United States
Department of
Agriculture

**Forest
Service**

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Environmental Assessment

Middle Santiam Thin Timber Sale

Sweet Home Ranger District
Willamette National Forest
Linn County, Oregon

Cougar Creek located within the Middle Santiam Subwatershed
(photo taken by K.C. Briggs)

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Summary

Purpose and Need

The Sweet Home Ranger District of the Willamette National Forest proposes to commercially thin about 1550 acres of young, densely-stocked, managed stands in the Donaca and Headwaters Middle Santiam River subwatersheds to:

- increase growth and vigor of residual trees;
- accelerate development of structural and compositional complexity; and
- contribute commercial wood products to the district's harvest target for fiscal years 2007-2009.

Proposed stand treatments are intended to improve habitat conditions, habitat function and connectivity within the Critical Habitat Unit (CHU) for northern spotted owls, the Middle Santiam River Corridor and the Santiam Area of Concern (AOC).

The action is needed because the stands proposed for treatment do not meet the tree size or compositional and structural habitat conditions desired in the CHU, Middle Santiam River Corridor and AOC. For many decades management objectives here were to maximize tree growth to provide a sustained yield of timber commodities over time, while also meeting other multiple use objectives. With the designation of CHU and AOC, the objectives for management of these stands have changed. Now the goal is to provide primary constituent elements of nesting, roosting and foraging habitat for spotted owls in the CHU and at a minimum dispersal habitat in the AOC. In addition, because of the checkerboard ownership pattern in the analysis area, the Middle Santiam Watershed Analysis proposed the Middle Santiam River Corridor be developed to connect habitat with the Late Successional Reserve (RO 215) to the south. The change in management direction here responds to the listing of the northern spotted owl as a threatened species.

The need for habitat development for spotted owls is somewhat tempered within the primary shade zone portion of Riparian Reserves because the Middle Santiam River from river-mile 5.3 (Green Peter Reservoir) to 3.7 (headwaters) is a 303 (d) listed stream for temperatures that exceed state water quality standards for salmonid rearing during a portion of the summer. The primary shade zones, which consist of vegetation that intercepts solar radiation and provides stream shade during the hottest part of the day, will not be thinned along the Middle Santiam River and all perennial streams that flow into it. Retention of these shade zones along the Middle Santiam River will aid in the recovery of water temperatures here while retention of shade zones along tributary perennial streams will ensure that water entering the Middle Santiam River does not contribute to its warming.

There is some urgency in developing habitat in young, managed stands more quickly than might occur without treatment to ensure viability of threatened spotted owl populations. Recent research indicates that "if the plantations in …owl habitat areas are treated with the proper types of thinning and some other management actions, the actions may accelerate the development of some old-growth characteristics by decades. Some benefits in biological diversity could occur within the next two or three decades" *(USDA 2002).*

Alternatives including the Proposed Action

Proposed Action*:* Based on a) management direction, b) recommendations included in the *Middle Santiam Watershed Analysis* and c) various research findings about increasing growth and vigor of young, densely-stocked, managed stands and accelerating structural and compositional development in young stands; the following proposal was made to accomplish project objectives:

- 1549 acres of 30-60 year-old, even-aged managed stands in the *Donaca and Headwaters Middle Santiam subwatersheds* would be commercially thinned;
- Occasional small openings (gaps) would be scattered among some of the thinned areas in the uplands to simulate gaps that naturally occur in late-successional stands. In all about 25 acres of gaps would be created within the 1549 thinned acres. These gaps would be planted with cedar;
- About 940 acres of the original 2490 acres of managed stands considered for thinning would be left intact (skips);
- Snags and down wood would be created to increase structural diversity;
- Species and tree size diversity would be encouraged through retention of minor conifer species such as western redcedar, Pacific yew, western white pine and most hardwoods.

Riparian Treatments in the Proposed Action:

- None of scattered, small openings (gaps) would occur in the Riparian Reserves.
- Portions of Riparian Reserves within proposed harvest units, which are not contributing to primary stream shade or channel bank stability, would be thinned to enhance stand growth and diversity.
- No-harvest buffers of at least 50 feet would be maintained in the primary shade zones along all perennial streams to provide the shading necessary to maintain water temperatures on the 303 (d)-listed Middle Santiam River. In addition, similar buffers would be maintained on all perennial tributaries to the Middle Santiam River to ensure these streams do not contribute to its warming. These buffers will also create filter zones necessary to reduce sediment delivery to streams.

Finally, a portion of one harvest unit would be thinned on an active earthflow to increase vigor and tree size within the stand thus helping to maintain the overall water balance on the earthflow and encouraging more long-term stability here.

These stand treatments would be accomplished using a combination of helicopter, skyline and ground-based yarding systems to harvest a total of 47 units yielding about 31,000 CCF (hundred cubic feet) of timber.

To access the proposed harvest units approximately 1 mile of new, native-surface, temporary spur roads would be constructed and approximately 2.2 miles of closed native surface, non-system spur roads that were created during the last harvest entry would be re-opened. These spur roads would be closed with berms, scarified and seeded following timber harvest. In addition, twenty roads, totaling 36 miles, would require various maintenance activities such as spot rocking, brush cutback to provide a safe site distance, road blading, and ditch cleanout. Another 37 miles of road reconstruction would be

required. This would include ditch culvert replacement, grubbing/brushing, slump repair, danger tree removal and repairing a hole in the road.

Alternatives to the Proposed Action*:* An alternative way to achieve the desired stand characteristics, without accelerating their development, is to take No Action. In this alternative no silvicultural stand treatments would be done in young, even-aged stands within the analysis area. These previously-managed stands would be allowed to mature over time, on their own.

Another option for accelerating the development of desired stand characteristics on these young, managed stands is achieved with similar treatments to the proposed action, but on fewer acres because the use of expensive helicopter yarding would be eliminated in this alternative.

Road access to harvest units is treated similarly to the proposed action in all respects except that this alternative would reconstruct an additional road and harvest one unit using conventional systems rather than with helicopter, as it was in the proposed action.

Issues

Issues include the following: 1) proposed treatments in the CHU designed to benefit northern spotted owl habitat in the long-term may have short-term effects on both habitat and individual spotted owls intended to benefit by the project; 2) proposed habitat improvement treatments in the AOC may temporarily degrade dispersal habitat (although currently of marginal quality) that the project is attempting to improve over the longer-term; 3) treatments in Riparian Reserves to benefit habitat here could potentially impact water quality on the 303 (d) listed Middle Santiam River; 4) ground-disturbing activities associated with harvest operations could affect the introduction and/or spread of invasive plants into the area thus potentially affecting species dependent on the mix of native plants here; 5) the natural timing of snag and down wood habitat could be affected by treatments to improve growth and vigor of residual trees; and 6) the ability to economically achieve project objectives with expensive helicopter yarding versus more conventional yarding systems such as skyline and ground-based systems that require road access could impact whether or not the timber sale or sales are purchased thus affecting the attainment of project objectives.

Environmental Consequences

Introduction: The alternatives use both active and passive methods of attaining desired stand characteristics in the CHU, Middle Santiam River Corridor and AOC. The No Action alternative uses passive management to attain project objectives on both the uplands and Riparian Reserves. The Proposed Action uses active stand treatments to achieve project objectives on both the uplands and in the portion of Riparian Reserves which is not directly providing shade on perennial streams or contributing to channel bank stability on intermittent streams. This alternative also maximizes the number of acres treated while using some expensive helicopter yarding. A second action alternative also actively treats both upland and the portion of Riparian Reserves which is not directly providing shade on perennial streams or contributing to channel bank stability on intermittent streams, but this alternative treats fewer acres than the proposed action in favor of more economical yarding methods.

Both action alternatives necessitate the use of various yarding, loading and hauling equipment which require road access to treat areas.

None of the alternatives harvest in primary shade zones (or areas contributing to stream shade during the hottest part of the day) along perennial streams.

Consequences: Late-successional habitat is in short supply in the Pacific Northwest and some species dependent on this habitat are in decline, so active or passive methods of attaining desired stand characteristics affect the **timing of habitat** development in the *CHU, AOC and Middle Santiam River Corridor.* Alternatives Two and Three actively treat stands to attain desired stand characteristics while Alternative 1 passively addresses these stand objectives. It is estimated that attainment of desired stand characteristics would be perhaps decades faster with active treatment than with passive treatment (*USDA 2002*). There is some risk with passive management in these dense plantations. Both active and passive management can have different effects on dependent species or individuals within the treatment areas. With active treatments, there may be some short-term (*5 to 10 years*) impacts to the species that would ultimately benefit from treatments because thinning would open up the canopy on these stands for several years.

Between alternatives there are differences in the **amount of habitat treated** which affects the timing of attainment of desired habitat conditions in the *CHU,* AOC and Middle Santiam River Corridor areas. Alternative 1 does not actively treat any acres. This results in a trade off between the time it takes to develop late-successional habitat here and the potential effect of extending the recovery time for species that use this habitat, which is currently in short supply in the Pacific Northwest.

Alternative 2 actively treats 1549 acres and Alternative 3 actively treats 1412 acres which would contribute to accelerated development of desired habitat conditions for the northern spotted owl.

In addition, development of more suitable habitat in the CHU and dispersal habitat in the AOC and Middle Santiam River Corridor would cumulatively contribute toward improved habitat conditions and connectivity between suitable habitat areas, which may eventually aid in the recovery of spotted owl populations currently in decline.

Differences in access and the types of yarding systems used in the two action alternatives can affect logging costs and amount of ground disturbance which can affect soil compaction, soil displacement and the potential for invasive weed establishment. Alternative 2 utilizes skyline yarding on 1126 acres, helicopter on 120 acres and ground-based yarding on 303 acres. Alternative 3 utilizes skyline yarding on 1105 acres and ground-based yarding on 307 acres.

There are virtually no differences in the amount of shade affected adjacent to streams in all alternatives because primary shade zones are kept intact except for some yarding corridors in the action alternatives. According to the *Sufficiency Analysis* done for this project, stream temperature increases are not expected with any alternative although there is a slight risk in both action alternatives because they both treat stands in the secondary shade zones of Riparian Reserves (*see Hydrology effect and Sufficiency Analysis files for this project which are available for review at Detroit Ranger District).*

The tradeoff of not taking any risk in order to protect stream temperatures in the primary shade zones along streams is that development of desired stand characteristics, as defined by the NW Forest Plan, could be delayed, by perhaps decades. For example, the young, even-aged, overstocked, managed stands here would take longer to develop into large trees desired for habitat and quality stream shade in

Riparian Reserves. In addition, it would take longer to develop the large woody component desirable in stream channels to hold sediments and pool water for aquatic habitat.

Tree growth expected from thinning in the secondary shade zones areas in the Proposed Action would contribute to improved habitat conditions in the Riparian Reserves and the development of travel and dispersal corridors which would contribute to improved connectivity in the watershed, perhaps decades sooner than with passive management here.

Project Location

The project area is located in Donaca and Headwaters Middle Santiam 6th field subwatersheds of the Middle Santiam River 5th field Watershed (*see Vicinity Map, figure 1*). Within the 5th field watershed, proposed harvest units are located in T12 S, R5E, Sections 25-29, 34 and 36; T 12 S, R 6E, Sections 29, 30 and 32; T 13 S, R 5 E, Sections 2, 10, 12 and 24 and T 13 S, R 6 E, Sections 6, 8, 17 and 18, Willamette Meridian in Oregon.

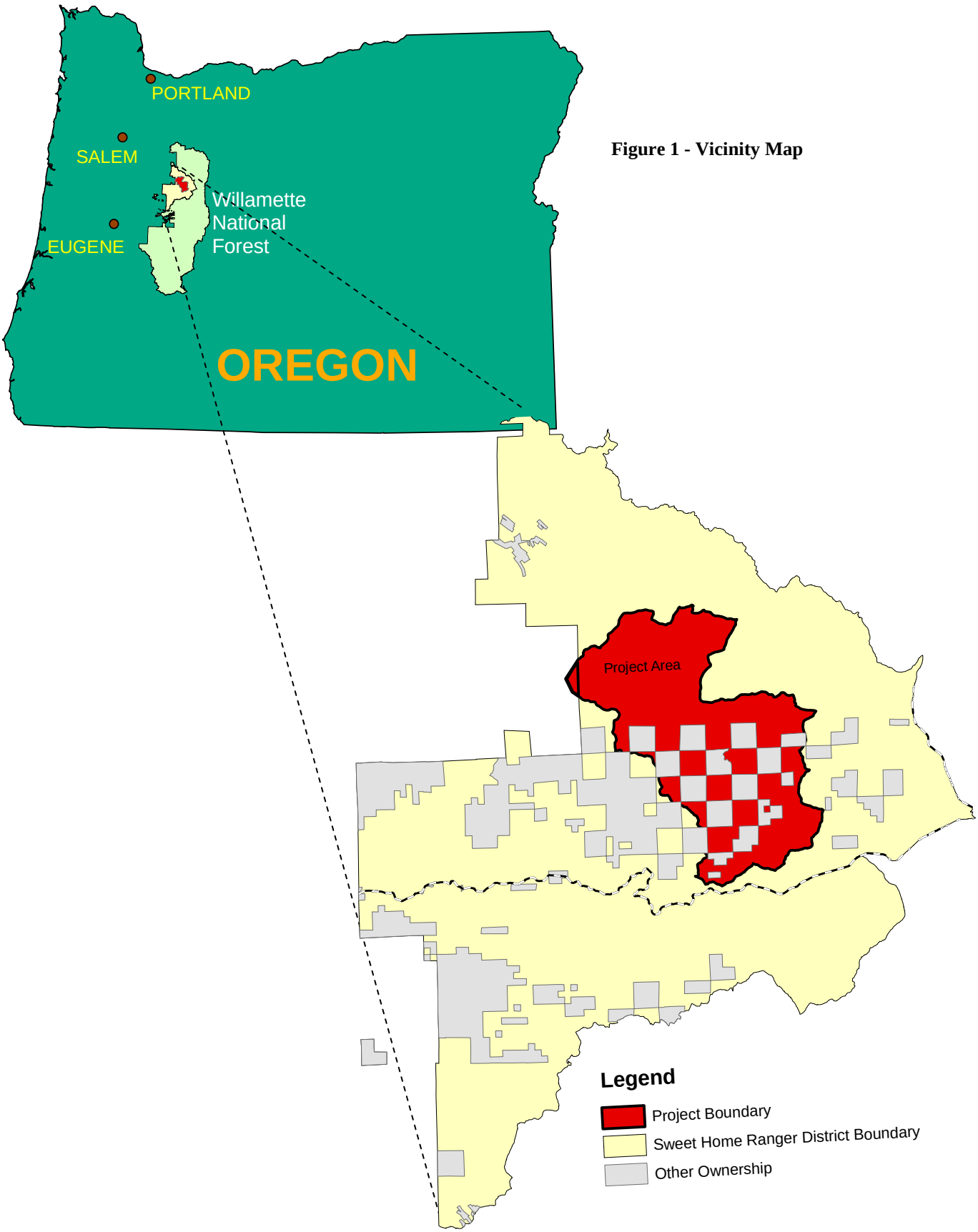


Figure 1 - Vicinity Map

Decision

Based upon the effects of the alternatives, **the responsible official would decide:** which alternative best meets project objectives; whether the area should be managed using passive (Alternative 1 – No Action) or active management (Alternatives 2 or 3); whether more acres should be treated at greater expense or fewer acres at less expense; and whether thinning should occur on an active earthflow.

This decision affects the length of time to achieve project objectives, the number of acres treated and the expense of treating those acres.

Document Structure

The Forest Service has prepared this Environmental Assessment in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This Environmental Assessment discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into four parts:

- **Introduction**: The section includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.
- **Comparison of Alternatives, including the Proposed Action**: This section provides a more detailed description of the agency's proposed action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on significant issues raised by the interdisciplinary team, from public comments and from consultation with other agencies. This discussion also includes possible design criteria for the alternatives. Finally, this section provides a summary table 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 area. Within each resource area, the current conditions of the affected resource are described first, followed by the effects of the No Action Alternative that provides a baseline for evaluation and comparison of the other alternatives that follow.
- **Consultation and Coordination**: This section provides a list of preparers and agencies consulted during the development of the environmental assessment.
- **Appendices**: The appendices provide more detailed information to support the analyses presented in the environmental assessment.

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

Introduction

A. History of the Project Proposal

1. Why here, why now?

In 1996 the Middle Santiam Watershed Analysis was completed to enhance understanding of the relevant ecosystem elements in the watershed and to help guide the general type, location and sequence of appropriate management activities there. Recommendations from the analysis identified thinning in managed stands as a way to improve structural diversity in both the Middle Santiam River corridor (USDA, 1996) and in the Headwaters Middle Santiam subwatershed (USDA, 1996). It also recommended thinning in managed stands in this portion of the watershed to meet timber harvest objectives in the next decade (USDA, 1996).

Between 1999 and 2001, queries were made of the district's Geographic Information System (GIS) database of managed stands in the appropriate age ranges for commercial thinning in this watershed and elsewhere on the district. Time was spent ground-truthing these queries and determining when the identified stands would be ready for thinning. Areas were prioritized across the district and those areas most in need of treatment were placed highest on the list of projects needing to be accomplished on the district. Stands in this watershed were prioritized for harvest in about 2007.

Studies have shown that "trees grown in dense plantations are most responsive to thinning when they are less than 80 years old" (PNW, 2002) The managed stands identified for treatment in this watershed are 30-60 years old, a time when they are most responsive to thinning. In addition, these stands are also showing signs of decreased growth and vigor due to inter-tree competition of light, space and nutrients so they are in need of thinning. Furthermore, the watershed analysis identified a need to develop structural diversity in managed stands here. Research has shown that "the options for accelerating forest development may diminish substantially if stands are not thinned when young." (PNW, 2002).

So given that the age of the stands is optimal to respond to thinning; the stands show a need for thinning as evidenced by inter-tree competition; and a need has been identified to develop structural diversity in these managed stands; the stands proposed for treatment are good candidates in this area and at this time.

2. The managed stands being considered for this project.

The young, even-aged, managed stands being considered for treatment in this project are about 30 to 60 year old stands with average diameters of 9-13 inches and heights of about 70-80 feet. They are predominantly Douglas-fir with lesser amounts of western hemlock, silver fir, noble fir, western redcedar, and Pacific yew with some big leaf maple and red alder. These stands were clearcut between 1949 and 1978 and most were broadcast burned and planted. They contain little or no legacy downed wood or snags because of past harvest practices.

Currently the stands average about 270 trees per acre and are beginning to see effects of overcrowding such as reduced stand vigor and mortality.

When these stands were initially harvested and reforested they were planted densely with the idea that they would be pre-commercially and commercially thinned as they grew and started to crowd each other and compete for light and nutrients. In this management scenario, the objectives for these stands were aimed at maximizing tree growth to provide a sustained yield of timber commodities over time, while also meeting various multiple use objectives.

In order to accomplish these commodity-based management objectives on both public and private land, about 196 miles of roads were constructed to access various harvest units in the analysis area. This resulted in open road densities of about 3.2 miles per square mile here.

The map (figure 2) below illustrates the harvest pattern on Forest System lands in the planning area as well as the road system developed to access harvest units. The harvest units are color-coded by the decade in which harvest occurred. The lighter colored units were harvested earlier than the darker colored units. The map shows about 13,000+ acres of harvest in the project area since the 1940's.

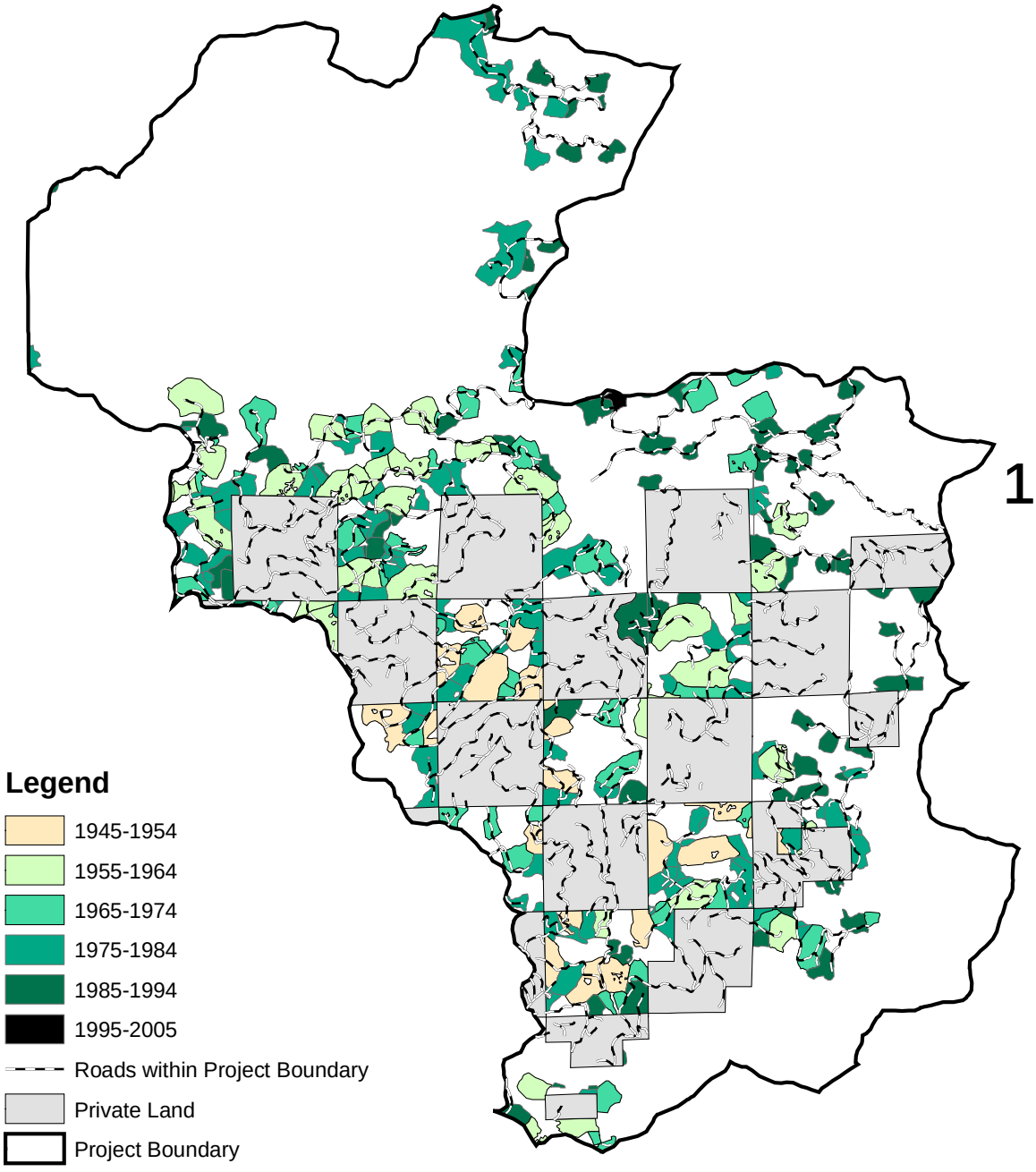


Figure 2 - Past harvest on public lands in project area

3. The Place

The Middle Santiam Thin analysis area is about 34,700 acres in size and lies within the Donaca and Headwaters Middle Santiam subwatersheds (outlined in red) in the middle of the larger Middle Santiam watershed (shown in purple).

