to be cut down during harvest operations due to safety considerations and that some downed logs would be degraded through the process of logging. The proposed action involves the use of approximately 312 landings as described in s. 1.4.7.1. Snags or live trees with decadence that are hazardous would have to be felled for safety reasons adjacent to landings. However any landing adjacent to an open road would already have hazard trees felled as part of routine road maintenance. Approximately 57% of these proposed landings are directly adjacent to or on open roads and should have few if any additional snags felled. Previous experience with landings on similar thinning projects is that most landings have no hazard snags that need to be cut and that occasionally one or two snags per landing may be cut if they lean toward the landing. Helicopter landings pose additional risks due the effect of rotor wash that might create a hazard that would not exist with other logging methods. All of the helicopter landings and service landings are on existing open roads and many are in rock quarries which already have a very large cleared area. A few hazard snags may need to be felled for each of the approximate 15 helicopter landings. A precise estimate of hazards cannot be made at this time because some snags or trees that are hazardous now may fall before operations begin and some trees that are alive or stable now may die or become unstable by the time operations begin.

The proposed action would result in fewer snags and less down wood compared to no action. The following analysis shows a long-term projection for snags inside plantations. 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 created 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. The effect of ongoing road maintenance on hazard snags was addressed above and it is presumed that hazard mitigation would continue in the future along open roads.

There are five recent and 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 (269), Fan (209 ac), Pin (401 ac), and Pink (188 ac) for a total of 1,128 acres. There are also several thinning units within the Collawash watershed from previous EAs that have not yet been awarded that add up to approximately 209 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 2,925 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 Action
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. The time frame for past projects includes past regeneration harvest that have not yet closed their canopy and shaded out forage species. Forage quality and quantity is best for approximately ten years after regeneration harvest and quality begins to be lost as plantations grow. This thinning and other ongoing thinning provide some limited quality forage which is likely to last approximately ten years into the future before shade again becomes a limiting factor. There are five recent and 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 (269), Fan (209 ac), Pin (401 ac), and Pink (188 ac) for a total of 1,128 acres. These are also thinning projects and would result in similar benefits to forage as described for the proposed action. There are also several thinning units within the Collawash watershed from previous EAs that have

not yet been awarded that add up to approximately 209 acres. 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.

Cumulative effects for pileated woodpeckers are addressed in s. 3.8.2.4 above. That section summarized that there are an abundance of snags at the landscape scale 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. 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.

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 15^{th}.

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

This section summarizes the scenery/recreation report which is incorporated by reference. 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

This section summarizes the scenery/recreation report which is incorporated by reference. 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.

Some of the units are adjacent to the Bull of the Woods Wilderness. The boundary has been surveyed and accidental intrusion into the wilderness is not likely.

The proposed project is not in an Inventoried Roadless Area. Areas that were once roadless areas have recently been incorporated into the Bull of the Woods Wilderness. Potential Wilderness is defined by FSH 1909.12 chapter 71. The project area does not meet Forest Service criteria for Potential Wilderness because the unroaded/undeveloped portions of the landscape are less than 5,000 acres in size, are not contiguous to existing wilderness, and are not self-contained ecosystems.

There are no areas with unroaded and undeveloped character identified during public scoping.

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

This section summarizes the wild and scenic river report which is incorporated by reference. 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 3.4 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 3.4 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 river was 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.

In terms of cumulative effects, there are several other ongoing and recent thinning projects that are within the ¼ mile buffer. There are parts of four units of Fan Thin which have not yet been thinned and parts of three units of the Hot Thin which were recently completed. These units cannot be seen from the river bank because they occur above a slope break. No other foreseeable actions would occur within the river corridor and there are no private lands. 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 cumulative effects. The Hot and Fan projects combined with Jazz would not likely have an adverse effect to the values for which the river was added to the National Wild and Scenic River System.

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). That analysis and the transportation specialist report are incorporated by reference and summarized below. 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.

Virtually all of the units proposed for thinning were clearcut many years ago and logged to a road system that was constructed to access logging. Some of those roads have since been decommissioned and some are in need of repair before they can be safely used. During the development of the proposed action, all of the original access roads were examined to determine if it was appropriate to reuse them or access the units some other way. The roads that access units 16, 20, 28, 36, 40, 60, 116, 150 and 152 were evaluated for reconstruction but they were not included as part of the proposed action due to aquatic risk and cost issues. Approximately six miles of roads were considered but eliminated and units were evaluated for the use of helicopter logging systems.

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.