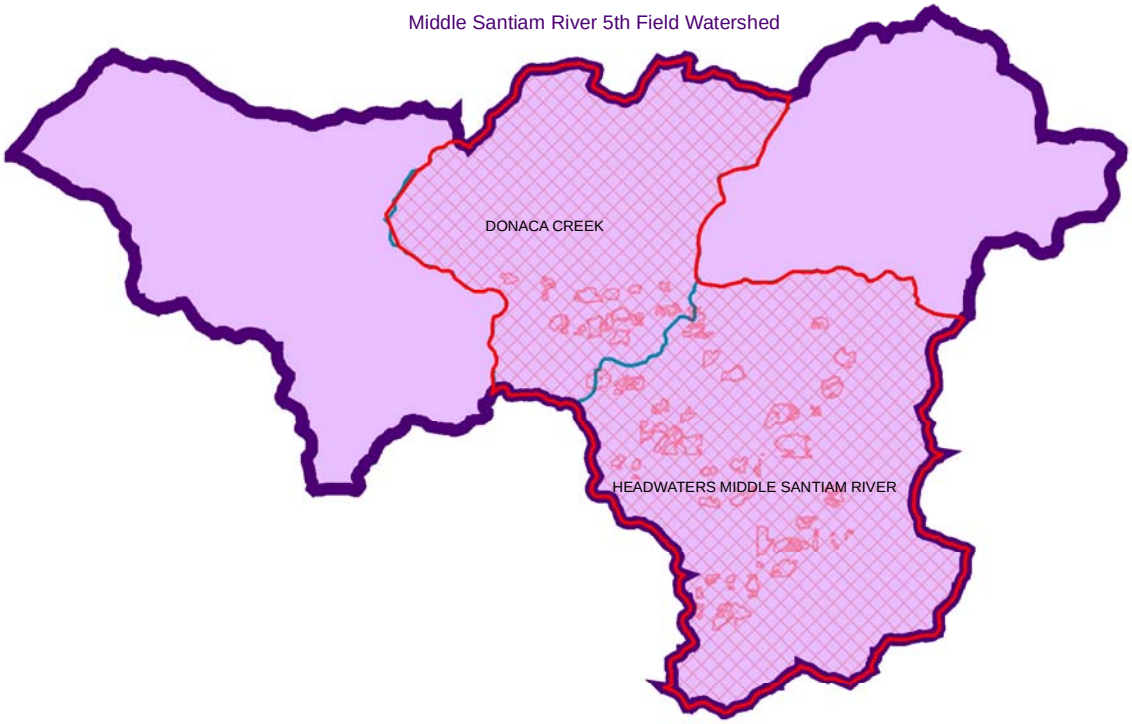


Figure 3 - Donaca and Headwaters Middle Santiam 6th field watersheds within the Middle Santiam 5th field Watershed

B. Planning and Management Direction

1. Planning

Planning for this project was done in accordance with National Environmental Policy Act (NEPA) of 1969. Procedures described in the Council of Environmental Quality's implementing regulations for NEPA (Title 40; CFR Parts 1500-1508) were used to ensure compliance with NEPA.

To avoid duplication of analysis that has already been completed this document is tiered to and relies upon the analysis in the 1990 Final Environmental Impact Statement (FEIS) and Record of Decision (ROD) for the Willamette National Forest Land and Resource Management Plan (hereafter referred to as the Forest Plan) (USDA, 1990) and all subsequent NEPA analyses for plan amendments including the Final Supplemental Environmental Impact Statement on the Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl (USDA and USDI, 1994).

The Forest Plan, as amended, marries the forest-level strategy for managing land and resources on the forest with the Northwest Forest Plan's regional strategy for managing old-growth and late-successional forest ecosystems on federal lands. The plans provide direction, land allocations (management areas), and standards and guidelines.

2. Management Direction and Project Design

Development and design of this project was guided by numerous state and federal laws, agency regulations, interagency agreements and management direction. The primary guidance for this project is summarized below and in individual specialist reports in the Appendices.

The amended *Willamette Forest Plan* provides resource management direction, defines various management areas (MA's), describes desired conditions for these management areas and outlines standards and guidelines under which lands and resources administered by the Willamette National Forest are managed. The following table (Table 1) lists the various management allocations within the project area, displays the sizes of those allocations, and identifies the allocations where management activities are proposed.

Table 1- Management Allocations

Management Allocation (MA)	Total Acres of MA within Project Area	Harvest Proposed Within Management Allocation with this Project
Matrix – General Forest	11,494	Yes
Wilderness	8,632	No
Late Successional Reserve	2,087	No
Special Interest Area	1,567	No
Dispersed Recreation Semi-Primitive Non-Motorized	1,148	No
Scenic Modification Middleground	893	No
100-acre Late Succession Reserve	572	No
Pileated Woodpecker	308	No
Scenic Partial Retention Middleground	138	No
Pine Marten	120	No
Riparian Reserves	*see note below	Yes, outside of the primary shade zone
Other Ownership Lands	7,408	No
Total	**34,666**	

*__Note__: Riparian Reserves overlay other allocations. “Riparian Reserve standards and guidelines apply and are added to the standards and guidelines of other designated areas.” (USDA and USDI, 1994, p. C-1).

The relevant management allocations for this project are Matrix-General Forest (MA14a) and Riparian Reserves (MA15). A complete explanation of the Management Allocation goals and objectives, descriptions of each area, and applicable standards and guidelines can be found in the Willamette Forest Plan, Chapter IV, and the NW Forest Plan Attachment A to the Record of Decision.

The map (figure 4) below illustrates the spatial arrangement of the various management allocations within the project area. The timber stands considered for treatment in this project are outlined in red.

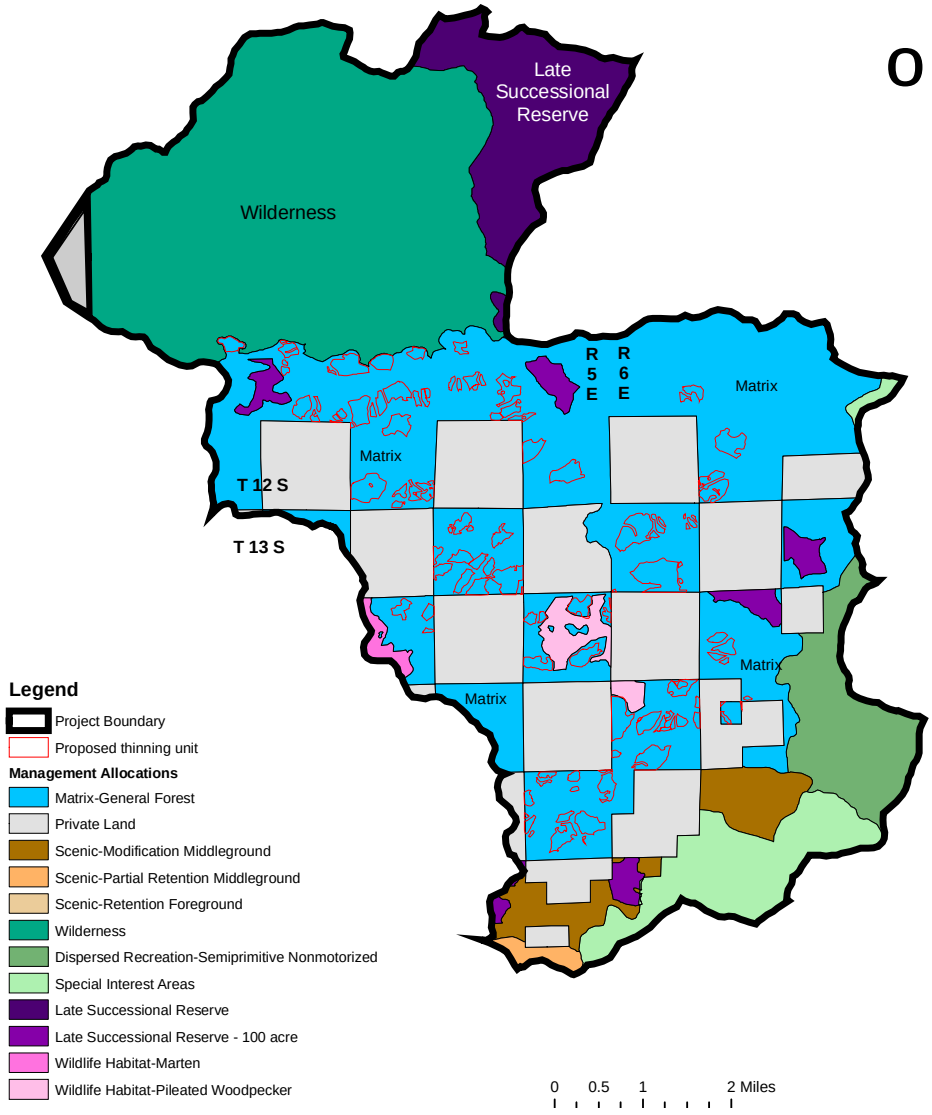


Figure 4 - Management Allocations

C. Other Resource Guidance Information

1. Northwest Forest Plan Temperature TMDL Implementation Strategies (Sept. 2005)

The provisions of this document apply to streams not meeting State water quality standards for temperature. The implementation strategies in this document "provide a basis for analyzing stream shade, effects of shade on stream temperature, and management of riparian areas to meet water quality and broader objectives embodied in the Northwest Forest Plan Aquatic Conservation Strategy (ACS)." (USDA and USDI. 2005, p. 4) This document is incorporated by reference and available for public review at either the Detroit or Sweet Home Ranger District offices.

The Middle Santiam River lies within the analysis area and is listed on the State's 303 (d) list of water quality impaired water bodies because stream temperatures do not meet water quality standards for salmonid rearing during a portion of the summer months. All perennial streams in this analysis area flow into the Middle Santiam River, so it is important to ensure that these streams do not contribute to high summer stream temperatures in the Middle Santiam River. The primary shade zones, which consist of vegetation that intercepts solar radiation and provides stream shade during the hottest part of the day, will not be thinned along all perennial streams within, or adjacent to, proposed harvest units. This is being done in order to retain as much shade as possible to moderate water temperatures on the Middle Santiam River and streams that flow into it.

2. Critical Habitat Unit (CHU) for Northern Spotted Owls

In 1990, the U.S. Fish and Wildlife Service listed the northern spotted owl under the Endangered Species Act and determined that the spotted owl was threatened throughout its range by the loss of suitable habitat as a result of timber harvesting and catastrophic events such as fire. In 1992 critical habitat (CHU's) for the owls were designated on federal lands. As stated in the Federal Register designation, this "critical habitat focuses on the nesting and roosting habitat as the most important elements of spotted owl habitat" (Federal Register Vol. 57, No. 10 January 15, 1992). The designation goes on to say that "the emphasis for future management would be on maintaining or developing habitat that has the characteristics of suitable nesting and roosting habitat and to avoid or reduce the adverse effects of current management practices." (Federal Register Vol. 57, No. 10 January 15, 1992). Within the CHU, federal agencies must ensure that any actions they authorize, fund or carry out are not likely to jeopardize the continued existence of a listed species, or destroy or adversely modify its designated critical habitat.

The map below shows the location of the Critical Habitat Unit for northern spotted owls within the planning area in green as well as the locations of stands being considered for treatment in red.

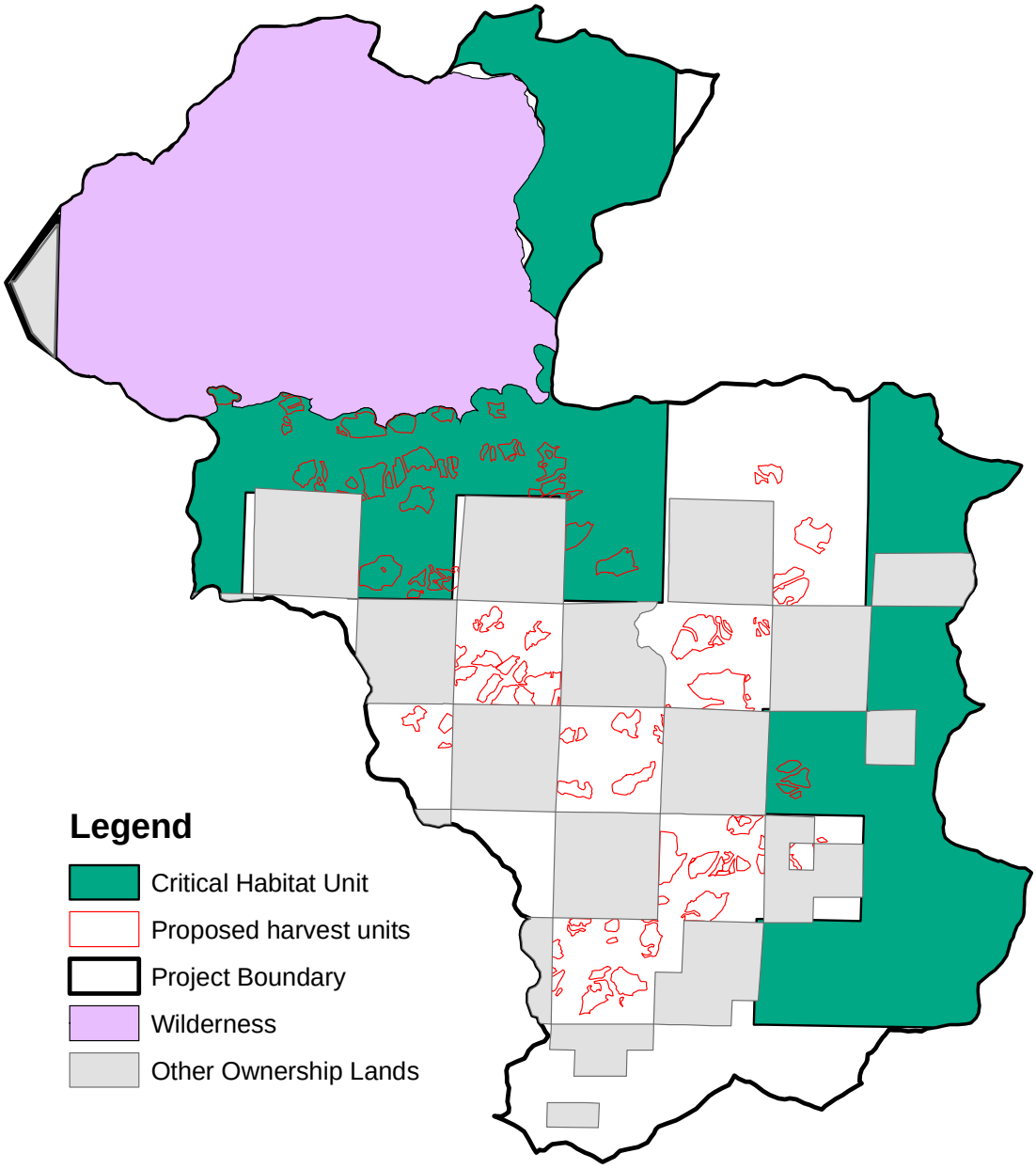


Figure 5 - Critical Habitat Unit

3. The Santiam Pass Area of Concern (AOC)

The AOC encompasses portions of the Sweet Home, Detroit and McKenzie River Ranger Districts and was established because the area was unable to fully facilitate dispersal requirements for northern spotted owls in two quarter-townships around the Santiam Pass (USDI, 2006). This area was identified due to the existing poor quality, quantity and distribution of habitat, relatively low owl numbers and the concern that this area had the potential to be a biological bottleneck for north/south and east/west movement of owls (USDI, 2006).

The goal in this area is to provide habitat conditions that meet at least minimum dispersal requirements of northern spotted owls to allow them to move between blocks of nesting, roosting and foraging habitat "to provide genetic and demographic exchange among subpopulations" and "for juvenile owls to disperse from their natal areas" (USDI, 2006). The Interagency Scientific Committee developed the 50-11-40 rule which was thought to be the minimum standards to provide adequate dispersal of juvenile spotted owls. The rule states that to provide adequate dispersal 50% of each quarter township of federal land should contain trees averaging at least 11 inches in diameter and 40% canopy closure. The map below shows the AOC in purple and proposed harvest units in red. Comparing figures 5 and 6, shows that there is some overlap between the AOC and the CHU. In areas of overlap, the CHU requirements take precedence over AOC requirements.

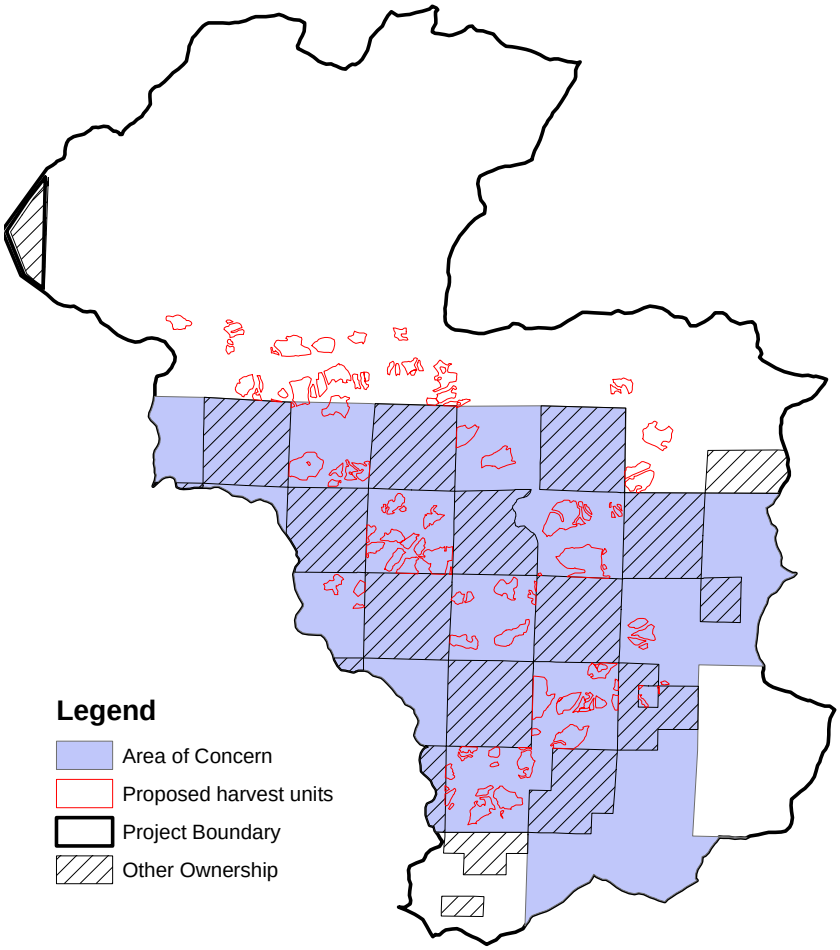


Figure 6 - Area of Concern

4. Wild and Scenic Rivers Act of 1968

The Willamette Forest Plan identified the segment of the Middle Santiam River from T12S, R5E, Section 36 west to the Forest Boundary, as an eligible candidate for designation as a Wild and Scenic River (USDA 1990). The forest planning analysis only looked at this river for eligibility not for designation as a Wild and Scenic River. Until such time as a determination of suitability for Wild and Scenic River status is made, the Outstandingly Remarkable Values (ORV's) that led to its eligibility are to be protected (USDA, 1990).

The Outstandingly Remarkable Values identified for the river as a whole include: "high density stands of old-growth timber, spectacular scenery, an excellent trout fishery and outstanding opportunities for geological interpretation involving large land flows" (USDA, 1990). "The river's scenery, coupled with the geological and ecological/biological uniqueness, and it's proximity to a major population area give this river outstanding recreational opportunities" (USDA, 1990).

Of the eight miles of river which are eligible for Wild and Scenic River status, six miles are within the Middle Santiam Wilderness and would not be affected by the proposed project.

The remaining two-mile segment of the river outside of the wilderness was recommended for a "Scenic" classification. This segment also includes ORV's of spotted owl habitat and historic and pre-historic sites.

The map to the left shows the Wild and Scenic River protection area in blue and stands being considered for treatment outlined in red.

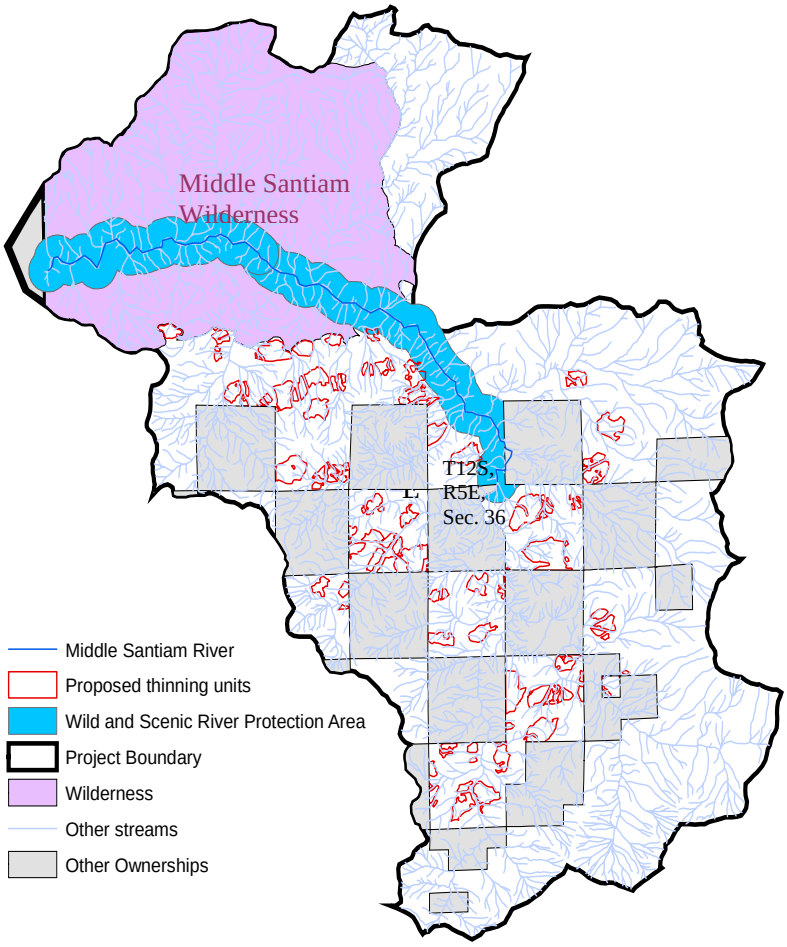


Figure 7 - Wild and Scenic River Protection Area

5. Middle Santiam Inventoried Roadless Area

A portion of Middle Santiam Inventoried Roadless Area (IRA) lies within the project area. This area was addressed in the 2000 Roadless EIS. Direction for activities within Inventoried Roadless Areas can be found in the 2001 Roadless Area Conservation Rule and in Forest Service Interim Directive 1920-2006-1.