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
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

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
7010.000	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
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 – All or part of this 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 approved in the Increment 2 Decommissioning EA.
** This column represents the road system after the Jazz 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. There are also several thinning units within the Collawash watershed from previous EAs that have not yet been awarded that add up to approximately 209 acres. Recent and ongoing projects include Day, Fan, Hot, Pin and Pink thins. 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 and botany specialist report have been prepared by an agency botanist to address the potential effect of activities on special status/sensitive species; they are incorporated by reference and summarized below. The objective is to avoid a trend toward Federal listing under the ESA.

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.

This section addresses special status/sensitive species including fungi, bryophytes, lichens and vascular plants on the Regional Forester's Special Status/Sensitive Species list. Invasive species are discussed in s. 3.14. The following is a summary of the Botanical Biological Evaluation which is incorporated by reference.

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 sensitive 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 special status/sensitive species that are known or suspected to occur in the proposed project area.

The elements of the proposed action that could affect botanical species include thinning, cutting trees for down logs, creating snags, and the removal of trees for road, landing, skyline corridor, and skid trail construction. For the proposed action, there would some potential effects to species even if they were not found during surveys.

Where field surveys determined the presence of suitable habitat for a particular species of fungi, it was presumed to be present. There are 25 species of special status/sensitive fungi identified as having potential habitat in the project area. For these fungi, the proposed action would have an effects determination of **May Impact Individuals or habitat but is not likely to lead to a trend toward federal listing.**

Where habitat is present for special status/sensitive species that were not found during field surveys there is still the potential to alter their habitat. There are six species of vascular plants, seven species of bryophytes, four species of lichens, and 25 species of fungi identified as having potential habitat in the project area. Because it is possible to miss present species during surveys, 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.**

Surveys found one special status/sensitive species: **pale blue-eyed grass** (*Sisyrinchium sarmentosum)* in Unit 36. Portions of this unit would be deleted to protect the pale blue-eyed grass populations. Because of the potential to impact undiscovered individuals, the proposed action would have an effects determination of **May Impact Individuals or habitat is but not likely to lead to a trend toward federal listing.**

Pale blue-eyed grass is not a grass but an iris. Habitat for the species includes dry to wet meadows, lake margins, open riparian areas, and, in some cases, forest openings. Most of the populations of pale blue-eyed grass on the Forest occur in meadows. In wetter meadows, it occupies drier (and slightly higher) ground compared to sedges and rushes, which grow in hydric or water-logged soils. Pale blue-eyed grass seems to prefer vernally wet soils that dry out later on as summer progresses. Populations of pale blue-eyed grass can be found on both the Clackamas River and Zigzag Ranger Districts. Threats to pale blue-eyed grass include invasive plants, livestock grazing, tree encroachment, trampling by recreationists, and logging. In 2011, a Conservation Strategy was completed by the Forest Service with a formal commitment made to protect all known populations and to annually monitor all sites. There are 27 documented occurrences of this species worldwide; fifteen of these occurrences are in Washington and nine are in Oregon. All ten Oregon populations occur on the Forest. One of the largest of these populations occurs in the project area in unit 36.

3.13.2 Cumulative Effects

The analysis areas for botanical species for cumulative effects are the thinning units and the areas directly adjacent to them, including riparian reserves. These are appropriate boundaries because actions more than a few hundred feet outside the unit boundaries would have little or no effect to botanical species within the units, and the actions within the unit boundaries would have little or no effect to species elsewhere. The time scale for cumulative effects analysis is quite long: some impacts from 30 to 60 years ago when stands were clearcut persist today particularly for species that are old-growth dependent; and alterations made during thinning have the potential to affect special status/sensitive species that may be present in the stands for many years into the future. 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.

There have been no recent harvests in or directly adjacent to the Jazz units. Recent and ongoing projects in the area, such as Day, Hot, Fan, Pin and Pink, and the planned but not awarded harvest units from other EAs are not in or directly adjacent to the Jazz units. Since there would be little negative direct or indirect effect to special status/sensitive botanical species with the proposed action, and there are no adjacent actions, there would be no incremental impact and no substantial cumulative effect.

Project design criteria, including the retention of live trees, snags, riparian reserves and skips would minimize impacts to special status/sensitive species that may be present but were not discovered. 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 INVASIVE SPECIES

This section addresses invasive plants. A biological evaluation and botanist report have been developed by a botanist to address the potential effect of activities on invasive species; they are incorporated by reference and summarized below. Invasive plants are sometimes called noxious weeds.