The map (figure 8) below shows the Middle Santiam Inventoried Roadless Area in dark blue, the Middle Santiam Wilderness in light blue and the outline of stands being considered for treatment with this project in red. No project activities are planned within the Inventoried Roadless Area.

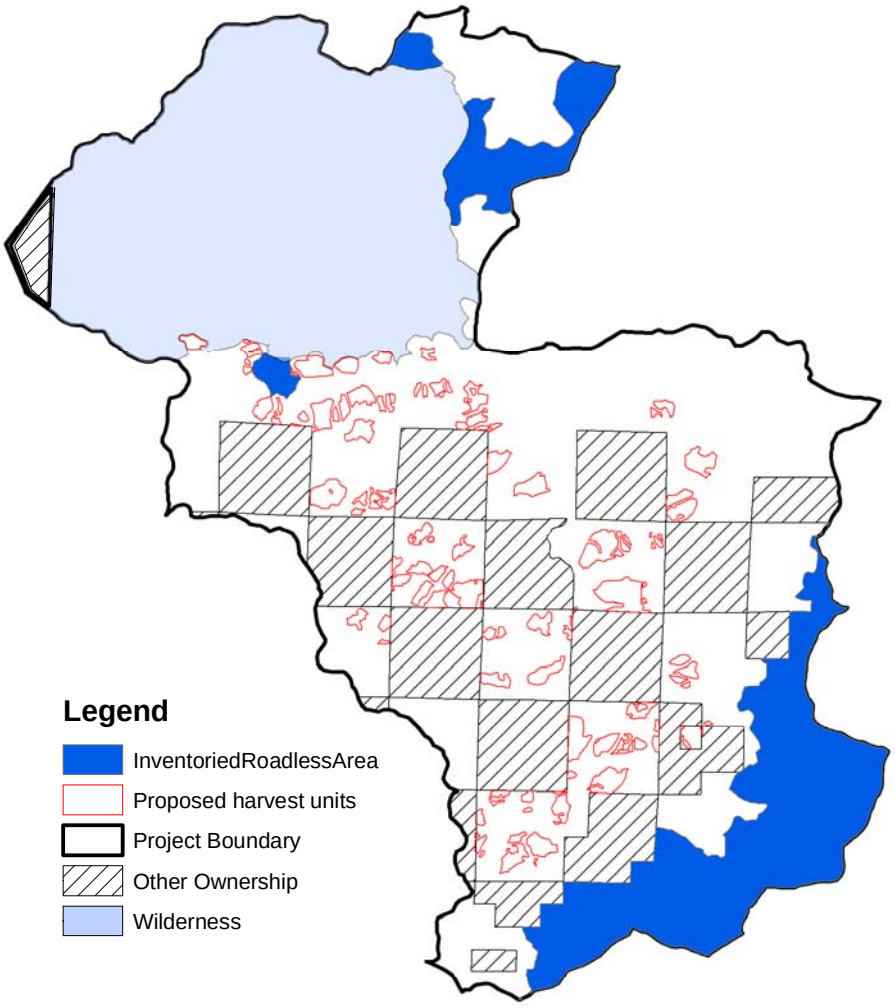


Figure 8 - Middle Santiam Inventoried Roadless Area

6. Watershed Analysis (April 1996)

The Middle Santiam Watershed Analysis (April 1996) is incorporated by reference and is available for public review at the Sweet Home Ranger District office. As required by the Aquatic Conservation Strategy in the *Northwest Forest Plan* a comprehensive watershed analyses was completed for the Middle Santiam watershed in April 1996 to enhance understanding of the relevant ecosystem elements in the area and to help guide the general type, location and sequence of appropriate management activities there. It also provides baseline data from which to compare changes in the watershed over time.

The proposed project lies within the area studied in this watershed analysis. Among the various recommendations in the Middle Santiam Watershed Analysis the following are important for this project:

- Maintain a corridor along the Middle Santiam River and over Sheep Creek Pass that is wide enough to provide an interior old-growth habitat connection to the south. This corridor should be approximately 700-2400 feet total width (slope distance). Width on either side of the river will depend on topography, whether the river is wide enough to function as an edge, existing habitat, unsuitable soils, and other management considerations (USDA. 1996).
- thinning objectives in managed stands within ½ mile of the Middle Santiam River should include development of multiple-layered canopies and larger diameter trees for future snags and future down wood (USDA. 1996).
- continue to improve structural diversity in both the channels and terrestrial parts of the Riparian Reserves in the Upper MidSantiam subwatershed (USDA. 1996).
- The best opportunity for timber harvest in the next decade (in this watershed) would be in managed stands (USDA, 1996)

The following map (figure 9) outlines the Middle Santiam River corridor discussed in the watershed analysis in purple. It shows the orientation of this corridor in relation to the Wild and Scenic River protection area in blue and displays the stands being considered for treatment that fall within the river corridor in red.

There is overlap between this corridor, the Critical Habitat Unit (CHU) and the Area of Concern (AOC). Where overlap occurs, the CHU objectives take precedence over the River Corridor objectives and the River Corridor objectives take precedence over the AOC objectives.

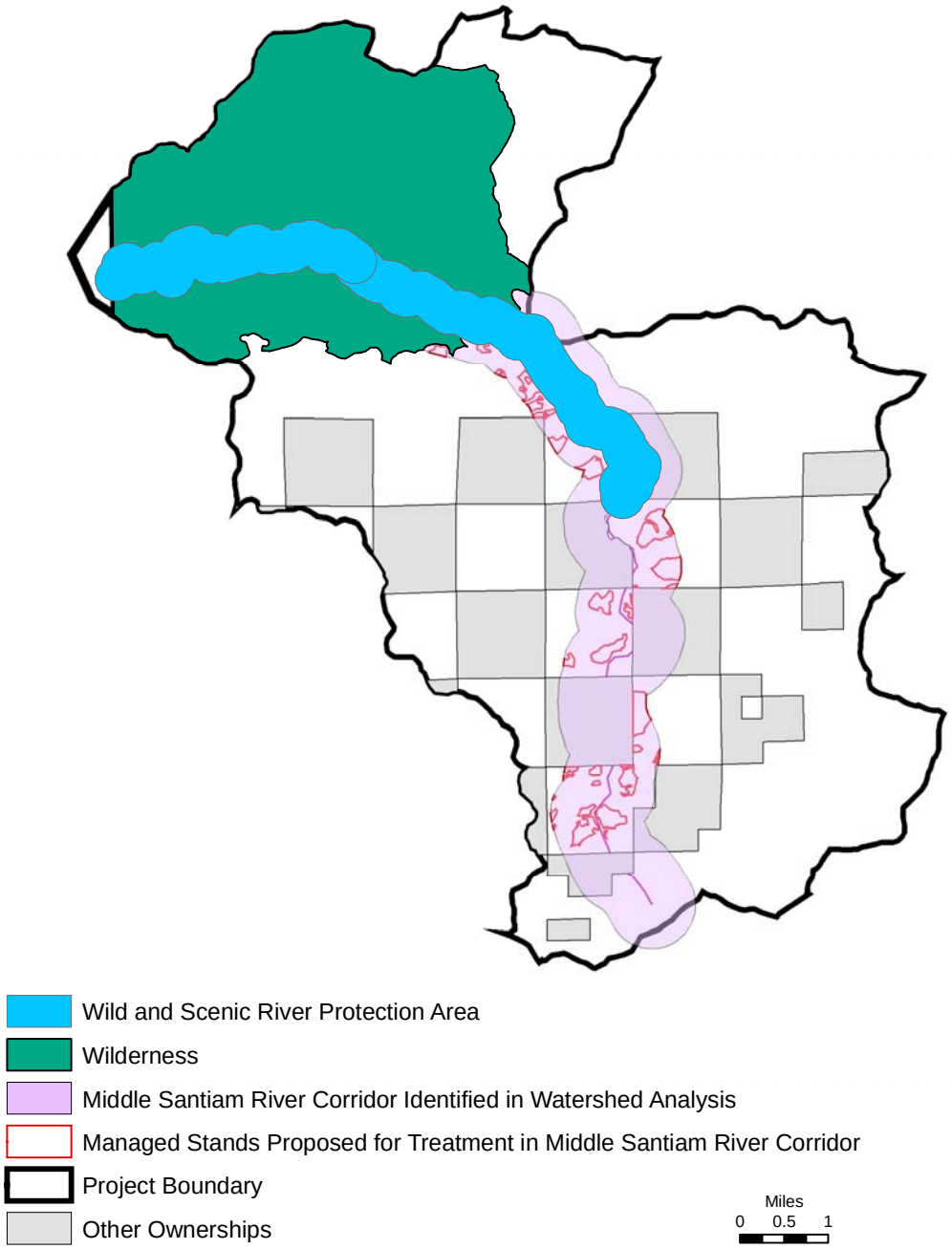


Figure 9 - Middle Santiam River Corridor Outlined in Watershed Analysis along with Wild and Scenic River Protection Area

7. The Willamette Forest Roads Analysis, 1998 as amended in 2003

The Willamette Forest Roads Analysis, 1998 as amended in 2003 is incorporated by reference and is available for public review at the Sweet Home Ranger District office. The roads analysis identified a network of Key Forest Roads "to provide sustainable access to National Forest System lands for administration, protection, and utilization in a manner consistent with Willamette Forest Plan guidance and within the limits of current and likely funding levels" (*USDA. 2003*). This analysis identified eight roads in the analysis area as being Key Forest Roads. They are: 2041, 2041 645, 2041 646, 2045, 2045 140, 2045 240, 2047 and 2047 840.

The analysis goes on to say, "Roads that are not selected as Key Forest Roads would generally be candidates for some form of treatment that stabilizes their erosion potential and reduces that impact on the resources. These roads would be considered for closure, stabilization, or, if unneeded decommissioning. Their status would be determined with input from watershed, district or project planning, NEPA, or as travel management plans are developed in response to local resource and social issues. Declining road maintenance budgets would also be a factor. Non-Key Forest Roads that pose an immediate threat to resources may require a physical barrier to eliminate traffic or may be decommissioned" (USDA. 2003)

The Middle Santiam Watershed Analysis analyzed the roads in the planning area and came to the conclusion that "In the Matrix most roads are sharecost and there is little latitude to adjust the system. Local roads can be storm-proofed where there are no active management projects" (USDA, 1996).

The map (figure 10) on the following page shows the key forest roads within the planning area in relation to stands proposed for harvest.

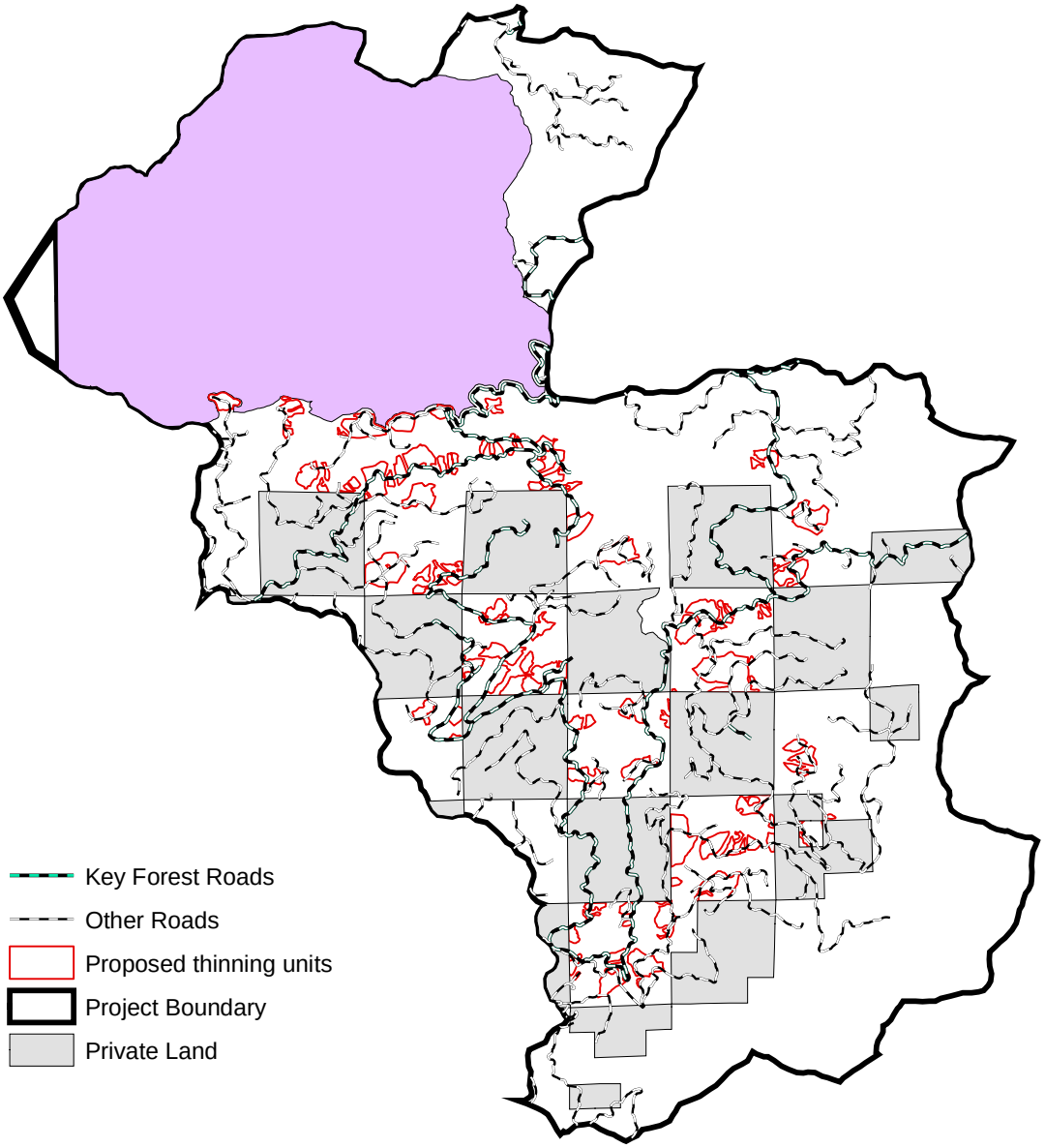


Figure 10 - Location of Key Forest Roads in relation to proposed thinning units

Purpose and Need

The Sweet Home Ranger District of the Willamette National Forest proposes to commercially thin about 1550 acres of young, densely-stocked, managed stands in the Donaca and Headwaters Middle Santiam River subwatersheds to:

- increase growth and vigor of residual trees;
- accelerate development of structural and compositional complexity; and
- contribute commercial wood products to the district's harvest target for fiscal years 2007-2009.

Proposed stand treatments are intended to improve habitat conditions, habitat function and connectivity within the Critical Habitat Unit (CHU) for northern spotted owls, the Middle Santiam River Corridor and the Santiam Area of Concern (AOC).

Purpose: The primary purpose of this project is to commercially thin about 1550 acres of managed stands to increase growth and vigor of residual trees and accelerate development of structural and compositional complexity in young, densely-stocked, uniformly-spaced, managed stands in the Donaca and Headwaters Middle Santiam River subwatersheds of the Sweet Home Ranger District. An additional purpose is to contribute commercial wood products to the district's harvest target for fiscal years 2007-2009.

The analysis area was divided into three separate areas, each with a slightly different management emphasis in achieving the project purpose. The areas are: 1) Critical Habitat Unit (CHU), 2) Middle Santiam River Corridor and 3) Area of Concern (AOC). The goals for each of these areas are as follows:

1) **Critical Habitat Unit (CHU)** –The long-term goal in the CHU is to accelerate development of structural elements and biodiversity associated with older forests that would provide opportunities for nesting, roosting and foraging for northern spotted owls. The desired structural elements generally associated with these older forests include: "large live trees, large dead trees (snags) and fallen trees; trees of varying ages, sizes and species; a deep complex canopy; patches of young trees, shrubs and herbs on the forest floor"(USDA, 2002).

2) **Middle Santiam River Corridor** - The goal within the Middle Santiam River Corridor is to begin the process of developing improved connectivity between the Middle Santiam watershed and the Late-Successional Reserve (RO215) to the south (USDA, 1996). The emphasis in this corridor is to accelerate development of some late-successional structural components especially multiple-layered canopies and large diameter trees for future snags and down wood in these young, single-storied stands with little structural diversity (USDA. 1996).

3) Within the **Santiam Area of Concern** the objective is to accelerate improvement of dispersal habitat conditions for northern spotted owls. Dispersal habitat consists of forest stands with adequate tree size and canopy closure (50-11-40 rule) to provide some degree of protection to spotted owls from avian predators and to allow the owls to forage at least occasionally. (Federal Register Vol. 57, No. 10. Jan.1992). A longer-term objective in this area is to improve connectivity to facilitate juvenile owl dispersal from natal areas and genetic exchange between blocks of nesting roosting and foraging habitat.

In each of the three divisions of the analysis area, treatment is proposed in the portion of the **Riparian Reserves** that are not within "Primary Shade Zones" or not in areas contributing directly to channel bank stability. The primary shade zones, which are areas of vegetation along perennial stream courses providing stream shade during the hottest part of the day, would be left intact as would areas contributing directly to channel bank stability. The remainder of the Riparian Reserves would be thinned. The purpose of treatments in these areas is to meet Aquatic Conservation Strategy Objectives by improving stand health and vigor and enhancing tree growth to accelerate development of larger trees that will eventually provide better shade for streams, moderate microclimate, improve overall structural diversity, and provide future sources of recruitment of large wood for streams. An additional purpose of treatments is to enhance habitat diversity and connectivity.

Earthflow: Finally, an area approximately 12 acres in size, on an actively unstable earthflow, is proposed for thinning to promote stand health and vigor. This unit was harvested in the 1960's, prior to any constraints on harvesting on unstable ground. Since the initial harvest, earthflows such as this have been classified as unsuited for timber management. The proposed treatment here is not to manage the timber for commodity production but rather to improve the potential for long-term slope stability. The young stand, resulting from the 1960's harvest is relatively small in size and densely-stocked. By improving tree vigor and increasing tree size through thinning, the vigorous trees would help to control the amount of water on the earthflow which in turn would contribute to greater stability (Gray 1970). These larger trees would eventually provide large woody material to the stream channel as earthflows are common sources of intermittent input of this material to stream channels (Carey, 2004).

Additional Requirements: Achieving this project's purpose is tempered with additional requirements to:

- Retain existing stream shade along primary shade zones to ensure adequate thermal regulation on the 303 (d) listed Middle Santiam River and its perennial tributaries.
- Maintain at least 50% (post-thinning) canopy closure (or about 90 trees per acre) in the secondary shade-zones within Riparian Reserves of the 303 (d)- listed Middle Santiam River and its tributaries.

- Preserve the Outstandingly Remarkable Values within ¼ mile of the Wild and Scenic River eligible segments of the Middle Santiam River.
- Preserve roadless qualities in the Inventoried Roadless Area.

Methods: The project objectives would be accomplished through the use of a variety of management techniques including: a) commercial thinning to reduce current stocking levels thereby lessening the competition for nutrients, sunlight, and growing space; b) retaining some areas of stands that are unthinned; c) introducing small openings or gaps into selected timber stands; c) utilizing harvest prescriptions which retain minor conifer species and hardwoods; d) underplanting gaps created in selected stands; and f) creating snags and down wood as needed to meet project objectives.

Outputs: The project would yield approximately 31,000 CCF of commercial wood products as a result of these prescribed stand treatments. This timber would be offered as part of the 2007-2009 timber sale offerings.

Need: The need for the project is that these young, overstocked, managed, second-growth stands are beginning to experience a slowing of growth due to inter-tree competition for water, nutrients and sunlight. The stands also tend to have closed canopies which shade out much of the understory vegetation (Oliver and Larson 1990). These conditions have lead to decreased growth and vigor and resulted in forests with little structural and compositional diversity which do not meet habitat needs in the CHU, Middle Santiam River Corridor, or Riparian Reserves.

Research has found that "young planted forests, established at high densities in very short time periods with the expectation of pre-commercial and commercial thinnings, are typically uniform and dense with little differentiation. Without density reductions, planted forests eventually evidence suppressed growth, high height to diameter ratios, and short crowns; conditions that have been shown to make stands susceptible to windthrow and inhibit the development of the large trees associated with old growth forests" (Wilson & Oliver 2000).

A wide variety of research has shown that many managed stands are impoverished in structure, species and ecological function (Carey, 1995, 1998, 2003; Carey et. al. 1996, 1999a: Harmon et. al.1996; Carey and Harrington, 2001). "Although researchers and land managers had assumed that these dense, young forests would, in time, grow to resemble the old-growth forests they replaced, a group of researchers have accumulated a wide range of evidence suggesting that this may not occur unless the young forests are selectively thinned to allow the remaining, uncut trees to grow under less-dense conditions." (ENS, 2002).

Even though these managed stands are mostly in Matrix-General Forest and Riparian Reserve management allocations, other resource considerations such as CHU and AOC designations for the threatened northern spotted owl, and the 303 (d) listing for the Middle Santiam River and it's tributaries alter somewhat, the desired conditions described for these allocations in the amended Willamette Forest Plan. For instance, the need to retain shade on this 303 (d) listed streams might

alter the timing of treatments to accelerate development of larger trees and structural features desired in Riparian Reserves.

In the three proposed treatment areas (CHU, Middle Santiam River Corridor and AOC) the need for treatment and the desired structural and compositional complexity characteristics for managed stands are described below.

CHU – When the U.S. Fish and Wildlife Service designated critical habitat for the threatened northern spotted owls it included a variety of seral stages such as the 30-60 year-old, managed stands proposed for treatment with this project. These young, managed stands were established to produce high yields of timber for commodity production rather than nesting, roosting and foraging habitat desired in the CHU's for northern spotted owls.

With the designation of the area as Critical Habitat for the northern spotted owl in 1992, the objectives for management of these stands changed. The goal here now is to provide large blocks of suitable habitat that provide the necessary elements to maintain stable, viable and interconnected populations of northern spotted owls. According to the Interagency Scientific Committee, the attributes of superior nesting and roosting habitat typically include a moderate to high canopy closure (60 to 80 percent closure); a multi-layered, multi-species canopy with large overstory trees (>30in DBH); a high incidence of large trees with various deformities (e.g., large cavities, broken tops, mistletoe infections, and debris accumulations); large accumulations of fallen trees and other debris; and sufficient open space below the canopy for owls to fly (Thomas, et al. 1990).

These are not the same characteristics that are desired for high-yield commodity production in even-aged timber stands. The current stocking levels and structure of these stands exhibit symptoms of suppressed growth and declining crown ratios that could delay the development of desired stand characteristics in the CHU. Scientific evidence has shown that thinning of younger forests can accelerate the development of (these desired) old growth characteristics (Acker et. al 1998, Tappeiner et. a. 1997, Carey et. al 1999, Muir et. al. 2002)

Middle Santiam River Corridor: The designation of the Area of Concern brought to light the marginal connectivity within the Middle Santiam watershed because of the checkerboard ownership pattern and past harvest practices here. After analyzing the watershed during the development of the Middle Santiam Watershed Analysis (1996), it was recommended that the Middle Santiam River corridor serve as a vital connection through this watershed to the Late-Successional Reserve (RO 215) to the south (USDA 1996). As evidenced by the map above (figure 9), there are numerous managed stands that fall within this corridor that do not currently meet desired stand conditions here. Since this area could provide an important link to the suitable habitat to the south for the threatened northern spotted owl, there is some urgency to improve habitat conditions within managed stands along this corridor. The watershed analysis targeted development of multiple-layered canopies and large diameter trees for future snags and down wood in these young, single-storied stands with little structural diversity (USDA 1996).

Area of Concern (AOC): The checkerboard ownership pattern and past harvesting in the AOC have resulted in poor quality, quantity and distribution of habitat for northern spotted owls and created an area that is unable to fully facilitate spotted owl dispersal requirements (USDA, 2006). The ability of these threatened owls to disperse between areas of suitable habitat is important for genetic exchange and for young owls to move from their natal areas. The young, managed stands being considered for treatment in this project are currently providing poor quality dispersal habitat for owls because of their small size and limited structural development.

Riparian Reserves Outside of Primary Shade Zones: Riparian Reserves were established with the intention of maintaining or protecting riparian functions and processes by retaining forest vegetation that provides shade, favorable microclimate, water quality, coarse wood input into streams and leaf and organic input. Many of the forest stands that were designated as Riparian Reserves under the Northwest Forest Plan were previously managed for timber production and are characterized by relatively dense, uniform, even-aged stands that typically are lacking in structural and biological diversity, such as the stands proposed for treatment. Lack of complexity makes these stands poorly suited for supporting many riparian-dependent species and meeting Aquatic Conservation Strategy (ACS) objectives of providing adequate stream shade, moderating microclimate, and eventually providing future sources of coarse woody debris for streams. Enhancing tree growth here would be more conducive to development of understory vegetation and more rapid development of large trees, that contribute to ACS objectives, than would occur without intervention.

As per the Northwest Forest Plan Temperature TMDL Implementation Strategy requirements (Sept. 2005) for the 303 (d) listed Middle Santiam River and its perennial tributary streams, the managed stands proposed for treatment outside of the "primary shade zones" meet the following requirements:

- The stands have high densities and would benefit from thinning;
- Proposed stand treatments would not result in less than 50% canopy closure (or about 90 trees per acre) post harvest; and
- NW Forest Plan standards and guidelines and Best Management Practices (BMP) would apply here.

Given all of this, there is also an overriding requirement to provide shade to the 303 (d) listed Middle Santiam River that exceeds State standards for salmonid rearing during portions of the summer months. There is also a need to provide shade to tributary perennial streams to the Middle Santiam River to ensure they do not contribute to the river's warming.

Earthflow: A portion of one of the stands proposed for timber harvest was clearcut on an active earthflow about 45 years ago. This managed stand is densely-stocked with trees which are starting to slow in growth as a result of inter-tree competition for sunlight, water and nutrients. There is a need to thin this stand to maintain the health and vigor of the trees here and to encourage the potential for long-term stability of the earthflow.

A healthy stand is needed to minimize the risk of fire, insects or diseases that could greatly weaken or kill the stand which is important for stability here. In addition, there is a need to remove cut trees from the site to reduce fuel loadings that would put this area at risk of wildfire and/or build up of bark beetle populations and potentially jeopardizing the stand as mentioned above.

A vigorous stand is needed because it takes up soil moisture with greater efficiency than would a stagnated stand. Since "most slope failures occur during major storms when the soil is saturated" (Ziemer, 1981) and vegetation can "reduce soil moisture which may significantly affect seasonal rates of creep and slump-earthflow movement (Gray, 1970), the district geologist theorized that if during the growing season, vigorous vegetation removed more water from the site than stagnant vegetation could, then going into the rainy season the earthflow may be able to tolerate a larger storm before a critical saturated condition develops.

In addition, there is a need to thin in order to grow larger trees on the earthflow that would eventually contribute large woody material to stream channels thereby increasing channel structure there. According to Carey (2003) "Large conifers in the flood plain and on areas with high potential for landslides primes the landscape to contribute the large and irregular inputs of large woody debris and sediment to streams that is essential for stream productivity." This earthflow has a perennial non-fish-bearing stream that has relocated approximately three times in the last 50 years. The need for larger woody material in the stream channels is important for many reasons including improvement of long-term sediment storage capacity and helping dissipate stream energies which can help stabilize stream channels among other things.

Proposed Action

To address the purpose and need for the project, the Sweet Home Ranger District of the Willamette National Forest proposes to commercially thin 1549 acres of 30-60 year-old, densely-stocked, uniformly-spaced, managed stands in the Donaca and Headwaters Middle Santiam subwatersheds.

The desired stand characteristics resulting from proposed stand treatments include: 1) development of larger, more vigorous, live trees, 2) creation of snags and down woody material; 3) creation of a mosaic of varying stand densities interspersed with occasional, small openings as appropriate; 4) retention of diverse, native species composition including hardwoods and other minor tree species, 5) an improved mix of tree ages and sizes, 6) improved understory development including young trees, shrubs and herbs on the forest floor that would lead to a more complex, multilayered canopy in the future; 7) canopy closures that meet riparian and northern spotted owl dispersal requirements, 8) retention of shade-providing trees along stream channels, and 9) increased resistance to disturbances such as fire, insects and disease.

To achieve these objectives, each stand in the CHU, Middle Santiam Corridor and AOC was analyzed to determine what combination of treatments was needed to meet desired stand characteristics in the respective areas. The following list of treatments would be utilized either individually or in various combinations to accomplish these project objectives:

- **Thinning-** This treatment is being done on about 1549 acres of young, overstocked managed stands to reduce current stocking levels thereby lessening the competition for nutrients, sunlight and growing space. This would allow for increased growth in remaining trees.

  Thinning densities vary from stand to stand and range from 50% - 70% canopy closure or 90 – 130 trees per acre. The following is a breakdown of acres by thinning density:

  1. 1158 acres would be thinned to 50% canopy closure (90 trees per acre);
  2. 373 acres would be thinned to 60% canopy closure (110 trees per acre) ,
  3. 12 acres would be thinned to 65% canopy closure (120 trees per acre and
  4. 6 acres to 70% canopy closure (130 trees per acre).

- **Retention of Unthinned Areas (skips)**- Unthinned areas are retained on about 940 acres (or about 38%) of the 2490 acres of managed stands considered for treatment in this alternative. The remaining 1549 acres would be thinned as explained above. The 940 acres of retention areas (skips) may include but are not limited to, buffers to protect sensitive plant species, stream shade buffers, and special habitat protection buffers.

- **Introduction of Gaps or Scattered Small Openings**: Scattered, small openings would be introduced into selected thinned stands on about 10% of the upland area of those stands mostly in the CHU and along the ½ mile-wide Middle Santiam River corridor. Overall about 25 acres of gaps would be created within the 1549 acres of thinned stands. These openings are designed

to simulate gaps that naturally occur in older and late-successional stands and to help encourage species diversity and development of multiple canopy layers.

The openings employ a Dominant Tree Release (DTR) treatment where a large tree is left and the remaining trees within 1/8 to ¼ acre circle surrounding that tree are removed with the exception of western white pine, western redcedar, Pacific yew and hardwoods other than alder. The exceptions are left to contribute to species and size diversity. These openings would be planted with cedar.

- **Retention of Minor Conifer Species and Hardwoods**- Thinning is designed to promote diverse, native species composition including hardwoods and other minor conifer species. Many of these managed stands are predominantly Douglas-fir with lesser amounts of western hemlock, western redcedar, western white pine, noble fir, silver fir, mountain hemlock, big leaf maple, and red alder. For this project, western redcedar, western white pine, Pacific yew, and hardwoods (with the exception of alder) would be retained.

  When determining spacing for thinning, cedar that are 10 inches in diameter at breast height (DBH) or greater would be included in the prescribed spacing. In addition, if a cedar (≥10" DBH) is present, it will take precedence over other species (even those with larger diameters), when determining spacing. Smaller western redcedarand other retained species would be treated as if they were invisible when determining tree spacing for thinning.

- **Snags and Down Wood Protection and Creation**- All existing snags and course woody material would be protected to the greatest extent possible from disturbance during harvest operations. Remnant stand structure such as large, live trees, snags, and down wood would be retained, except within road rights-of-way, yarding corridors or for safety reasons.

  Approximately five green trees per acre would be retained in thinned stands to contribute to both snag and down wood habitat during this harvest entry. Snags would be created through tree topping and/or girdling. Down wood would be felled after harvest activities are complete.

- **Riparian Reserve Treatments-** About 400 of the 1549 acres to be thinned are located in Riparian Reserves. The treated portion of the Riparian Reserves are not contributing to primary stream shade or channel bank stability, and would be thinned to no less than 50% canopy closure, or about 90 trees per acre. This treatment is being done to improve stand health and vigor, to enhance tree growth and to accelerate development of larger trees that provide a) better shade for streams, b) moderate microclimate, c) improve overall structural diversity, and d) provide future sources of recruitment of large wood for streams. An additional purpose of treatments is to enhance habitat diversity and connectivity.

  Gaps would not be introduced into thinned stands within the Riparian Reserves.

- **Slash Treatments-** Fine fuels created by the proposed harvest would be treated to reduce the majority of activity-generated fuels to 7-11 tons per acre as per Forest Plan Standards and

Guidelines. Fuel treatments are targeted at the highest risk areas such as along heavily-traveled roads; near wilderness; adjacent to privately-owned lands, and in areas of high existing fuel loadings to minimize fire starts which could potentially jeopardize the functioning of the habitat conditions that are being developed through this project. Proposed fuel treatments include: grapple piling along heavily-used roads; grapple piling within identified units yarded with ground-based equipment; yarding tops in specified units; and burning slash piles in landings.

- **Earthflow-** About 12 acres would be thinned on an active earthflow to encourage growth and vigor of residual trees. Trees would be individually marked on this earthflow to provide the best mix of tree sizes and species and to achieve the desired distribution of trees across the earthflow. The resulting canopy closure here is expected to be about 65% or about 120 trees per acre. The thinning is being done to increase health, vigor and tree size within the stand thus encouraging the potential for long-term stability. This area would be logged using a helicopter.

- **Road closures:** Roads 2041510 and 2041520 would be closed with a gate. Roads 2049 640, 2049 643 and 2047 846 would be closed with berms and roads 2041 515 and a short segment at the very end of road 2041 520 would be storm-proofed and stored for potential future use.

How it would be accomplished

Careful consideration was given to appropriate logging systems to accomplish treatment objectives. Depending on topography, soil conditions, accessibility, suspension requirements to meet ecological needs, and cost-benefit ratio, a combination of helicopter, skyline, and ground-based yarding equipment would be used to harvest a total of 47 units on 1549 acres and yielding about 31,000 CCF of timber.

Connected Actions: Actions connected to this proposal include reopening about 2.2 miles of closed non-system , native-surface, spur roads that were constructed during the first entry into these stands. In addition, about 1.0 miles of new temporary, native-surface, spur roads would be constructed. These roads are necessary to get logging equipment to the sites to implement the proposed silvicultural treatments. Following this harvest entry, these spur roads would be closed by blocking them with berms and ripping and seeding them with native seed. All of these roads are located in stands that do not currently meet late-successional stand characteristics. The tradeoff of constructing and re-opening these spur roads, temporarily during harvest operations, is expected to be outweighed by the benefits of improving habitat quality in these stands. These spur roads access approximately 359 acres of stands proposed for thinning.

In addition, about 36 miles of road maintenance, consisting of spot rocking, brush cutback to provide a safe site distance, road blading, and ditch cleanout would be required on existing access roads. Another 37 miles of road reconstruction would be needed. This consists of about 36 culvert replacements, grubbing, blowdown and hazard tree removal, slump repair, and fixing a hole in a road.

Roads that need spot rocking or other surfacing would require that rock be obtained from local rock sources. In the case of two small rock pits within or adjacent to harvest units, about 0.1 and 0.2 acres would have to be cleared of vegetation to access rock from these sources. These system roads that would either be reconstructed or have maintenance done on them would allow access to 1549 acres of stands proposed for thinning.

The following *design criteria* would be implemented to minimize anticipated effects of the proposed action:

- restricting harvest operations during times of the year when it would be detrimental to species' reproductive success,
- seasonal restrictions on use of native surface roads to minimize erosion,
- buffering sensitive species and habitats from disturbance during harvest activities,
- washing logging equipment prior to entering National Forest lands,
- pre-treating weeds along haul routes,
- using weed-free rock sources,
- seeding disturbed areas with native seed and other measures to minimize introduction or spread of these plants into the area,
- trailhead rehabilitation following harvest activities in the vicinity,
- tree planting in gaps introduced into thinned stands to help diversify stand age and species composition,
- subsoiling portions of units where ground-based logging systems were used in the past and existing compaction exceeds current Forest Plan standards and guidelines,
- creation of snags and down wood to provide structural elements in these stands, and
- using pre-designated skid roads to minimize compaction and soil disturbance.

Similar actions are post-harvest project opportunities that would be implemented as funding is available from this project. These actions are opportunities not design criteria/mitigation and include the following: existing harvest landing rehabilitation, fertilization to increase plant growth (not analyzed in this document), making firewood available for public use, pre-commercial thinning to enhance species diversity and increase growth rates of trees in young, managed stands near proposed harvest units (not analyzed in this document). See Appendix B for details on the above proposed activities.

Proposed Implementation Date: This project may be divided into more than one timber sale offerings and is proposed for implementation in Fiscal Years 2007-2009.

Decision Framework

The Sweet Home District Ranger, who is the deciding official for this project, will review the information presented in this Environmental Assessment including its analysis of the environmental consequences of the various alternatives, proposed design criteria to minimize anticipated effects and other supporting documentation as a basis for making the following decisions regarding this project:

- Which alternative best meets the project purpose of improving habitat in the Critical Habitat Unit, Middle Santiam River Corridor and the Area of Concern in young managed stands within the *Middle Santiam Thin* analysis area.
- Whether to actively treat young stands to accelerate the development of late-successional stand characteristics (in one of the action alternatives) or let those young stands develop desired characteristics on their own, over a much longer period of time (in the No Action alternative).
- Whether more acres of habitat should be treated but with more expensive logging methods (helicopter) or fewer acres of habitat treated without helicopter logging
- Whether to harvest Unit 36 using a helicopter or to reconstruct a portion of the road and log it using conventional logging systems.
- Whether a portion of a managed stand on an existing active earthflow should be thinned to increase the potential for long-term stability on this site or to leave it as it currently is.

Information regarding heritage resources would be included in the supporting documentation made available to the decision-maker although this information is exempt from public disclosure under the Freedom of Information Act (*FSM6271.2*).

This decision affects the length of time it would take for young stands to develop desired stand characteristics within the Middle Santiam watershed as well as the number of acres treated and the expense of treating those acres. For some species dependent on this habitat for their survival, the timing issue is very important.

Public Involvement

The Middle Santiam Thin Project was listed in the Willamette National Forest's Schedule of Proposed Action (SOPA) starting in the Winter of 2006. The SOPA is mailed out to a Forest mailing list of people interested in the management activities of the Forest and is also available on the Willamette Forest website. The SOPA provides a way of informing the public about upcoming projects and keeps them abreast of progress of individual projects.

A scoping letter with a description of the proposed action and additional project area information was sent out in April 2006 to people who had expressed an interest in the project after seeing it in the SOPA as well as the district's mailing list of individuals, interest groups, organizations, tribal representatives, and other federal and state agencies who have shown interest in similar projects. The cover letter explained the purpose and need for the project, provided a map of the project area, and solicited comments on the proposed action. A copy of the letter and the mailing list can be found in the project record.

The Middle Santiam Thin Project has also been included in the Annual Program of Work Review with the Confederated Tribes of the Grand Ronde on February 23, 2006 and the Confederated Tribes of Siletz Indians on March 15, 2006. No comments have been received specific to the Middle Santiam Thin Project as a result of these meetings.

After the scoping letter one written comment was received from Oregon Natural Resources Council (currently called Oregon Wild). A copy of the letter can be found in the project record. The following is a brief summary of topics they raised regarding this project:

Table 2 - Public Comment Summary

Comment Topic	Concerns	How Concerns Dealt With in EA		
		Alt. Development	Design Criteria/ Mitigation Measures	Environmental Effects
Road construction, reconstruction and decommissioning.	Long term impacts to soil, water quality, wildlife habitat, spread of invasive weeds, illegal access by OHVs, environmental and economic implications, and effects on Riparian Reserves		X	X
Thinning impacts on future snags and down wood habitat which are components of a complex forest.	Habitat for many small animals species that in turn help support populations of at-risk predators such as spotted owls, goshawk, fisher, and marten.		X	X

Comment Topic	Concerns	How Concerns Dealt With in EA		
		Alt. Development	Design Criteria/ Mitigation Measures	Environmental Effects
Type of snag creation techniques	Provide a diversity of snag and down wood habitat.		X	X
Decommission three specific roads*	These roads are in an unroaded area.	X	X	X
Water quality	Each ACSO should be discussed separately. Discuss how project would affect the water quality.			X
Control spread of invasive weeds and reduce populations of those weeds.	Close roads into area. Reduce fine fuel loads along roads, trails, ridges.		X	X
Thinning in CHU	Improve habitat and habitat structure	X		X
Soil degradation offset by long-term benefits from logging	Long-term soil productivity		X	X
Full range of alternatives	Include variable density thinning, no roads, old growth protection and *providing for non-motorized recreation in an alternative. (outside scope)*	X	X	

**two of these roads are outside of the analysis area and were not considered for closure.*

The interdisciplinary team reviewed the written comments and incorporated the concerns into the issues where applicable and appropriate. Information related to these concerns was either addressed in the discussion of the issues and environmental consequences or can be found throughout the various sections of the environmental analysis, analysis file or Decision Notice.

Issues

To help focus planning efforts, the interdisciplinary team (IDT) used comments from the public and other agencies and information they gained from field reconnaissance to identify issues for this project.

Planning regulations direct agencies to narrow the scope of environmental analysis by concentrating on the issues that are truly significant to the proposed action and to only briefly discuss other non-significant issues. Therefore, the Forest Service separated the issues into two groups: significant or non-significant.

Significant issues are key or relevant issues that are directly or indirectly caused by implementing the proposed action.

The significant issues for this project were identified by the interdisciplinary team after scoping and preliminary analysis of the project area and reviewing the public comments. Significant issues are tracked through issue identification, alternative development and description and Environmental consequences. Measurement criteria have been identified for these issues and are used to measure the effects of the issues and to compare different alternatives and design criteria relative to the issues.

Non-significant issues include those: 1) outside the scope of the proposed action; 2) already decided by law, regulation, Forest Plan, or other higher level decision; 3) irrelevant to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence. The Council on Environmental Quality (CEQ) NEPA regulations require this delineation in Sec. 1501.7, "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)…"

A list of both significant and non-significant issues are described below. Non-significant issues and reasons regarding their categorization as non-significant are found below.

Significant Issues

1) **Critical Habitat Units (CHU)-** CHU's were designated by the U.S. Fish and Wildlife Service in 1992 to provide habitat for the maintenance of stable, self-sustaining and well-distributed populations of threatened northern spotted owls throughout their range. The lands that were identified as critical habitat were considered essential for the conservation and recovery of the species. About 11,500 acres of one of those CHU's lies within the Middle Santiam Thin project area.

   With the designation of critical habitat, the agency defined both physical and biological features of the critical habitat that were essential to the species' conservation. These are called primary constituent elements and consist of features which support nesting, roosting, foraging and dispersal conditions for the owls.

   The CHU's contain many inclusions of young, managed stands of timber that do not currently have the tree size or structural and compositional elements to provide adequate

nesting, roosting or foraging habitat to sustain northern spotted owl populations. In fact, many of these stands are only marginally providing dispersal habitat.

Since the northern spotted owl is a threatened species, there is some urgency in improving habitat conditions within the CHU. In order to accelerate the development of habitat characteristics that would contribute to the conservation and recovery of this threatened species stand treatments have been proposed that research has determined would improve the quality of habitat over time (*Beggs et al 2005, Poage and Tappeiner 2002, Zenner 2004*).

Proposed stand treatments such as thinning to develop larger trees, opening up small gaps in the stands or creating snags to increase structural diversity can accelerate development of desired habitat conditions in the CHU over time, but require some short-term tradeoffs for the long-term gain. Some of the short-term tradeoffs include noise and disturbance to owls from harvest operations, potential degradation of dispersal (which is currently poor dispersal) habitat caused by opening up the stands during thinning, or decreasing competition between trees for sunlight, water and nutrients so for a time fewer trees might die and become snags or down woody material.

Evaluation Criteria: Acres of dispersal habitat affected, long-term benefits to CHU habitat.

2) Earthflow

In the short-term, until residual trees begin to grow and respond to the thinning, there is a slight potential to adversely affect slope stability after the initial removal of thinned trees proposed on an active earthflow. Immediately after the thinning and until trees have begun to grow in response to the thinning, there are fewer trees on the site taking up water and otherwise stabilizing the earthflow. This risk is considered very low as there was no field evidence to indicate increased instability after the large storm events in 1996-1999 when the trees were a lot smaller and the water was more prevalent than in a normal year.

In addition, there is some uncertainty as to whether the proposed treatment would actually aid in the stabilization of the earthflow. This process has been used on two other sites on the district. The first site where this treatment was tested was in a Flam and Owl Thinning Sale unit in the Adaptive Management Area. The treatment occurred about ten years ago and monitoring so far has shown that the thinning has not increased the rate of slope instability since harvest. In addition, trees have shown wider growth rings in the last 4-6 years which indicates increased growth and vigor. Using what was learned in the Adaptive Management Area, the thinning technique was applied to another unit in Sheep Soda Thin about two years ago. Monitoring has shown similar results with respect to not increasing slope instability but it has been too soon since the treatment to see much response in the tree growth and vigor. It is not possible to state conclusively that either site is “more stable” at this point, but the stands are reacting positively as was anticipated.

Research has shown that “deep-seated earthflows may be affected little by timber cutting or road building unless the distribution of mass or water within the slide is changed substantially

(Wilson, 1970). This is because the failure plane of earthflows is generally below the rooting depth of trees, so tree roots only provide reinforcement at the surface rather than at the failure plane.