The Pacific Northwest Region Invasive Plant Program Preventing and Managing Invasive Plants FEIS, was completed in 2005, and the “Site-Specific Invasive Plant Treatments for the Mt. Hood National Forest and Columbia River Gorge National Scenic Area in Oregon, including Forest Plan Amendment #16” FEIS, was completed in 2008. The invasive plant risk assessment for the proposed Jazz project is tiered to the 2005 and 2008 FEIS. The 2005 FEIS provides invasive plant management direction to all National Forest Land and Resource Management Plans in Region 6. The management direction includes invasive plant prevention and treatment/restoration standards intended to help achieve stated desired future conditions, goals, and objectives, and is expected to result in decreased rates of spread of invasive plants while protecting human health and the environment from the adverse effects of invasive plant treatment. The 2008 FEIS, in turn, is tiered to the 2005 FEIS. It identifies 208 invasive plant treatment areas on the Mt. Hood National

Forest and Columbia River Gorge National Scenic Area, where integrated invasive plant management methods (e.g., manual, mechanical, chemical, biological, and/or cultural treatments) would occur; authorizes the use of 10 herbicides; and provides for an early detection/rapid response (ED/RR) program. The goal of ED/RR is to identify and treat invasive plant populations early when they are still small since treatment and control become more difficult as populations get larger. Like the 2005 FEIS, the 2008 FEIS seeks to protect human health and the environment from the adverse effects of invasive plant treatment by minimizing risks to human health; drinking water; and botanical, terrestrial wildlife, and aquatic species. The design criteria in Section 1.4.9 related to invasive species were developed from the recommendations of these plans.

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.

3.14.2 Risk Assessment

The risk level for the introduction, establishment and spread of invasive plants/noxious weeds is high for this project. The following species are present in the project area.

Species Name	**Common Name**
Brachypodium sylvaticum	false brome
Cirsium arvense	Canada thistle
Cirsium vulgare	bull thistle
Cytisus scoparius	Scotch broom
Equisetum telmateia	giant horsetail
Geranium lucidum	shiny leaf geranium
Geranium robertianum	herb Robert
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.

Shiny leaf geranium and **herb Robert** are two invasive geranium species that are on the rise along Highway 224 and Highway 26, in campgrounds (e.g., Lazy Bend) and parking areas (e.g., Zigzag Ranger Station), and along major Forest Service roads on the west side of the Forest. Five years ago, these two species were only scattered and sporadic on the Forest. On the Mt. Baker-Snoqualmie National Forest, these two species are now abundant along most Forest Service roads at lower elevations, an indication of how invasive they are.

Threats: These two species are spreading rapidly on the Clackamas River and Zigzag Ranger Districts (particularly along major roads). They displace native plants. Once established, they are difficult to remove.

Mode of Establishment: Both species establish from seed and stem and root fragments that may easily be transported by vehicles, hikers, and animals.

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.

False brome is a highly invasive grass on the increase in western Oregon. Significant populations occur on the Willamette National Forest and in the Columbia River Gorge. There are only two known populations of this species, both small, on the Forest, one along Forest Service road 70 and the Collawash River and the other at Three Lynx near Highway 224. Both are being treated.

Threats: This non-native grass is an ecosystem-altering species, capable of quickly overrunning and displacing native plants in forests or in openings (along roads, in meadows). It can spread very quickly and, in the case of the Willamette National Forest, if not detected and treated early, occupy thousands of acres. Once established, it is difficult to eradicate.

Mode of Establishment: It reproduces from seed or vegetatively from root fragments.

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.

Threats: The plant can form monocultures, thereby excluding other native plant species.

Mode of Establishment: Spreads asexually via rhizomes (underground stems) or by wind, animals, and vehicles transporting spores.

3.14.3 Direct and Indirect Effects

With no action there would be less potential for the spread of invasive species, including noxious weeds; however, they may continue to spread even with no action because of vehicles traveling on open roads. Vehicles, people, and animals can transport invasive plant seed and other plant propagules (e.g., stem and root fragments) capable of generating new plants.

The invasive plants listed above (with the exception of false brome, shiny leaf geranium and herb Robert) 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 project design criteria in Section 1.4.9 would reduce the spread of invasive plants. Design criteria #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. These PDCs implement the standards and guidelines of the Region 6 FEIS for Preventing and Managing Invasive Plants (USDA 2005). The FEIS rates the effectiveness of these practices and explains the rationale for the effectiveness ranking. The use of native plant materials (particularly locally collected seed, cuttings, and divisions, and nursery-grown seedlings propagated from them) in revegetation of bare soils and the utilization of certified straw and mulch are considered highly effective. The cleaning of off-road equipment and the use of gravel from weed-free sources are ranked as moderately effective.