Even though the tree roots are only providing reinforcement at the surface, they can affect water balance well below that. Ziemer (1981) showed that "forests can move considerable quantities of soil moisture by evapotranspiration. Resultant negative pore water pressure or capillary tension in unsaturated soil increases intergranular pressure and thereby increases soil strength." His study also showed that "the most dynamic depletion of soil moisture…occurred at a depth of 2.4 to 4m, far deeper than the principal root mass." Gray (1970) concluded that vegetation can "reduce soil moisture which may significantly affect seasonal rates of creep and slump-earthflow movement.

Still, scientific studies have said that "the role of forest transpiration in preventing landslides is unclear. Ziemer (1981) contends that "once rainfall satisfies the soil moisture deficit and the soil becomes saturated, tension-induced intergranular pressures disappear." Gray (1970) on the other hand, argues that forested slopes can tolerate a larger storm before a critical saturated condition develops.

If a slope failure were to occur here it could affect the amount of sediment entering the adjacent perennial non-fish-bearing stream that is tributary to the Middle Santiam River.

Evaluation Criteria: Acres of landslide thinned to increase growth and vigor of trees, potential risk to short-term slope stability

3) Access Unit 36 with a road or yard with helicopter

A portion of the road that accesses unit 36 was washed out by a landflow in 1996. Currently a small trailhead exists just west of the washed out portion of the road. This area is used as a foot trail for accessing the Middle Santiam River and wilderness. If the road were reestablished to the landing for Unit 36, the trailhead and related motor vehicle traffic would be moved to the east side of the creek and be located closer to the Middle Santiam River.

Extending the road may also increase the potential for ATV traffic to move onto the closed sections of road 2041 that are beyond unit 36. Currently the existing trailhead location and creek crossing act as deterrents for ATV riders. Opening this road would remove these deterrents, and could bring ATV traffic closer to the Middle Santiam river and Wilderness.

The unit could be yarded by helicopter without the road construction and related concerns. This yarding method is expensive but the potential environmental effects of ATV traffic and proximity of vehicles to the wilderness is much less than with roading options and the use of conventional yarding equipment.

Evaluation Criteria:: roading vs. helicopter yarding costs, recreational effects of increased ATV use and increased vehicular traffic in vicinity of wilderness

4) Socio-Economic Issues- In areas of limited access or because of various resource concerns, helicopter logging provides an opportunity to accomplish project objectives with minimal impacts on the environment. This method is used sparingly, however; because of the expense. Recently the cost of fuel has resulted in increased helicopter yarding costs. For sales with small timber, such as these young stands, and many restrictions on when harvest can occur, using expensive yarding systems such as helicopters often make the sales less desirable to potential purchasers. If the sale cannot be sold, then project objectives cannot be realized.

Evaluation Criteria: difference in amount of acres treated to meet project objectives, cost-benefit ratio of project, present net value

Non-significant Issues

1) Connectivity in the Area of Concern (AOC) and the Middle Santiam River Corridor– Extensive harvest activities on both public and private lands within the analysis area has resulted in habitat connectivity issues in this area, especially for the northern spotted owl. For this reason the Santiam Area of Concern was designated to highlight and address concerns about spotted owl dispersal through this area.

In addition, the checkerboard ownership pattern here complicates landscape-level efforts to address connectivity and dispersal. These connectivity concerns could lead to a genetic bottleneck in spotted owl populations because they cannot disperse between areas of suitable habitat for genetic exchange and young owls can not safely disperse from their natal areas.

The Middle Santiam Watershed Analysis recommended utilizing the Middle Santiam River Corridor as a connection from this watershed to the LSR just south of here. In addition, the AOC is intended to provide owl dispersal habitat, at a minimum to provide connections with Late Successional Reserves nearby.

Thinning and other stand treatments can improve tree health and vigor in these young, densely stocked, managed stands and accelerate development of desired habitat conditions here in the long-term, but could downgrade or degrade this dispersal habitat in the short-term.

This issue was not considered significant for designing alternatives because it was addressed similarly in the action alternatives. The 50-11-40 rule is exceeded in the action alternatives because of the need to maintain 50% canopy closure (or about 90 trees per acre) in Riparian Reserves that are thinned. The affects of the proposed action and other alternatives on the AOC are discussed in the Environmental Consequences section under Terrestrial Wildlife.

2) Riparian Reserve Management*:*

The Riparian Reserve allocation overlays the Matrix-General Forest management allocation and is designed not only to address Aquatic Conservation Strategy Objectives but

also to address travel and dispersal corridors for many terrestrial animals and plants, and to provide for greater connectivity within and between LSR's. The young, even-aged, managed stands within the Riparian Reserves do not currently meet the desired stand characteristics for this allocation (*USDA and USDI 1994, B-11 and B-31*) but accelerating development of desired stand characteristics here is potentially in conflict with the need to retain shade on the Middle Santiam River and its tributaries. The Middle Santiam River is currently listed under section 303 (d) of the Clean Water Act, for the State of Oregon. The reason for this listing is because stream temperatures are outside of existing water quality requirements for juvenile salmonid rearing during part of the summer months. Thinning and associated activities within Riparian Reserves that could alter stream shade either directly or indirectly could affect stream temperatures and contribute to the reduction in survival of certain life stages of salmonids and other aquatic species.

About 25% of the acreage in stands proposed for treatment falls within Riparian Reserves. Proposed treatments in Riparian Reserves, designed to meet project objectives of accelerating development of stand structural and compositional elements in the CHU, Middle Santiam River Corridor and the AOC and development of stand conditions within Riparian Reserve to meet Aquatic Conservation Strategy objectives, can benefit this area in the long-term, but various activities associated with timber harvest can result in short-term impacts to the resources intended to benefit by the treatments such as water temperatures.

Temporary road construction, landing development, and road maintenance, necessary to access and log proposed harvest units has the potential to produce sediment, alter natural hydrologic drainage patterns and compact soils which could impact water quality, soil productivity and/or other aquatic resources. Yarding corridors, roads or other yarding activities within Riparian Reserves, or that cross streams, could produce sediment or reduce shade which could affect water quality and aquatic habitat.

Finally, not treating these young, densely-stocked, managed stands within Riparian Reserves that do not currently meet desired stand characteristics to provide adequate stream shade, moderate microclimate, and eventually provide coarse woody debris for streams could affect habitat conditions for many riparian-dependent species and affect their population levels.

This issue was not considered significant because all alternatives would meet the law (Clean Water Act), regulations, and Forest Plan standards and guidelines. All action alternatives include the same mitigated measures such as the Riparian Reserve prescriptions which exclude harvest in primary shade zones and retain at least 50% canopy closure (or about 90 trees per acre) in the remainder of the Riparian Reserve, and incorporate other Best Management Practices to maintain or reduce any impacts to within legal levels. Design criteria and mitigation measures address this issue in the Alternative Development section of the document. The effects of the proposed action and the other alternatives on water quality are addressed in the environmental consequences section of the document.

3) Invasive plants

There are already substantial populations of invasive weeds that have been documented within the analysis area. Proposed timber harvest and associated activities could result in soil disturbance and the creation of seed beds and/or light conditions favorable to the further spread of invasive weeds in the area. In addition, the movement of vehicles such as log trucks, and logging equipment can transport weed seeds to and from the harvest units.

This can lead to spread of existing invasive plant populations and introduction of new species to the area. Potential increases in these populations contribute to species composition changes and a reduction in plant diversity which may result in the displacement of plants and animals indigenous to the area that have adapted to the native plant species mix.

This issue was not considered significant for designing alternatives because specific mitigating measures would be used in all action alternatives to prevent expansion of existing invasive weed populations. See Design criteria/Mitigation Measures, Botanical Specialist Report in Appendix F and Integrated Prescriptions in Appendix A. The affects of the proposed action and other alternatives on invasive weeds are discussed in the Environmental Consequences section under Vegetation.

4) Snag and Down Woody Material

Past management activities may have altered the availability of large coarse woody material and snags in stands that were harvested. In many harvest units legacy material was not retained and the young stands that occupy these sites now, are not yet able to provide a source of large wood and snags with the desired characteristics to provide habitat for many species dependent on this material. Where legacy material was left, it is often beginning to break apart and does not fulfill the current habitat needs for some species. Lack of large snag and down woody material has affected stand structure and reduced habitat for a variety of species dependent on this habitat. These young stands with relatively small tree sizes do not provide desired snag and down wood characteristics.

Thinning stands to increase growth and vigor to meet desired habitat characteristics can delay snag and down wood creation that would have occurred in the dense young stands that are experiencing competition of sunlight, water and nutrients. Lack of snag habitat can affect species dependent on this habitat.

The way in which snags are created can influence the diversity of types of snags and down wood created.

This issue was not considered significant for designing alternatives because similar mitigating measures would be used in all action alternatives to create snags and down wood. While snag diversity is considered important, there was a concern about inoculating snags due to the potential introduction of a strain of inoculant that does not occur naturally in the area so only mechanical methods of snag creation were considered. See Design criteria/

Mitigation Measuresand Integrated Prescriptions in Appendix A. The effects of the proposed action and other alternatives on snags and down wood are discussed in the Environmental Consequences section under terrestrial wildlife..

5) Fuels and Private Land Protection Issues

Fine fuels resulting from thinning would contribute to increased fuel loadings. These increased fuel loadings could alter the timing, duration, rate of spread, intensity and size of potential fires that burn in the area thus potentially resulting in loss of soil nutrients and stability, decrease in water quality, increases in stream temperatures and reductions in habitat quality and quantity for northern spotted owls in the CHU and/or AOC.

Proposed thinning activities adjacent to private land could result in increases in fuel loadings that increase the potential fire risk here. If fires were to burn onto private lands they would impact the economic investment of these private landowners.

This issue was not considered significant because it is addressed by the Forest Plan standards and guidelines (FW-252) for management- created fuel –specifically fine fuels. All alternatives are designed to meet the standards and guidelines with a slight difference in the type and amounts of mitigating fuel treatments. The discussion of this issue can be found in the Environmental Consequences section under Fire and Fuels.

6) Soils Impacts

In the proposed action about 20% of the area proposed for treatment (about 300 acres) is slated to be thinned with ground-based logging systems. In addition, on about 140 of those acres the fuel treatment would involve grapple piling which also uses ground-based equipment. There is a concern that potential soil compaction and disturbance using ground-based yarding systems will not be offset by the intended benefits to the vegetation from thinning.

Furthermore, two of the proposed harvest units were logged almost 50 years ago before compaction and disturbance standards were established. On these two units unrestricted, ground-based yarding resulted in compaction that exceeds current Forest Plan standards and guidelines.

This issue was not considered significant because it is addressed by the Forest Plan standards and guidelines (FW-079 through 086, especially FW-081). All alternatives are designed to meet the standards and guidelines as well as Best Management Practices with respect to the soil resource with the exception of the two units that already exceed standards and guidelines. These units will be subsoiled following harvest activities, which will reduce compaction closer to standards and guidelines, but because of other resource concerns may not be in full compliance with standards and guidelines. The discussion of this issue can be found in the Environmental Consequences section under Geology/Soils.

Alternatives, including the Proposed Action

This chapter describes and compares three alternatives considered for the Middle Santiam Thin project: No Action and two action alternatives. It includes a description and map of each alternative considered. (***Please note*** that maps and treatment descriptions for each individual harvest unit can be found in Appendix A). This section also presents the alternatives in comparative form, sharply defining the differences between each alternative and providing a clear basis for choice among options by the decision maker. Some of the information used to compare the alternatives is based upon the design of the alternative (i.e., helicopter yarding versus skyline or ground-based yarding) and some of the information is based upon the environmental, social and economic effects of implementing each alternative (i.e., amount of soil compaction, impacts on dispersed recreation activities or logging costs and present net values).

Alternative 1 - No Action

Accomplishing the project objectives of increasing growth and vigor of residual trees and accelerating the development of structural and compositional diversity of young, densely-stocked, uniformly-spaced, managed stands under the *No Action* alternative would mean that desired stand characteristics in the Critical Habitat Unit (CHU), Middle Santiam River Corridor and Area of Concern (AOC) would occur passively, without timber management intervention. It is expected that over time, many stands would advance through the natural growth cycle of competition for growing space resulting in growth reductions and eventual mortality of some trees and then expression of further dominance by some trees and development of shade-tolerant canopy layer, and so on until eventually the desired stand characteristics would be attained.

The rate at which these stands develop the desired stand characteristics is not only dependent on growth rates but also on the amount and frequency of natural disturbances such as fire, insects and diseases.

The ***No Action*** alternative provides a basis for comparison to evaluate changes in the existing condition associated with the action alternatives.

Alternative 2 - The Proposed Action

Alternative 2 would commercially thin about 1549 acres of 30-60 year-old managed stands to increase growth and vigor of residual trees and accelerate the development of structural and compositional diversity of young, densely-stocked, uniformly-spaced, managed stands in the Donaca and Headwaters Middle Santiam subwatersheds. A total 47 units would be harvested, producing about 31,000 CCF of commercial wood products that contribute to the district's harvest target.

This alternative focuses on maximizing stand treatments and contribution to the district's harvest target utilizing ground-based, skyline and helicopter yarding systems as appropriate.

The analysis area was divided into three separate areas, each with a slightly different management emphasis in achieving the project purpose. The areas are: Critical Habitat Unit (CHU); Middle Santiam River Corridor and Area of Concern (AOC). The desired stand characteristics resulting from this treatment in each of these areas is outlined below:

1) **Critical Habitat Unit (CHU)** –The desired outcome of stand characteristics in this area are to accelerate development of: "large live trees, large dead trees (snags) and fallen trees; trees of varying ages, sizes and species; a deep complex canopy; patches of young trees, shrubs and herbs on the forest floor"(PNW, 2002) to provide future nesting, roosting and foraging habitat for northern spotted owls.

2) **Middle Santiam River Corridor** – The desired outcome of stand treatments here is to grow large diameter trees for future snag and down wood recruitment and to begin to develop some late-successional structural components especially multiple-layered canopies to improve connectivity between this watershed and the Late-Successional Reserve (RO215) to the south for northern spotted owls (USDA, 1996).

3) **Santiam Area of Concern-** Short-term stand characteristics preferred after treatment in this area include: average stand diameters of at least 11 inches and tree canopy closures in excess of 40% in half or more of the quarter township and introduction of some structural components into these even-aged, managed stands. This would facilitate dispersal of northern spotted owls between areas of suitable habitat with some degree of protection from avian predators and some opportunities for foraging along the way. A longer-term desire from these treatments is to accelerate improvement of stand conditions and connectivity through this region so it no longer is a bottleneck to juvenile owl dispersal from natal areas and genetic exchange within northern spotted owl populations.

In each of the three divisions of the analysis area, treatment is proposed within **Riparian Reserves** which do not include "Primary Shade Zones" or areas contributing to channel bank stability. The desired conditions following treatment here are: improved stand health and vigor

and enhanced tree growth to accelerate long-term development of larger trees that provide better shade for streams, moderate microclimate, improve overall structural diversity, and to provide future sources of recruitment of large wood for streams as well as to enhance habitat diversity and connectivity in the upland portion of the reserve.

Earthflow: Finally, the outcome of the treatment in this area is to accelerate development of a larger, more vigorously growing stand that is fairly evenly-distributed across the earthflow. The intent is to maintain or enhance evapotranspiration across the slide thereby potentially contributing to greater long-term slope stability. The longer-term outcome of treatment here is also to develop a future source of large woody material for the adjacent stream channels.

Additional Requirements: These stand treatments would be tempered by additional requirements to:

- Retain existing stream shade along primary shade zones to ensure adequate thermal regulation on the 303 (d) listed Middle Santiam River and its perennial tributary streams.
- Maintain at least 50% (post-thinning) canopy closure (or about 90 trees per acre) in the secondary shade-zones within Riparian Reserves of the 303 (d)- listed Middle Santiam River and its tributaries.
- Preserve the Outstandingly Remarkable Values within ¼ mile of the Wild and Scenic River eligible segments of the Middle Santiam River.
- Preserve roadless qualities in the Inventoried Roadless Area.

These requirements, where they apply, would take precedence over other stand treatments.

The Proposal

Individual harvest units were analyzed to determine which treatments were needed within the stands to meet the desired conditions within the CHU, Middle Santiam River Corridor and the AOC. A variety of techniques described below would be implemented to attain desired these stand characteristics (see also table 8 for a summary of treatments by unit and Appendix A for individual unit maps and detailed treatment descriptions).

1) **Thinning-** This treatment is being done on about 1549 acres of young, overstocked managed stands to reduce current stocking levels thereby lessening the competition for nutrients, sunlight and growing space. This would allow for increased growth in remaining trees.
    - Thinning densities vary from stand to stand and range from 50% - 70% canopy closure or 90 – 130 trees per acre. The following is a breakdown of acres by thinning density:
    - 1158 acres would be thinned to 50% canopy closure (90 trees per acre);
    - 373 acres would be thinned to 60% canopy closure (110 trees per acre) ,
    - 12 acres would be thinned to 65% canopy closure (120 trees per acre and
    - 6 acres to 70% canopy closure (130 trees per acre).

2) **Retention of Unthinned Areas (skips)**- Unthinned areas are retained on about 940 acres or about 38% of the 2490 acres of managed stands considered for treatment in this alternative (see individual unit maps in Appendix A). The remaining 1549 acres would be thinned. The 940 acres of retention areas (skips) may include, but are not limited to, buffers to protect sensitive plant species, stream shade buffers and special habitat protection buffers.

3) **Introduction of Gaps or Scattered Small Openings**: Scattered, small openings would be introduced in about 10% of the upland area of selected stands (25 acres) that are thinned. Gaps are targeted mostly in the CHU and along the ½ mile-wide Middle Santiam River corridor. These openings are designed to simulate gaps that naturally occur in older and late-successional stands and to help encourage species diversity and development of multiple canopy layers. The openings would be planted with western redcedar to start a second age class and ensure species diversity. In addition, natural seeding is also expected in gaps and release of existing understory is expected in thinned areas to add to age and size class diversity and development of multiple canopy layers.

   The openings employ a Dominant Tree Release (DTR) treatment where a large tree is left and the remaining trees within 1/8 to ¼ acre circle surrounding that tree are removed with the exception of western white pine, western redcedar, Pacific yew and hardwoods other than alder. The exceptions are left to contribute to species and size diversity. These openings would be planted with cedar.

4) **Retention of Minor Conifer Species and Hardwoods**- Thinning prescriptions are designed to promote diverse, native species composition including hardwoods and other minor conifer species. Many of these managed stands are predominantly Douglas-fir with lesser amounts of western hemlock, western redcedar, western white pine, noble fir, silver fir, mountain hemlock, big leaf maple, and red alder.

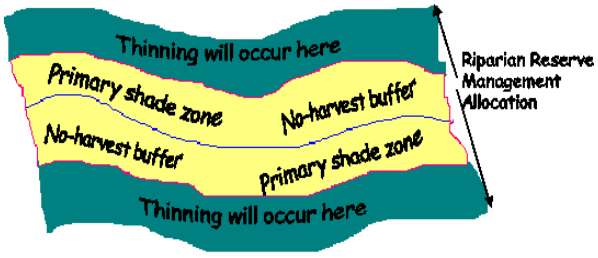
   For this project, western redcedar, western white pine, Pacific yew, and hardwoods (with the exception of alder) would be retained in harvest units to the greatest extent possible, except within road right-of-ways, yarding corridors or for safety reasons. If one of these retained species needs to be felled for reasons listed above, it would be left on site.

   When determining spacing for thinning, that are 10 inches in diameter at breast height (DBH) or greater would be included in the prescribed spacing. In addition, if a western redcedar($\geq$10" DBH) is present, it will take precedence over other species (even those with larger diameters), when determining spacing. Smaller western redcedarand other retained species would be treated as if they were invisible when determining tree spacing for thinning.

5) **Snags and Down Wood**- All existing snags and course woody material would be protected to the greatest extent possible from disturbance during operations. Remnant stand structure such as large, live trees, snags, and down wood would be retained, except within road rights-of-way, yarding corridors or for safety reasons.

Approximately five green trees per acre would be retained in thinned stands to contribute to both snag and down wood habitat during this harvest entry. After harvest activities are complete, the 2.1 of the retained trees per acre would be topped and/or girdled to create snags and the remainder would be felled for down wood.

6) **Riparian Reserves-** There are about 1245 acres of Riparian Reserves within and adjacent to the 2,490 acres of existing stands that were considered for treatment. Of these, about 400 acres of Riparian Reserves within proposed harvest units, which are not contributing to primary stream shade or channel bank stability, would be thinned to improve stand health and vigor and enhance tree growth to accelerate development of larger trees. This will provide better shade for streams, moderate microclimate, improve overall structural diversity, and provide future sources of recruitment of large wood for streams. An additional purpose of treatments is to enhance habitat diversity and connectivity. Thinned areas would retain at least 50% canopy closure or about 90 trees per acre. Gaps would not be introduced into thinned stands within the Riparian Reserves.



7) **Primary Shade Zone Portion of Riparian Reserves**: A "Sufficiency Analysis for Stream Temperatures" was conducted to evaluate the adequacy of Riparian Reserves, within proposed harvest units, to achieve and maintain, water quality standards for stream temperatures along the Middle Santiam River and its tributaries (this document is available for public review at the Detroit Ranger District where the hydrologist is stationed). Areas within the Riparian Reserves that were directly contributing to primary stream shade and channel bank stability were eliminated from harvest units and left intact. Generally the primary shade zone is a minimum of 50 feet wide and occurs along perennial streams. Trees contributing to channel bank stability would also be left on intermittent streams (for specific unit prescriptions see Appendix A).

8) **Earthflow-** About 12 acres of Unit 26 would be thinned to encourage growth and vigor of residual trees. Trees would be individually marked on this earthflow to provide the best mix of tree sizes and species and to achieve a fairly even distribution of trees across the earthflow. The resulting canopy closure here is expected to be about 65% or about 120 trees per acre. The

thinning is being done to increase vigor and tree size within the stand thus affecting the water balance on the earthflow and encouraging more long-term stability.

Other Project Actions:

- **Slash Treatment-** Slash would be treated in high-risk areas to minimize fire starts which could potentially jeopardize the functioning of the habitat conditions that are being developed through this project. Slash treatments include: 236 acres of yarding tops, 66 acres of roadside grapple piling along the more heavily traveled roads, grapple piling 141 acres that are proposed to be logged with ground-based yarding systems, and burning 280 landings and numerous grapple piles (see Table 3). ***Note:*** Opportunities would be made available for the public to utilize logging slash for firewood and potentially for alternative biomass utilization if a market exists for the wood fiber. These fuel utilization opportunities would reduce the amount of fuel to be burned.

  Prescribed fire would take place when duff and soil moistures are high or weather and fuels are in spring-like conditions. Spring-like conditions are: Fuels 3" and greater in diameter (*1,000 hour fuels*) would have fuels moistures of 25% or greater, soil moistures and duff moistures would be damp, at levels where duff consumption could be limited to less than 15% across the unit and mortality of overstory trees would be low. See table 4 and Appendices A and J for fuel treatments by harvest unit.

Table 3 -Alternative 2 Fuel Treatments by Individual Harvest Unit

Unit Number	Acres	Grapple Pile Acres	Roadside Grapple Pile Acres	Yarding Tops Acres	Number of Landings to Burn
1	11	0	1	9	4
2	20	0	2	20	6
3	24	0	1.5	0	6
4	14	0	0.5	0	2
5	52	0	2	0	9
6	59	0	3	0	10
7	13	0	0	0	5
8	17	0	1	0	4
9	21	0	1.25	0	6
10	40	30	0	0	6
11	22	0	2	0	3
12	48	0	0	0	7
13	7	0	0	0	0
14	98	33	0	0	11
15	81	0	6	0	17
16	7	0	0.5	0	1
17	34	0	1.5	0	6
18	27	0	1	0	6
19	43	0	0	0	13
20	18	0	1	0	4
21	11	2	1	0	3
22	59	0	2	0	4
23	33	0	1.5	0	5
24	30	0	3	30	8
25	51	0	2.5	0	11
26	58	0	3	46	6
27	24	0	2.25	24	7
28	29	0	1.5	23	7
29	28	0	2	0	6
30	31	0	0	8	4
31	22	0	0	0	0
32	20	9	0	11	3
33	13	7	0	6	3
34	23	0	2.25	23	4
35	45	21	0	24	7
36	10	0	0	0	3
37	15	3	1	12	6
38	49	0	0	0	10
41	38	0	0.5	0	6
42	16	14	0	0	2
43	3	0	0	0	2
44	36	0	0	0	4
46	76	0	5.5	0	14
47	28	0	2	0	6
48	58	22	1	0	6
49	49	0	4.5	0	12
52	38	0	6.25	0	5
Totals	1549	141	66	236	280

- **Road closures:** Roads 2041510 and 2041520 would be closed with a gate. Roads 2049 640, 2049 643 and 2047 846 would be closed with berms and roads 2041 515 and a short segment at the very end of road 2041 520 would be storm-proofed and stored for potential future entries.

Connected actions

Roading: Actions connected to this proposal include reopening about 2.2 miles of closed non-system , native-surface, spur roads that were constructed during the first entry into these stands. In addition, about 1.0 miles of new temporary, native-surface, spur roads would be constructed (see Table 4). These roads are necessary to get logging equipment to the sites to implement the proposed silvicultural treatments. Following this harvest entry, these spur roads would be closed by blocking them with berms, ripping them and seeding them with native seed. All of these roads are located in stands that do not currently meet desired stand characteristics. The tradeoff of constructing and re-opening these spur roads, temporarily during harvest operations, is expected to be outweighed by the benefits of improving habitat quality in these stands. These spur roads access approximately 359 acres of stands proposed for thinning.

In addition, about 0.2 acres adjacent to a rock pit in Unit 46 and 0.1 acres adjacent to the rock pit in Unit 38 would be cleared to access rock for use on roads for this project.

Table 4 -Temporary and Non-system Road Information

Unit	Total Feet of Road To Be Constructed	Of the total length of road to be constructed:		Estimated Acres of Thinning Accessed by temporary roads	Road Distance in Riparian Reserve	Stream Crossings Required
		Amount (in feet) that is existing non-system road	Amount (in feet) that is new temporary road			
3	175	0	175	5	None	No
5	175	0	175	15	None	No
8	650	650	0	15	None	No
9	1050	650	400	17	None	No
10	1800	1800	0	25	500 ft.	One
11	650	650	0	10	None	No
12	675	675	0	20	None	No
14	525	525	0	12	None	No
15	1125	0	1125	20	None	No
19	900	400	500	20	50	One
22	475	475	0	8	None	No
23	1250	1250	0	45	None	No
25	2000	1500	500	40	None	No
26	550	550	0	20	None	No
28	550	250	300	5	None	No
29	1150	1150	0	15	None	No
34	850	850	0	20	None	No
38	925	0	925	17	None	No
41	550	300	250	10	None	No
47	175	0	175	7	None	No
48	300	0	300	5	None	No
49	500	0	500	8	None	No
Totals	**17,000 ft = 3.2 mi**	**11,675 ft = 2.2 mi.**	**5325 ft = 1 mi.**	**359+ acres**	**550 ft.**	**Two**

A total of 73 miles of road would be used for hauling activities, which includes 59.8 miles in share-cost agreement areas. Twenty roads, involving 36 miles, would require various maintenance activities such as spot rocking, brush cutback to provide a safe site distance, road blading, and ditch cleanout. Another 37 miles of road reconstruction would be required. This would include ditch culvert replacement, grubbing/brushing, slump repair, danger tree removal and repairing a hole in the road (see Tables 5 and 6 below and the Transportation Report in Appendix L for more details).

Rights-of-way or temporary easements would be necessary to provide access to Units 2, 3, and 10 within the planning area and would be obtained prior to harvest activities.

Table 5 -Haul Road Status and Anticipated Level of Work Activities

Road Number	Haul Miles	Total Miles	Share Cost Miles	Recon-struction	Pre-haul Mtce	Anticipated Major Reconstruction Activity	Material Source
2041000	13.80	20.03	12.2	X		Brushing, ditch reconditioning, slough removal, culvert cleanout and replacement, spot surfacing, danger tree removal.	M-Line Pit M.P. 10.90
2041510	2.00	2.00	0	X		Brushing, ditch reconditioning, slough removal, slump repair, culvert cleanout and replacement, spot surfacing.	
2041515		2.13**					
2041519		0.31					
2041520	2.80	2.80	2.04	X		Remove blowdown, brushing, ditch reconditioning, slough removal, culvert cleanout and replacement, spot surfacing, repair hole in road.	
2041559	0.30	0.30	0	X		Brushing, clearing and grubbing, and spot surfacing.	
2041563	0.05	0.05	0	X		Brushing clearing and grubbing	Cayuse Pit
2041625	1.26	1.77	1.26	X		Brushing, ditch reconditioning, culvert cleanout and replacement, spot surfacing.	
2041640	0.30	1.67	0.90		X		
2041645	1.20	1.48	1.16	X		Brushing, blowdown removal, ditch reconditioning, spot surfacing, culvert cleanout and replacement.	
2041646	0.60	0.60	0		X		
2041 660	0.1	0.19	0	X		Culvert replacement	
2045000	7.83	7.83	7.83	X		Brushing, blowdown removal, ditch reconditioning, slough removal, culvert cleanout and replacement, spot surfacing.	
2045120 *	0.64	2.24	0.64	X		Brushing, slough removal, culvert cleanout, spot surfacing	
2045123 *	0.20	0.20	0.20	X		Brushing, spot Surfacing	
2045140	1.90	2.64	1.90	X		Brushing, ditch reconditioning, spot surfacing, culvert cleanout and replacement	

Road Number	Haul Miles	Total Miles	Share Cost Miles	Recon-struction	Pre-haul Mtce	Anticipated Major Reconstruction Activity	Material Source
2045142	0.43	1.50	0.43	X		Brushing, ditch reconditioning, culvert cleanout and replacement	
2045147	0.77	0.77	0.77	X		Brushing, ditch reconditioning, repair washouts, spot surfacing, culvert cleanout and replacement, drain dip construction	
2045149		0.17					
2045161	0.15	0.15	0		X		Holman Pit
2045170*	0.10	0.10	0.10	X		Brushing , Clearing and Grubbing	
2045223	0.44	1.02	0	X		Brushing , Clearing and Grubbing	
2045240	0.48	0.68	0		X		
2045250	1.90	3.19	0.77	X		Brushing, ditch reconditioning, spot surfacing.	
2047000	13.20	20.89	12.2		X		
2047720	0.15	0.60	0.15		X		
2047721	0.40	0.63	0		X		
2047722	0.15	0.15	0		X		
2047725	0.26	0.71	0	X		Brushing, borrow placement, culvert replacement.	
2047726	0.10	0.10	0		X		
2047739	0.48	0.48	0		X		
2047825	0.73	2.54	0.73	X		Brushing, ditch reconditioning, culvert cleanout and replacement.	
2047826	0.24	0.29	0.24		X		
2047827	0.15	0.15	0		X		
2047828	0.50	0.58	0.50		X		
2047840	1.00	5.11	1.00		X		
2047843	0.21	0.21	0		X		
2047846	0.83	0.83	0		X		

Road Number	Haul Miles	Total Miles	Share Cost Miles	Recon-struction	Pre-haul Mtce	Anticipated Major Reconstruction Activity	Material Source
2047852	0.10	1.26	0		X		
2049000	9.46	9.46	9.46		X		Mid-Santiam Pit M.P. o.76
2049550	0.80	1.16	0.80		X		
2049555	0.80	2.06	0.80		X		
2049610	0.40	1.72	0.40	X		Brushing, ditch reconditioning, culvert cleanout and replacement.	
2049615	2.02	2.02	1.68		X		
2049617	0.45	0.72	0		X		
2049620	0.30	0.30	0		X		
2049630	1.20	2.16	0.70		X		
2049635	0.41	3.98	0.41		X		
2049636	0.22	1.30	0.22		X		
2049640	0.84	0.84	0.35		X		
2049643	0.63	0.63	0		X		
Total	**73.28 Miles**	**144.67 Miles**	**59.84 Miles**	**20 Roads 37.11 miles**	**28 Roads**		

* *Requires R/W or Temporary Easement*
** *First 1.43 Miles is on Private Land*
*** *Material Source Access*
Mtce. - Maintenance
* Need R/W or Temporary Easement

The following road closures are planned:

Table 6 - Road Closure Information

Road Number	Closure Miles	Type of Closure
2041 510	2.0 mi.	Gate
2041 515	0.7 mi.	Decommission, hand waterbar
2045 520 (very end of road)	0.25 mi.	Storm-proof and store for potential future use
2041 520	2.5 mi.	Gate at jct. with 526 road
2049 640/643	1 mi.	Berm and storm-proof
Totals	**6.45 mi**	

Yarding: Careful consideration was given to appropriate **logging systems** to accomplish treatment objectives. Depending on topography, soil conditions, accessibility, suspension requirements to meet ecological needs and cost-benefit ratio, a combination of helicopter *(120 acres)*, skyline *(1126 acres)*, and ground-based systems *(303 acr*es) were selected to harvest a total of 47 units.

There are 40 existing landings within Riparian Reserves on the current road system. These landings are outside of primary shade zones. An additional 5 new landings are proposed in Riparian Reserves outside of primary shade zones. In addition, there are two ground-based stream crossings on intermittent streams and 5 crossings for skyline corridors. Locations of these stream crossings would be designated, as per Best Management Practices and would occur perpendicular to stream channels. Logs would be fully suspended across stream channels and through Riparian Reserves in skyline corridors. In addition, trees felled for yarding corridors within Riparian Reserves would be left in place to contribute to down woody material *(Refer to Appendix A Unit Prescriptions for specific locations).*

Design criteria

Design criteria that would be implemented to minimize anticipated effects of the proposed action include:

- restricting harvest operations during times of the year when it would be detrimental to species' reproductive success,
- seasonal restriction on use of native surface roads to minimize erosion,
- buffering sensitive species and habitats from disturbance during harvest activities,
- washing logging equipment prior to entering National Forest lands to minimize the spread of invasive plants;
- pre-treating weeds along haul routes, using weed-free rock sources,
- seeding disturbed areas with native seed and other measure minimize introduction or spread of these plants into the area,
- trailhead rehabilitation following harvest activities in the vicinity,
- tree planting in DTR's to help diversify stand age and species composition,

- subsoiling portions of units where ground-based logging systems were used and existing compaction exceeds standards and guidelines,
- creation of snags and down wood to provide structural elements in these stands, and
- using pre-designated skid roads to minimize compaction and soil disturbance

(see also Design Criteria/Mitigation Measures common to all alternatives in Table 13).

Similar actions: Funding would be collected from this timber sale to implement required design criteria/mitigation outlined in the upper portion of the Table 7 below. As additional funding is available, post-sale opportunities listed on the bottom portion of Table 7 would be implemented in priority order. Both design criteria/mitigation and post-sale opportunities are described in more detail in Appendix B.

Table 7 - Alternative 2 Mitigation/Design Criteria and Post-Sale Opportunities

Priority	Type of Project	Covered in EA
Design Criteria/Mitigation Projects*		
1	Subsoiling and seeding to be within Forest Plan Standards and Guidelines	Yes
2	Invasive weed survey and treatment	Yes
Post-Sale Opportunities		
3	Snag and down wood creation	Yes
4	Plant in gaps (DTR's); and about two acres in Unit 7 adjacent to pond/wetland	Yes
5	Gates and berms to close roads	Yes
6	Fisheries project to thin (and leave material) to improve size of future coarse woody material in part of secondary shade zone not otherwise being treated.	Yes
7	Timber Stand Improvement (TSI) – precommercial thinning	No
8	Waterbar 2041 515 road by hand	Yes
9	Landings should be cleaned up and made useable for dispersed recreational activities. Berms placed on closed roads should be placed such that area could be made useable for dispersed recreational activities.	Yes
10	Subsoiling in ground-based units where S and G's are not exceeded	Yes
11	Timber Stand Improvement (TSI) - fertilization	No
12	Timber Stand Improvement (TSI) - pruning	No
13	Firewood	Yes

*For other design criteria/mitigation measures see Table 13.

The following table (Table 8) is a summary of proposed treatments for individual harvest units for Alternative 2.

Table 8 - Alternative 2 Unit Summary

Unit #	Planned Thinning Acres	Acres in CHU	Acres in MS River Corridor	Acres in AOC	Target Canopy Closure %	Gaps (% of thinned area in upland)	Acres of Skips	Acres grd-based logging	Acres Skyline	Acres Helicopter	Volume (CCF)
1	11		11	11	50		17	2	9		220
2	20		20	20	50		26		20		400
3	24			24	50		14		24		480
4	14			14	50		11		9	5	280
5	52			52	50		12	4	48		1040
6	59			59	50		19	24	35		1180
7	13			13	50% north of Holman Ck. 70% south		15		13		260
8	17			17	50		39		17		340
9	21			21	50		25	3	18		420
10	40	40		40	50		44	30	10		800
11	22			22	50		7		21	1	440
12	48				50		9	11	37		960
13	7		7	7	50		30			7	140
14	98		96	98	50		22	33	65		1960
15	81		71	81	60	10%	21		81		1620
16	7		34	7	60	10%	28	2	5		140
17	34		27	34	50		7	14	20		680
18	27			27	60		12		27		540
19	43				50		7		40	3	860

Unit #	Planned Thinning Acres	Acres in CHU	Acres in MS River Corridor	Acres in AOC	Target Canopy Closure %	Gaps (% of thinned area in upland)	Acres of Skips	Acres grd-based logging	Acres Skyline	Acres Helicopter	Volume (CCF)
20	18				50		15		18		360
21	11			11	50		12	2	9		220
22	59	59		59	60	10%	17	38	21		1180
23	33	33		23	60	10%	17	7	26		660
24	30	30	30		60		7		30		600
25	51	51		4	50		37	5	46		1020
26	58	58			50 except 65 in earthflow		37		46	12	1160
27	24	24	14		50		20		24		480
28	29	29	23		50		42		23	6	580
29	28	28		28	50		8	8	20		560
30	31	31			50		25		8	23	620
31	22	22			50		38			22	440
32	20	20			50		67	9	11		400
33	13	13	13		50		32	7	6		260
34	23	23			60	10%	36		23		460
35	45	45			50		-	21	24		900
36	10	10	10		50		33			10	200
37	15			15	60		15	3	12		300
38	49		49	49	60	10%	3	6	43		980
41	38			38	50		17	22	16		760
42	16			16	50		49	14	2		320
43	3			3	50		1	3			60

Unit #	Planned Thinning Acres	Acres in CHU	Acres in MS River Corridor	Acres in AOC	Target Canopy Closure %	Gaps (% of thinned area in upland)	Acres of Skips	Acres grd-based logging	Acres Skyline	Acres Helicopter	Volume (CCF)
44	36	36		36	50		2	4	7	25	720
46	76		76	76	50		18		76		1520
47	28		28	28	50		12	3	25		560
48	58		58	58	50		-	22	36		1160
49	49			49	60	10%	23		43	6	980
52	38	38	38	38	50		17	6	32		760
Totals	**1549**	**590**	**605**	**1078**			**965**	**303**	**1126**	**120**	**30,980**

Middle Santiam Thin

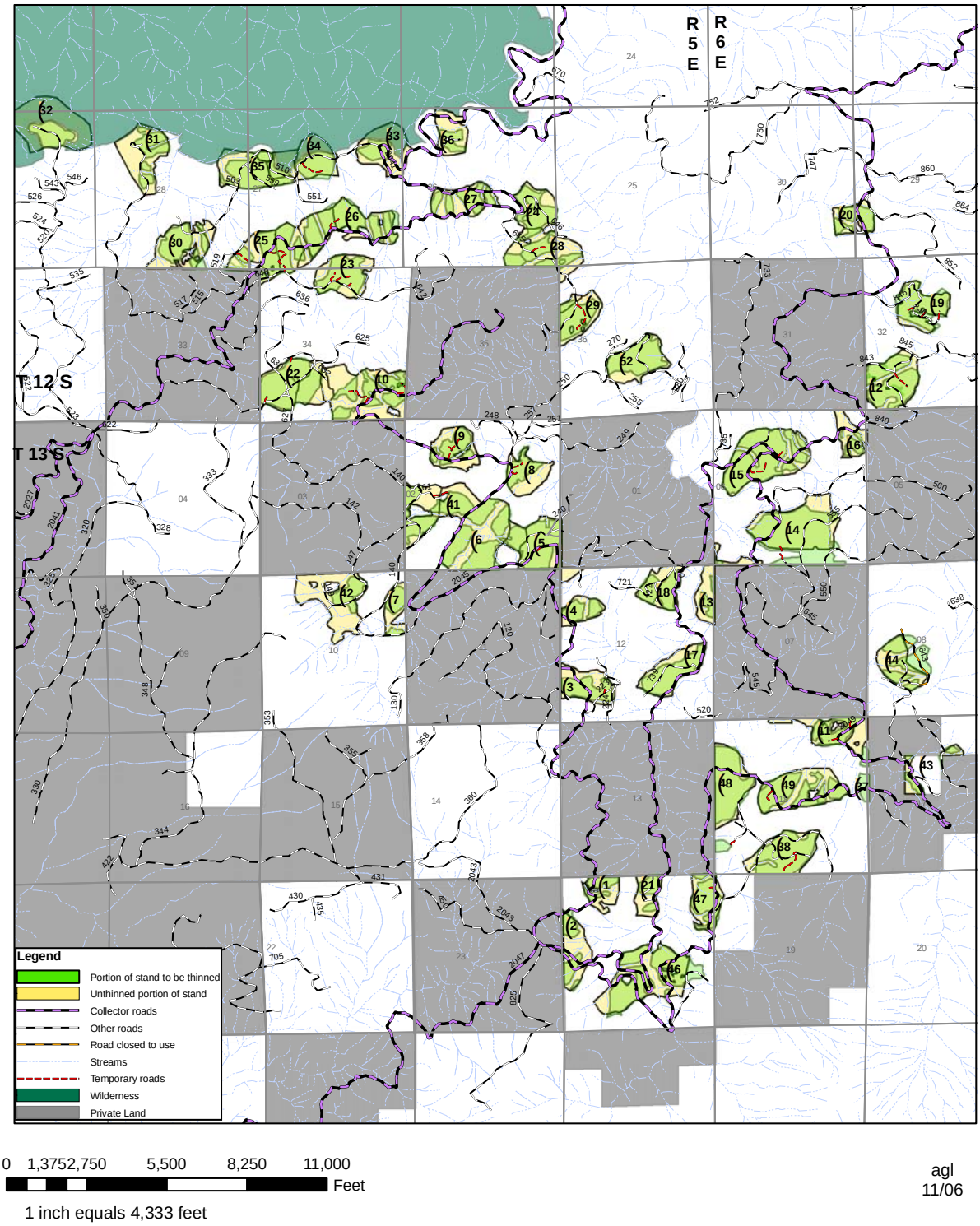


Figure 11 - Alternative 2 Map

Alternative 3

Alternative 3 would be commercially thinned to about 1412 acres of 30-60 year-old managed stands to increase growth and vigor of residual trees and accelerate the development of structural and compositional diversity of young, densely-stocked, uniformly-spaced, managed stands in the Donaca and Headwaters Middle Santiam subwatersheds. A total 44 units would be harvested, producing about 28,240 CCF of commercial wood products that contribute to the district's harvest target.

This alternative focuses more on economic viability and utilization of conventional yarding systems (ground-based and skyline) than Alternative 2. Unit 18 and units proposed for helicopter logging Alternative 2 are dropped in this alternative with the exception of Unit 36. In Alternative 3, Unit 36 is accessed by reconstructing a portion of a road that was removed by a landslide in a storm event in 1996. After road access is achieved, this unit would be logged with ground-based and skyline yarding systems.

The analysis area was divided into three separate areas as described in Alternative 2. The desired outcomes of stand treatments for CHU, Middle Santiam River Corridor, Area of Concern, and Riparian Reserves which lie outside of "Primary Shade Zones" would be similar to descriptions given in Alternative 2 as are the "Additional Requirements."

The same techniques as described in Alternative 2 would be implemented to attain desired stand characteristics in this alternative except the for earthflow stability improvement. This unit would not be included in this alternative (see Table 12 for summary of treatments by unit and Appendix A for individual unit maps and detailed treatment descriptions).

Other Project Actions:

Slash Treatment- Slash is similar to Alternative 2 but the number of units treated and the number of landings burned varies. See Table 9 for proposed slash treatment by harvest unit for this alternative.

Table 9 -Alternative 3 Fuel Treatments by Individual Harvest Unit

Unit Number	Acres	Grapple Pile Acres	Roadside Grapple Pile Acres	Yarding Tops Acres	Number of Landings to Burn
1	11	0	1	9	4
2	20	0	2	20	6
3	24	0	1.5	0	6
4	9	0	0.5	0	2
5	52	0	2	0	9
6	59	0	3	0	10
7	13	0	0	0	5
8	17	0	1	0	4
9	21	0	1.25	0	6
10	40	30	0	0	6
11	21	0	2	0	3
12	48	0	0	0	7
14	98	33	0	0	11
15	81	0	6	0	17
16	7	0	0.5	0	1
17	34	0	1.5	0	6
19	40	0	0	0	12
20	18	0	1	0	4
21	11	2	1	0	3
22	59	0	2	0	4
23	33	0	1.5	0	5
24	30	0	3	30	8
25	51	0	2.5	0	11
26	46	0	3	46	6
27	24	0	2.25	24	7
28	23	0	1.5	23	7
29	28	0	2	0	6
30	8	0	0	8	3
32	20	9	0	11	3
33	13	7	0	6	3
34	23	0	2.25	23	4
35	45	21	0	24	7
36	10	0	0	0	3
37	15	3	1	12	6
38	49	0	0	0	10
41	38	0	0.5	0	6
42	16	14	0	0	2
43	3	0	0	0	2
44	11	0	0	0	4
46	76	0	5.5	0	14
47	28	0	2	0	6
48	58	22	1	0	6
49	43	0	4.5	0	12
52	38	0	6.25	0	5
Totals	1412	141	66	236	268

Road Closures: The following table shows roads proposed for closure by this alternative. Road proposed for closures are similar to Alternative 2 except road 2041 515 would not be closed because no harvest would occur off this road and it would not be included in the sale area.