3.14.4 Cumulative Effects

The analysis areas for invasive plant management for cumulative effects are the thinning units and the areas directly adjacent and the roads leading to the project. The time scale for cumulative effects analysis is quite long: some impacts from 30 to 60 years ago when roads were constructed and the stands were clearcut persist today, and activities during thinning, particularly along roads, have the potential to affect the spread of invasive plant species that could be persist for many years into the future.

The 2005 Record of Decision and FEIS for Preventing and Managing Invasive Plants and the 2008 Record of Decision and FEIS 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. The former applies to all national forests in the Pacific Northwest Region (Region 6).

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. The Oregon Department of Agriculture treats populations of Japanese knotweed, spotted and diffuse knapweed, rush skeletonweed, herb Robert, and Canada thistle that are scattered in the Clackamas and Collawash watersheds annually or biennially depending on the species and population persistence. A number of these populations are located along haul routes (e.g., Highway 224; FS roads 46, 63, and 70). A population of false brome along FS road 70 is being treated manually by agency botanists. 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.

A number of the species listed above are relatively common along roadsides. Generally, these and other common, widespread invasive plant species associated with roads are not targeted for treatment because of limited resources (funding). Species targeted for treatment are those that are highly invasive and capable of altering ecosystems (e.g., Japanese knotweed, false brome, garlic mustard) and relatively new invaders that are on the increase (e.g., shiny leaf geranium and herb Robert). Populations for some common and widespread invasive plant species are targeted if they threaten other natural resources (e.g., riparian areas, wetlands, rare plant sites) or can spread easily because of their location in or along frequented campgrounds, trails, and parking areas. The proposed action and all of the existing contracts that use the same roads have similar contract provisions to minimize the likelihood of spreading existing species or introducing new invasive species from outside the project area. Practices such as the washing of equipment and the use of certified weed-free straw for erosion control and the use of certified weed-free seed for revegetation have been found to be effective in reducing the introduction, establishment, and spread of unwanted species.

3.15 AIR QUALITY

This section summarizes the air quality report which is incorporated by reference. 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

This section summarizes the economic evaluation that is part of the logging system report which is incorporated by reference. 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 which is incorporated by reference.

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). In terms of cumulative effects, there are no foreseeable future actions that would affect this historic site, therefore adverse cumulative effects are not likely.

This action is consistent with Forest Plan goal to protect important cultural and historic resources.

3.18 CLIMATE CHANGE

This section summarizes the climate change report which is incorporated by reference.

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

Competing and Unwanted Vegetation

The Record of Decision and Mediated Agreement for the "Managing Competing and Unwanted Vegetation" Final Environmental Impact Statement (USDA 1998) no longer apply to invasive species management but are still applicable to unwanted native vegetation, brush control and fuel treatments. Fuels treatments in thinning projects are exempt. 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.

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

Implementation of the proposed action would not conflict with the plans or policies of other jurisdictions, including the Tribes. This project would not conflict with any other policies, regulations, or laws, including the Clean Water Act, Endangered Species Act, and the National Historic Preservation Act. Effects to air quality and compliance with the Clean Air Act are addressed at s. 3.15.

Potential or Unusual Expenditures of Energy

The proposed action would require expenditures of fuel for workers to access the project, use power equipment and utilize the logging systems. In addition, jet fuel use for helicopter operations would also occur; however, these alternatives would not result in any unusual expenditure of fuel. The no action alternative would require no expenditure of fuel. No other direct, indirect, or cumulative effects are expected to occur.

Consumers, Civil Rights, Minority Groups, and Women

Contracting procedures would ensure that projects made available to contractors through this project would be advertised and awarded in a manner that gives proper consideration to minority and women-owned business groups. Because of this consideration, there would be no direct, indirect, or cumulative effects to consumers, civil rights, minority groups with implementation of any of the alternatives. See also s. 3.19.

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 over 30 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 over 30 years in Washington and Oregon.

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 over 30 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 20 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 over 30 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 over 30 years as a hydrologist for the Forest Service in California and Oregon.

Todd Parker – Hydrologist. Todd has a B.S. in Forest Management and a B.S. in Business Management from Oregon State University, 1981. He has been the Hydrologist on the Columbia Gorge and Zigzag Ranger Districts since 1992. He has considerable experience with watershed resources, watershed restoration and geographic information systems.

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 15 years in California and Oregon and for the state of Oregon for 6 years.

Mark Boyll - Botanist. Mark earned his B.S. 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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