Table 10 -Road Closure Information

Road Number	Closure Miles	Type of Closure
2041 510	2.0 mi	Gate
2045 520 (very end of road)	0.25 mi.	Decommission
2041 520	2.5 mi.	Gate at jct. with 526 road
2049 640/643	1 mi.	Berm and storm proof
Totals	**5.75 mi.**	

Connected actions

Roading: Temporary road construction and existing non-system road reconstruction is similar to Alternative 2.

Road maintenance and reconstruction vary slightly from Alternative 2. Four fewer road segments are needed for Alternative 3 than Alternative 2 because some units or portions of units have been dropped. Roads 2047 720 (0.15 miles), 2047 721 (0.4 miles), 2047 722 (0.15 miles) and 2041 510 (0.7 miles) are not needed in this Alternative (see Tables 6 and 7). One additional road is needed in Alternative 3 that is not used in Alternative 2. This road is 2041 660 (0.1 miles) which is needed to access Unit 36. This road requires reconstruction including a culvert crossing where a portion of the road washed out in a 1996 storm event.

Trailhead: Currently a small trailhead exists just west of the washed out portion of the road. This trailhead would be reestablished at the landing for Unit 36, thus moving it to the east side of the creek crossing.

Yarding: A combination of skyline *(1105 acres)*, and ground-based equipment *(307 acr*es) was selected to harvest a total of 44 units for this alternative. No helicopter logging is proposed.

Landings within Riparian Reserves, stream crossing, and other requirements associated with stream crossings are similar to Alternative 2.

Design criteria

Design criteria would be implemented to minimize anticipated effects in similar ways to Alternative 2. Design criteria common to both action alternatives is summarized in Table 13.

Similar actions: Funding would be collected from this timber sale to implement required mitigation outlined in the upper portion of Table 11 below. As additional funding is available post-

sale opportunities listed in the bottom portion of Table 11 would be implemented in priority order. Both mitigation and post-sale opportunities are described in more detail in Appendix B.

Table 11 - Alternative 3 Mitigation/Design Criteria and Post-Sale Activities

Priority	Type of Project	Covered in EA
Mitigation/Design Criteria Projects*		
1	Subsoiling and seeding Units 10 and 22 to be closer to Forest Plan Standards and Guidelines for Compaction	Yes
2	Invasive weed survey and treatment	Yes
Non-mitigation Projects		
3	Snag and down wood creation	Yes
4	Underplanting DTR's and in Unit 7 adjacent to pond/wetland and in Unit 10	Yes
5	Gates and berms to close roads	Yes
6	Fisheries project to thin (and leave material) to improve size of future DWD in part of secondary shade zone not otherwise being treated.	Yes
7	TSI – precommercial thinning	No
8	Waterbar 2041 515 road by hand	Yes
9	Landings should be cleaned up and made useable for dispersed recreational activities. Berms placed on closed roads should be placed such that area could be made useable for dispersed recreational activities.	Yes
10	The trailheads at the end of Forest Roads 2041 and 2041-646 would be moved after harvest operations in Unit 36 are completed	Yes
11	Subsoiling in ground-based units where S and G's are not exceeded	Yes
12	TSI - fertilization	No
13	TSI - pruning	No
14	Firewood	Yes

*For other design criteria see Table 13 entitled Design Criteria/Mitigation Measures Common to All Alternatives, after the description of Alternative 3. In addition see Post Sale Activities in Appendix B.

Table 12 - Alternative 3 Unit Summary

Unit #	Planned Thinning Acres	Acres in CHU	Acres in MS River Corridor	Acres in AOC	Target Canopy Closure %	Gaps (% of thinned area in upland)	Acres of Skips	Acres grd-based logging	Acres Skyline	Acres Helicopter	Volume (CCF)
1	11		11	11	50		17	2	9		220
2	20		20	20	50		26		20		400
3	24			24	50		14		24		480
4	9			9	50		16		9		180
5	52			52	50		12	4	48		1040
6	59			59	50		19	24	35		1180
7	13			13	50% north of Holman Ck. 70% south		15		13		260
8	17			17	50		39		17		340
9	21			21	50		25	3	18		420
10	40	40		40	50		44	30	10		800
11	21			21	50		8		21		420
12	48				50		9	11	37		960
14	98		96	98	50		22	33	65		1960
15	81		71	81	60	10%	21		81		1620
16	7		7	7	60	10%	28	2	5		140
17	34		27	34	50		7	14	20		680
19	40				50		10		40		800
20	18				50		15		18		360
21	11			11	50		12	2	9		220
22	59	59		59	60	10%	17	38	21		1180
23	33	33		23	60	10%	17	7	26		660
24	30	30	30		60		7		30		600

Unit #	Planned Thinning Acres	Acres in CHU	Acres in MS River Corridor	Acres in AOC	Target Canopy Closure %	Gaps (% of thinned area in upland)	Acres of Skips	Acres grd-based logging	Acres Skyline	Acres Helicopter	Volume (CCF)
25	51	51		4	50		37	5	46		1020
26	46	46			50		49		46		920
27	24	24	14		50		20		24		480
28	23	23	23		50		48		23		460
29	28	28		28	50		8	8	20		560
30	8	8			50		48		8		160
32	20	20			50		67	9	11		400
33	13	13	13		50		32	7	6		260
34	23	23			60	10%	36		23		460
35	45	45			50		-	21	24		900
36	10	10	10		50		33	4	6		200
37	15			15	60		15	3	12		300
38	49		49	49	60	10%	3	6	43		980
41	38			38	50		17	22	16		760
42	16			16	50		49	14	2		320
43	3			3	50		1	3			60
44	11	11		11	50		27	4	7		220
46	76		76	76	50		18		76		1520
47	28		28	28	50		12	3	25		560
48	58		58	58	50		-	22	36		1160
49	43			43	60	10%	29		43		860
52	38	38	38	38	50		17	6	32		760
Totals	**1412**	**456**	**571**	**1007**			**966**	**307**	**1105**	**0**	**28,240**

Alternative Three

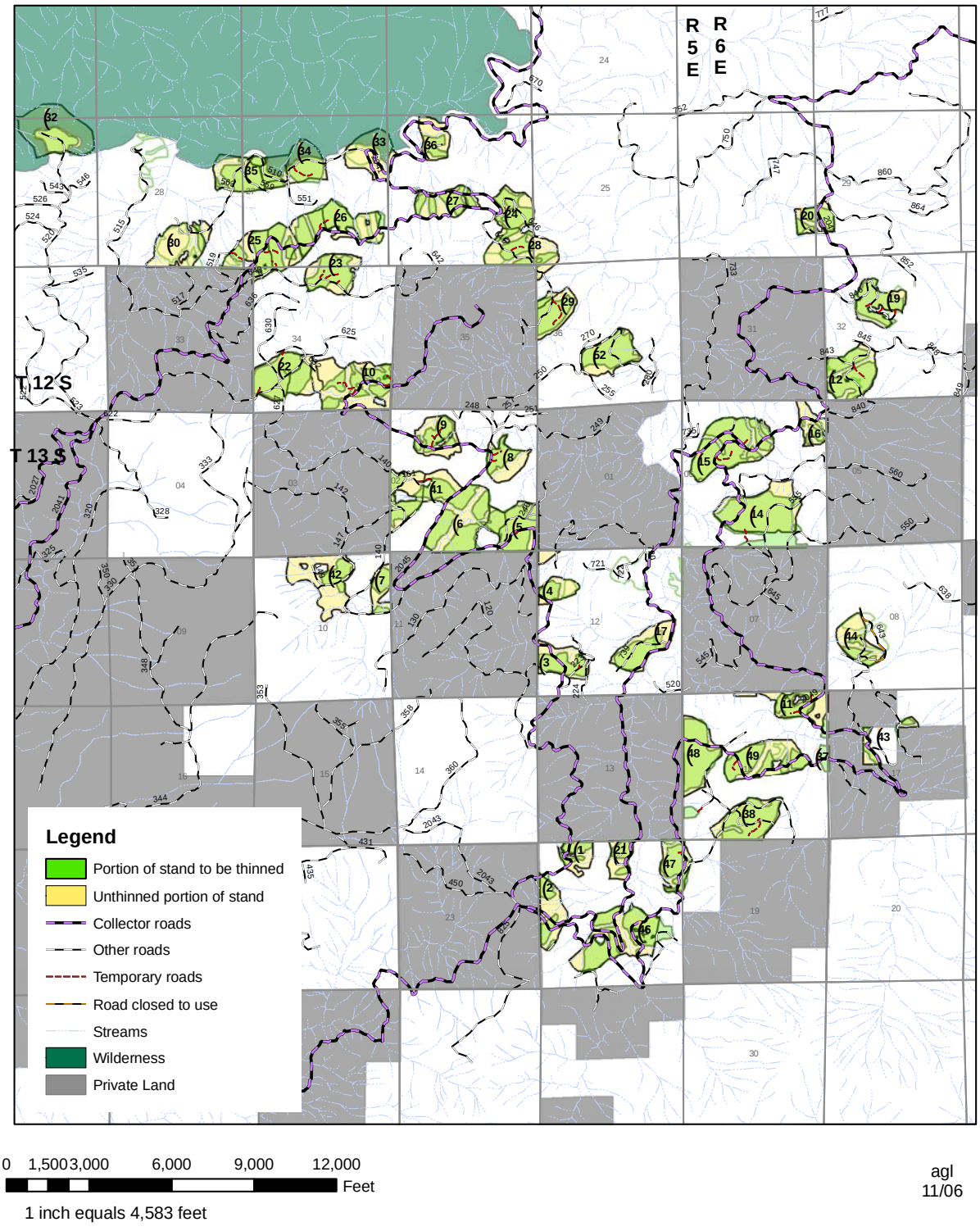


Figure 12 - Alternative 3 Map

Design Criteria/Mitigation Measures Common to All Action Alternatives__

The following design criteria/mitigation measures were developed to ease some of the potential adverse effects the various alternatives may cause. They apply to any of the action alternatives, unless another specifically identified criterion is listed below or in the individual unit prescriptions in Appendix A.

Table 13 - Design Criteria and Mitigation Measures Common to All Action Alternatives

Unit #	Design Criteria/Mitigation Measures	Restriction Dates
Wildlife		
All	Existing snags and down logs would be protected to the greatest extent possible during harvest operations.	
All	Biological legacies such as large live trees, snags and down wood would be retained to the extent possible, except within road right-of-way, yarding corridors or for safety reasons. If snags or large legacy trees need to be felled, they would be retained in the unit.	
All	Leave 5 trees per acres for snags and down wood creation in addition to thinning leave trees	
All	"Except for hauling and the removal of hazard trees to protect public safety, no activity shall take place within the disruption distance of a known activity center or in unsurveyed suitable habitat during March 1 – July 15 (critical nesting period for northern spotted owls), unless the habitat is known to be unoccupied or there is no nesting activity, as determined by survey to protocol. The distance and timing may be modified by the district wildlife biologist according to site-specific information" (USDI, 2006)	3/ 1 – 7/15
Vegetation		
All	***Vegetation – General:*** Logging systems would be designed to minimize damage to residual trees and soil. Some of the major considerations are: • Tractor systems – Require pre-designated skid roads, with line pulling and subsoil skid roads as needed following logging. • Skyline systems – require parallel corridors whenever possible, fall trees to the lead, avoid downhill yarding. • Helicopter systems – use an appropriately sized helicopter that would work within proposed leave tree spacing	
All	***Sensitive and Survey and Manage Botanical Species:*** Known sites of sensitive and Survey and Manage species would be protected from physical disturbance by prescribed no-harvest protection buffers of 100-172 feet (see Integrated Prescriptions for individual unit protection buffers in Appendix A)	
All	***Invasive Plants:*** • Survey to locate invasive weed populations and remove/control them where possible in harvest units and along adjacent roads prior to harvest activities. • Gravel for road construction and reconstruction would be obtained from a weed-free rock source. • Areas of soil disturbance would be minimized during all harvest activities including spur road construction and re-opening, road reconstruction, and fuels treatment. All disturbed areas, including landings and subsoiled skid roads, would be seeded with native species to reduce weed establishment.	

Unit #	Design Criteria/Mitigation Measures	Restriction Dates
	• Berm, gate or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.	
19	Place a 100 foot containment buffer around false brome population.	
25	Do not use landing with scotch broom population. Place a 50 foot no-harvest buffer on this invasive plant population.	
15 and 36	Landings with scotch broom populations will be covered with filter cloth and covered with at least six inches of gravel prior to harvest activities to minimize spread of scotch broom	
Fisheries		
All	• Any project activity such as culvert replacement that must occur within fish-bearing and other perennial streams would comply with Oregon Department of Fish and Wildlife seasonal restrictions on in-stream work activities. Best Management Practices including placement of sediment barriers, provision of flow bypass, and other applicable measures would be included in project design as necessary to control off-site movement of sediment.	6/ 1 – 9/30
Hydrology/Stream Channels/Water Quality/Riparian Reserves		
All	• Retain no-harvest riparian buffers of at least 50 feet on perennial streams and including trees contributing to stream bank stability on intermittent streams (see Appendix A for exact distances on individual units). These buffers are prescribed to minimize sediment delivery to streams and reduce the potential for temperature increases. All buffers are measured from the trees nearest the stream rather than the waters edge. • Haul on native surface roads will generally occur during the time of year when weather and soil moisture conditions do not result in road surface damage that can lead to sediment washing from damaged road surfaces into stream channels. This time period is usually during the normal operating season established for the timber sale (BMP R-20). • To minimize impact from skyline corridors across streams and riparian areas, trees would be directionally felled into stream channels, where possible. If trees cannot be felled into stream channels, fell them away from riparian vegetation to minimize damage. These trees would be left on site. • Ground-based harvest operations would restricted in Riparian Reserves when ground and weather conditions result in excessive erosion and sedimentation. • No DTR’s would occur in Riparian Reserves Best Management Practices (BMP's) were utilized in the development of mitigation, design criteria and compliance to ACSO's. These BMP's can be found in "General Water Quality Best Management Practices” Pacific Northwest Region, Nov., 1988. Utilizing BMP’s for this project specifically address direction and guidance in the protection of water quality. Middle Santiam Thin project objectives and design criteria/mitigation measures for water quality are:	

Unit #	Design Criteria/Mitigation Measures		Restriction Dates
	Objective	**Design Criteria/Mitigation Measures**	
	Continue recovery of downstream riparian, channel and water quality conditions	Design units to insure channel bank stability, and provide adequate buffers to reduce sediment inputs and minimize peak flow effects (BMP T-2; T-7; T-8; T-12). Boundaries are placed in such a manner to avoid compromising stability of the channel banks.	
	Maintain or improve the quality of water for domestic and fisheries users	Designate riparian management units and specific prescriptions for each individual unit adjacent to stream courses requiring protection (BMP; T-7).	
All	Maintain natural filtration of surface, overland flow, through post sale activities.	Establish appropriate riparian management units and establish fire lines to ensure maintenance of established buffers, filter strips (BMP T-7; T-8; F-2; F-3).	
	Maintain or improve channel bank stability.	Establish riparian management units that include channel bank areas and or establish marking prescriptions that prevent any tree attributing to bank stability from being marked (BMP T-2; T-6; T-7; T-8).	
	Control the amount of sediment leaving the road system.	Utilize appropriate provisions within the contract to ensure that winter haul occurs on roads with adequate surface rock and that erosion control techniques such as mulching of bare soils associated with the road system occur and season of haul permissible for water quality reasons.	
Soils			
All	• Ground-based equipment should generally operate in the dry season, usually during the normal operating season, unless otherwise restricted by other resource concerns or agreed to by Forest Service personnel. • Harvested trees should usually be topped and limbed in the units in order to provide for nutrient recycling and control of ravel and slough on steep side slopes, unless otherwise specified in fuel treatment requirements. • Prescribed ground -based equipment shall generally be limited to slopes less than 30%, unless otherwise directed by Forest Service personnel, in order to reduce soil disturbance. • Ground-based skidding equipment shall stay on designated skid trails. Ground-based skid trails would be pre-designated and pre-approved before use (LTSR =Locate Tractor Skid Roads). They should not usually exceed 15 feet in width and where practical the skidder, cat or processor/ forwarder should travel on slash. Traveling on slash has been shown to reduce off site soil erosion or lessen soil compaction. Skid roads would generally be 100 to 200 feet apart with conventional line pulling operations, and 40 to 60 feet apart with processor/forwarder operations. • Partial or one end suspension is required on skyline units, except at tail trees and landings. Given the uneven terrain in some units, small areas of ground lead may occur along ridge lines or benches.	

Unit #	Design Criteria/Mitigation Measures	Restriction Dates
	• The reopening of non-system roads should usually occur in the dry season, generally considered May through October to avoid surface erosion from exposed soil (unless directed otherwise by Forest Service personnel). Open roads should be storm proofed if they have to sit through extended periods of wet weather. Storm proofing includes standard erosion control measures outlined in the Timber Sale contract provisions. • Where practical, at the completion of harvest activities, limbs and woody debris should be placed on areas of exposed soil to reduce the potential for off site soil erosion. • Unclassified or temporary roads used outside the standard operating season should generally be rocked, snow covered, or frozen to reduce the potential for erosion, unless other mitigating or extenuating circumstances are present. • Cable corridors spacing should be set to both minimize damage to standing timber, as well as the underlying vegetation and soil. • Trees, not designated for harvest in riparian buffers that need to be cut to facilitate harvest operations, should be dropped into the stream if possible to aid in woody debris recruitment. • Avoid disturbance to the existing down woody debris concentrations created by the initial entry as much as practical. • In any unit that borders or contains failure scars, slash should be added to those areas as is practical to provide additional stabilization for soil ravel and slough. • At the completion of harvest activities, spur roads, tractor skid roads or forwarder roads should be waterbarred and scarified, as is necessary. Where possible, skid roads and landings should be subsoiled in order to reduce compaction and return the site to near original productivity. Subsoiling needs to be considered in light of the potential for root pruning, damage to existing regeneration, and the increased amount of soil disturbance. At this time, approximately 55 acres of subsoiling is planned. This means that the amount of acres in a subsoiled condition would equal about 55 within the over 300 acres proposed for ground-based harvest methods, as well as some additional acreage associated with skyline landings. All ripped and subsoiled areas would be seeded with native seed mix. **Note**: Twelve of the 55 acres planned for subsoiling are required mitigation in Units 10 and 22 and will be funded, the remainder acres are project opportunities as funds are available. • Standard contract language should provide for sufficient erosion control measures during timber sale operations (BMP T-13). Revegetation of areas disturbed by harvest activities (such as landings, temporary roads, and equipment storage areas) is required with an appropriate grass seed mix (BMP T-14, T-15, and T-16). • Erosion control measures would be implemented as soon as possible after soils have been disturbed.	
Fire/Fuels/Air Quality		
All	• Tops and limbs that are yarded would be piled at the landing. • Machine piles should be piled in haystack fashion, meaning that the heights of the piles are approximately equal to their width • Care should be taken to make piles so as to minimize damage to standing trees during	

Unit #	Design Criteria/Mitigation Measures	Restriction Dates
	the burning phase. • Slash piles would be covered and dry when burned to reduce the amount of smoke produced. • Grapple and landing piles would be burned during fall and winter months according to limitations established by Oregon Smoke Management System forecaster	
Special Habitats		
All units with identified special habitats	Special habitats, including seeps rock outcrops and gardens, caves, and meadows, would be protected in accordance with the Forest Plan and the Special Habitat Management Guide. General protection measures include: • Directional falling away from special habitats • Avoiding placement of equipment, landings, skyline corridors, and designated skid roads through special habitats • Seeps and small wetlands would have a 50 foot buffer • Meadows would generally have a 50 ft. no-harvest buffer or as wide as necessary to protect the site.	N/A
Transportation		
All	• All existing spur roads opened to access harvest units and all new spur roads constructed would be closed, water barred and seeded with native seeds following activities.	N/A
All	• Danger trees along haul routes would be identified, assessed, and treated according to the Forest Service Pacific Northwest Region (Region 6) policy as detailed in FSM 7733, R6/PNW Supplement Number 7730-2005-1, December 12, 2005."	N/A
Recreation/Public Safety		
All	• Timber harvest activities would be prohibited during weekends between Memorial Day and Labor Day holidays, in order to minimize congestion on major arterial roads and to avoid displacement of recreating visitors. Weekends are defined as starting at 12pm on Friday and ending at midnight on the following Sunday. • Timber harvest activities would also be prohibited during the one-week West Cascades Elk season in October. • Dispersed sites damaged by timber harvest activities would be repaired or replaced with a similar site in the area. • Temporary logging spurs and skid trails connected to system roads would be blocked and planted to discourage use by OHV riders.	Weekends between Memorial – Labor Day West Cascades Elk Season
Heritage		
All	• Protect eligible heritage sites. • In the event that heritage resources are encountered during project implementation project activity would cease until an archeologist can make a determination of effect on the heritage resource. • Re-survey for heritage resources following timber harvest activities and prior to post-sale ground-disturbing activities such as subsoiling.	

Alternatives Not Considered in Detail

Thinning in Natural Stands: The watershed analysis for the Middle Santiam Watershed recommended obtaining harvestable timber from existing managed rather than natural stands in this watershed. There were numerous managed stands in need to treatment to meet habitat goals in the AOC, Middle Santiam River Corridor and the AOC.

In addition, the AOC designation of this area was made because of the extensive timber harvest here that altered habitat and compromised connectivity through this area. There was a need to address the conditions in the identified managed stands at this time.

Heavy Thinning Treatments: Thinnings that reduce canopy closures below 50% (or about 90 trees per acre) were not considered because of the need to maintain at least this much closure within thinned areas of Riparian Reserves in order to meet the TMDL temperature implementation strategies. Also given the current condition of dispersal habitat in the AOC, it was not thought to be wise to bring canopy closures down to minimum levels of 40% which would leave little room for error if trees were lost to natural events such as strong winds, fire, or disease/insect infestations.

Harvest in the primary shade zones of Riparian Reserves was not considered because of the need to meet the TMDL implementation strategy to protect shade on the 303 (d) listed Middle Santiam River and tributary perennial streams. Until such time as stream temperatures moderate, no harvest would likely be planned in these areas.

Alternatives that did not consider construction or re-opening of non-system roads was not considered in detail because over 350 acres could not be treated to meet project objectives without reasonable access to these areas. The cost of helicopter options to access these areas is prohibitive. It was felt that the trade off of building the roads and closing them after harvest was outweighed by the benefits of stand treatments in this area.

Comparison of Alternatives

This section provides a summary of the effects of implementing each alternative. Information in the table is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives.

Table 14 - Comparison of Alternatives

Comparison Factor	Alternative 1 No Action	Alternative 2	Alternative 3
Volume (CCF)	0	30,980	28,240
Acres Commercially Thinned	0	1549	1412
Percent of total area in original stands thinned	0	62%	57%
Acres of Skyline Logging	0	1126	1105
Acres of Ground-based Logging	0	303	307
Acres of Helicopter Logging	0	120	0
Habitat Development in the CHU			
Acres of Suitable Habitat Affected in CHU	0	0	0
Acres of Dispersal Habitat Affected in CHU	0	252	213
Acres improved in CHU (long-term benefits)	0	590	456
Earthflow			
Acres of earthflow treated to increase growth and vigor of stand	0	12	0
Potential risk to short-term slope stability	No change	Slight increase	No change
Unit 36 access with road and conventional logging systems or log with helicopter			
Cost of road reconstruction or helicopter	0	$55,000	$50,000
Recreation Effects	No change	No change	Increased ATV traffic near wilderness
Economics			
Acres treated to meet project objectives	0	1549	1412
Cost/benefit ratio	0	2.46	2.57
Net Present Value	0	$2,989,751	$3,012,144
Habitat Development in the CHU, AOC and Middle Santiam River Corridor			
Acres thinned in AOC and River Corridor	0	1206	1027
Acres of multi-layered canopy development in all three areas.	0	25	25
Riparian Reserve Management			
Percent of existing canopy closure retained in Primary Shade Zone	100%	100%	100%
Percent of area harvested outside of primary shade zone where 50%+ canopy closure is retained	100%	100%	100%

Comparison Factor	Alternative 1 No Action	Alternative 2	Alternative 3
Acres of Riparian Reserves thinned outside of the primary shade zone	0	400	293
Landings in Riparian Reserves	0	40 existing, 5 new	40 existing, 5 new
Stream Crossings (intermittent streams)	0	2	2
Yarding Corridor Crossings	0	5	5
Invasive Plants			
Acres harvested	0	1549 ac.	1412 ac.
Construction of new native-surface temporary roads	0	1 mi.	1 mi.
Reopen existing native-surface non-system roads	0	2.2 mi.	2.2 mi.
Road Maintenance	0	36	35
Road Reconstruction	0	37 mi.	37 mi.
Subsoil skid roads	0	55 acres	55 acres
Landings, new and existing	0	280	268
Acres of grapple piling in units and along roadsides	0	207	207
Snags and Down Wood			
Number of trees retained to create snags and down wood (5 TPA)	0	7745	7060
Methods to create snags	N/A	Top/Girdle	Top/Girdle
Fuel Treatment/Private Land Protection			
Fuel loadings exceeding Forest Plan standards and guidelines for about ten years.	0	On about 30% of the treated stands	On about 30% of the treated stands
Acres of grapple piling within harvest units	0	141	141
Acres of grapple piling along roads	0	66	66
Acres of yarding tops	0	236	236
Acres of burning landings.	0	280	268
Other Stand Structure Development			
Gaps in 10% of upland acres that were thinned which would lead to development of multiple canopy layers	0	25 ac.	25 ac.
Skips (areas not thinned)	all	965 ac.	1079 ac.
Species diversity – retained cedar, pine, yew, and hardwoods	yes	yes	yes

Table 15 - How Alternatives Meet Project Objectives

Objective	Alternative 1	Alternative 2	Alternative 3
Accelerate development of late-successional stand characteristics in young stands in the CHU The desired stand characteristics include the following: • an appropriate stand component of large diameter trees • multi-layered stands with well developed understories • snags and down woody material of sufficient size and arrangement to meet habitat and ecological needs now and into the future • complex stand structure and diversity • variations in stand densities that are occasionally interspersed with small openings. • diverse species composition including hardwoods and other minor species	Modeling suggests these stands would achieve some late-successional characteristics like large trees in about 160 years. But would not develop desired multi-canopy layers, etc.	1549 acres would be treated 1. An appropriate stand component of large diameter trees - By decreasing inter-tree competition more light and nutrients are available to the residual trees which grow faster as a result. 2. Variations in stand densities that are occasionally interspersed with small openings in some stands. 3. Multi-layered stands with well developed understories – reducing the tree densities would open up the stand so more light can reach the ground to promote shrub and young tree growth. In addition, gaps in some stands would contribute even more to multiple canopy layers and they would be planted with cedar. 4. Future snags and down woody material of sufficient size and arrangement to meet habitat and ecological needs – tree growth from thinning should develop larger snags and down wood sooner than might occur without treatment. 5. Complex stand structure and diversity – see 1-4 and 6. 6. Diverse, native species composition including hardwoods and other minor species – Unit prescriptions call for retention of cedar, yew, pines and hardwoods. Western redcedar > 10 inches DBH would be used in spacing for leave trees. Western redcedar would be planted in gaps providing a diverse composition of native species.	1412 acres would be treated 1. An appropriate stand component of large diameter trees - By decreasing inter-tree competition more light and nutrients are available to the residual trees which grow faster as a result. 2. Variations in stand densities that are occasionally interspersed with small openings in some stands 3. Multi-layered stands with well developed understories – reducing the tree densities would open up the stand so more light can reach the ground to promote shrub and young tree growth. In addition, gaps in some stands would contribute even more to multiple canopy layers and they would be planted with cedar. 4. Future snags and down woody material of sufficient size and arrangement to meet habitat and ecological needs – tree growth from thinning should develop larger snags and down wood sooner than might occur without treatment 5. Complex stand structure and diversity – see 1-4 and 6. 6. Diverse, native species composition including hardwoods and other minor species – Unit prescriptions call for retention of cedar, yew, pines and hardwoods. Western redcedar >10 inches DBH would be used in spacing for leave trees. Western redcedar would be planted in gaps providing a diverse composition of native species.

Objective	Alternative 1	Alternative 2	Alternative 3
Encourage development of connectivity in the Middle Santiam River Corridor and the AOC • accelerate development of late-successional structure especially multiple canopy layers and large diameter trees for future snags and down wood • accelerate improvement of dispersal habitat conditions	Connectivity within the AOC would develop on its own over a longer period of time than would the action alternatives.	1. By decreasing inter-tree competition more light and nutrients are available to the residual trees which grow faster as a result. Refer to diameter growth discussion in vegetation effects. 2. Multi-layered stands with well developed understories - reducing tree densities would open up the stand so more light can reach the ground to promote shrub and young tree growth. In addition, gaps in some stands would contribute even more to multiple canopy layers. These gaps would be planted with cedar adding to an additional canopy layer.	1. By decreasing inter-tree competition more light and nutrients are available to the residual trees which grow faster as a result. Refer to diameter growth discussion in vegetation effects. 2. Multi-layered stands with well developed understories - reducing tree densities would open up the stand so more light can reach the ground to promote shrub and young tree growth. In addition, gaps in some stands would contribute even more to multiple canopy layers. These gaps would be planted with cedar adding to an additional canopy layer.
Outside Primary Shade Zones in Riparian Reserves • Meet ACS Objectives by improving stand health and vigor to accelerate development of larger trees to provide better shade and future sources of down wood. • Enhance habitat diversity and connectivity	Stand development of larger tree sizes, better shade and future sources of down wood, as well as diversity and connectivity would develop over a much longer period of time than with the action alternatives.	Same as above	Same as above
Earthflow • Increase tree growth and vigor to increase stability one earthflow	No change in stability enhancement	By decreasing inter-tree competition more light and nutrients are available to the residual trees which grow faster as a result thus contributing to potential of long-term stability. Larger trees would eventually provide a source of coarse woody material to the stream channel.	No change in stability enhancement

Environmental Consequences

This section describes the existing condition of the resources and the anticipated environmental effects of implementing the proposed action and other alternatives. This analysis is organized by resource area. Within each section, the affected environment is described first, followed by the effects of the No Action Alternatives that provides a baseline for evaluation and comparison of the other alternatives that follow.

The cumulative effects discussed in this section includes an analysis and a concise description of the identifiable present effects of past actions to the extent that they are relevant and useful in analyzing whether the reasonably foreseeable effects of the proposed action and its alternatives may have a continuing, additive and significant relationship to those effects. The cumulative effects of the proposed action and the alternatives in this analysis are primarily based on the aggregate effects of the past, present and reasonably foreseeable future actions. Individual effects of past actions have not been listed or analyzed and are not necessary to describe the cumulative effects of this proposal or alternatives (Connaughton, James L., 2005. CEQ Memorandum, Guidance on the Consideration of Past Actions in Cumulative Effects Analysis, June 24, 2005).

A listing of past, present and reasonably foreseeable future actions that are still having an influence on one resource or another in the watershed are: timber harvest, road development, traffic on roads, recreation use of area, and amount of broadcast burning. General information about these projects is listed below. Project names are listed in Appendix N. The scale of analysis for the each resource varies from the individual harvest units to the planning area to the 5th field watershed. The following is a summary of past, present and reasonably foreseeable actions that are still contributing to cumulative effects for some resources.

Past Actions

Extensive timber harvest, mostly regeneration harvesting, has occurred on both public and private lands in this planning area and 5th field watershed. In order to access harvest areas, an extensive road system was developed. For some resources these past activities are still contributing to cumulative effects and for some resources they are not.

The table 16 below shows the amount of timber harvest and road development that has occurred on public lands and is estimated to have occurred on private lands since the first timber harvests began in the 1940's both at the planning area scale and the 5th field watershed scale. Most of this harvest that occurred was clearcuting and much of it included broadcast burning for slash treatment. It can be inferred from table16 that broadcast burning is on the same level of magnitude as timber harvest for each decade. There is no traffic count data or dispersed recreation use data for these areas. The traffic is likely to be somewhat proportional to the amount of roads in the planning area and in the 5th field watershed (see table 16 below).

Table 16 -Harvest on Public Lands by Decade in the Planning Area and the 5th Field Watershed

Item	Planning Area	5th field watershed
Total Acres in Subwatershed	**34,666**	**66,749**
Harvest by Decade on National Forest System Lands		
1941-1950	840	860
1951-1960	1624	2037
1961-1970	1087	2123
1971-1980	1080	2422
1981-1990	1343	3442
1991-2000	15	60
Total Acres Harvested on NF System Lands	**5989**	**10,944**
Acres of National Forest System Land	**27,258**	**51.922**
Acres of Other Ownership	7,408	14,827
Estimate Acres harvested on other ownership lands in last 40-60 years	7,300	14,500
Total miles of road both public and other ownership lands	130	197

To get an idea of the spatial arrangement of harvest in the 5th field watershed see figure 13 and in the planning area see figure 14.

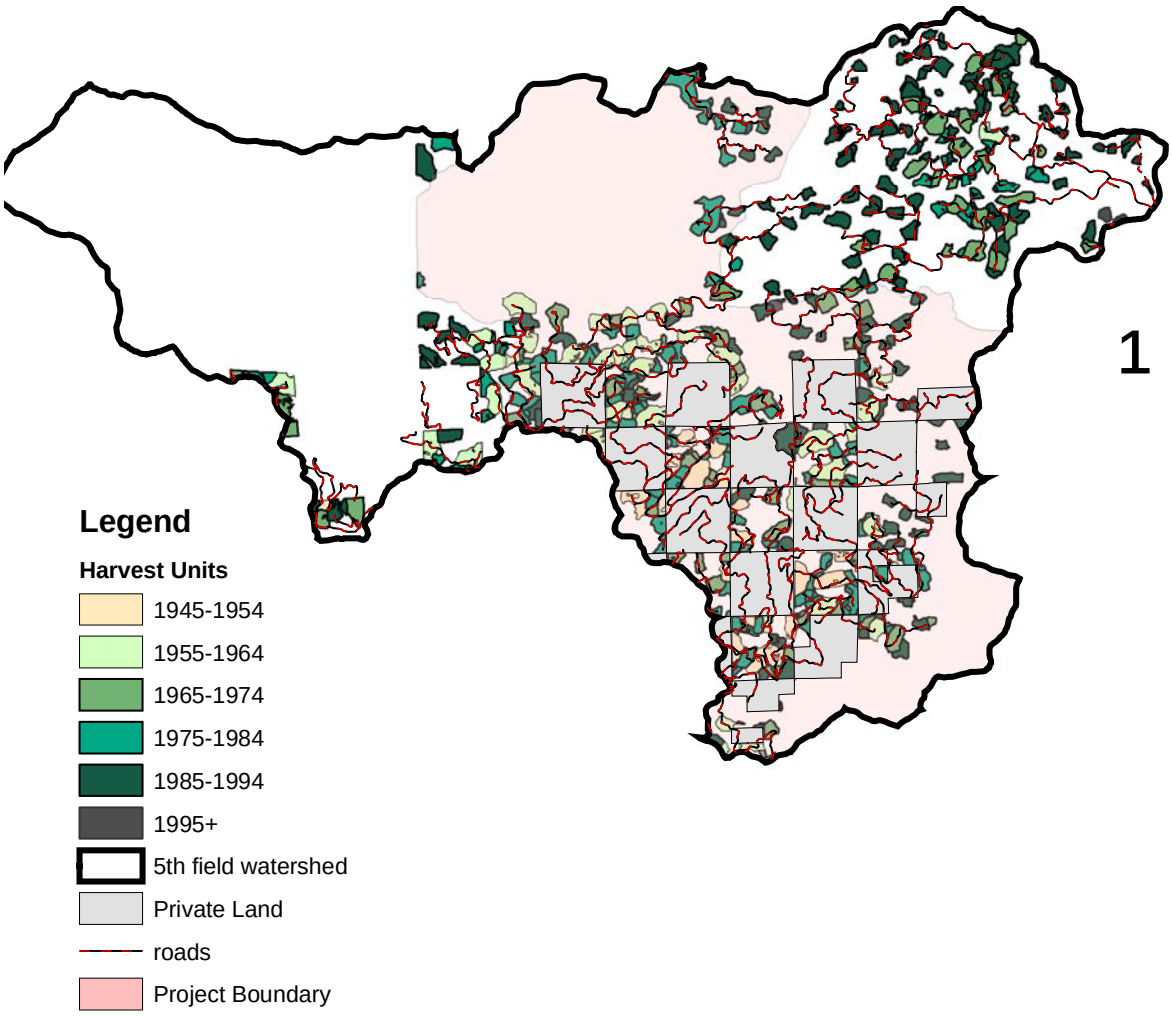


Figure 13 - Map of Harvest by Decade and Road Construction in the Middle Santiam 5th field Watershed

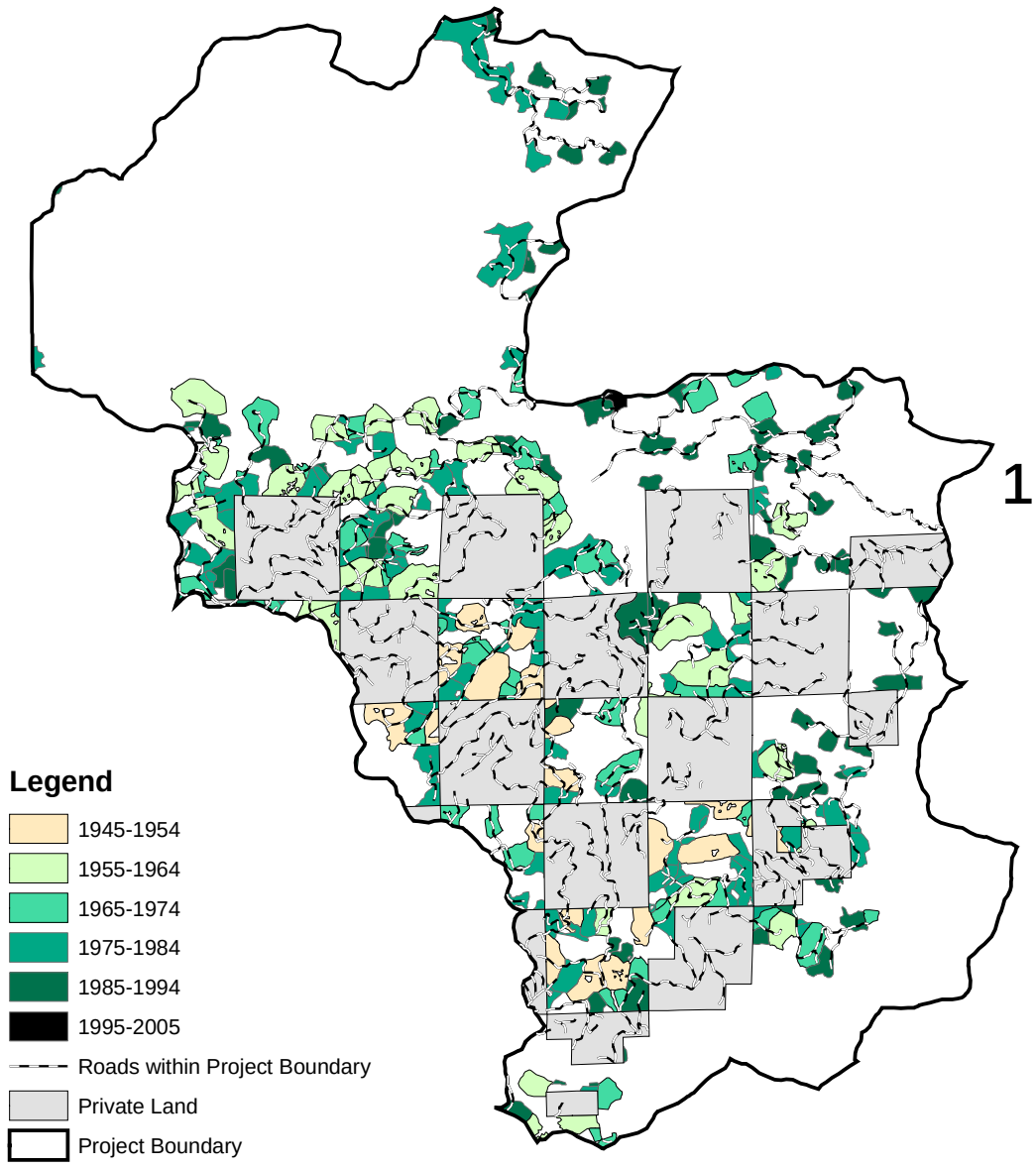


Figure 14 - Map of decadal harvest and road construction in analysis area

Present Actions

The Middle Santiam Thin timber sale would thin about 1549 acres of young, managed stands in this watershed in the next four to five years.

Reasonably Foreseeable Future Actions

In the foreseeable future, the Sweet Home Ranger District is planning pre-commercial thinning of managed stands in this subwatershed. No additional commercial harvest is planned on public lands here in the foreseeable future but would more than likely occur on private lands.

About 460 acres of young managed stands on public lands in the subwatershed are prime candidates for pre-commercial thinning (PCT) in the foreseeable future. PCT operations reduce stand densities to approximately 200-250 trees per acre. This work does not require new road construction or reconstruction to complete. Current appropriated budgets have only been able to accomplish 10% of PCT thinning needs. Funding from commercial thinning sales could accomplish another 10% of available acres over the next 10 years.

On slightly over 7,400 acres of private land in this planning area and 14,800 acres in the 5th field watershed, some commercial thinning and regeneration harvest would likely occur in the foreseeable future. All private land harvest would occur in managed stands. How much private harvest would occur is difficult to estimate, but given the landowner's even-flow harvest strategy, harvest could affect 12-15% of private lands in this subwatershed in the next decade.

Regeneration harvesting would likely be more common than commercial thinning on these private lands. Thinning by the landowner has so far been limited to gentle terrain near roads that can be completed with ground-based equipment. Prescriptions have been conservative by thinning from below and retaining 60-70% canopy closure or about 90 -130 trees per acre. In contrast to public lands, very little pre-commercial thinning occurs on these private lands.

Private land harvest would also rely heavily on the existing road system, requiring very little new road construction. The private landowners in this subwatershed routinely close (berms or gates) short local spurs when they are not needed for harvest activities.

Commercial harvest operations on both public and private lands can be expected to create fuel reduction activities, such as slash burning. Most slash reduction would occur as pile burning, though broadcast burning could occur on steeper private land after regeneration harvest. Slash piles are created with tractor or manual labor.

It is also likely that windthrown trees from natural and managed stands would be salvaged in the next 10 years. Such salvage would likely be confined to existing road prisms, unless a sizable stand area (over 5 acres) is substantially affected (half of the trees).

For further information about cumulative effects, refer to environmental effects in the following pages, individual specialist reports in Appendices D though M, and cumulative effects information in Appendix N.

Terrestrial Wildlife

A. Coarse Woody Debris

Introduction and Analysis Methods

Coarse woody debris and snag retention play a significant role in influencing ecosystem functionality and productivity. This significance is addressed in the Forest Plan and elsewhere (Brown et al. 2003). Management Standards and Guidelines in the Northwest Forest Plan further emphasize the significance of this relationship. American marten, Pacific fisher and Oregon slender salamander rely on coarse woody debris, specifically. Cavity-nesting birds and bats rely on snags for roost and nesting sites.

For the Willamette National Forest, the Forest Plan requires that 240 linear feet of down wood per acre be retained in a harvest area. Logs must be 20" or larger in DBH (diameter at breast height) and at least 20 feet in length. Decay class 1 and 2 logs may be counted in these totals. Snag habitat, under the Forest Plan, shall be retained within a harvest unit at levels sufficient to support species of cavity-nesting birds at 40% of the potential population (2.1 snags per acre in decay classes 1, 2 & 3 greater than 20 feet tall with a DBH of 18" or greater).

Current science suggests that other approaches should be considered when identifying appropriate levels of down wood and snag abundance in addition to the potential population approach as directed by the Forest Plan. One recommended approach is to use DecAID, a repository of information devoted to identifying appropriate levels of down wood and snags in selected habitat types. DecAID is "the decayed wood advisor for managing snags, partially dead trees and down wood for biodiversity in forests of Washington and Oregon" (Mellen et al. 2006). DecAID is based on a synthesis and integration of published scientific literature, research data, wildlife databases, forest inventory databases and expert judgment (Mellen et al. 2006). Although DecAID is known as the best available science, it also has limitations. It should be noted that DecAID is a tool that can help managers evaluate the effects of forest conditions. It is intended to evaluate across a landscape scale, not to evaluate site specific areas. DecAID also highly recommends that an analysis area should be at least 20 square miles or roughly 12,800 acres in size. The Middle Santiam Thin Planning Area is approximately 34,670 acres and meets the criteria when using DecAID to evaluate snag and down wood levels. Proposed acres to be treated in the Middle Santiam Thin are approximately 1,549 in Alternative 2 and 1,412 in Alternative 3 and comprise about 4.1-4.5 % of the Planning Area. The Westside Lowland Conifer-Hardwood Forest Habitat Type was chosen, with a Small/Medium Tree Vegetation Condition in the DecAID Repository and all stands within the Middle Santiam Planning area fall into this habitat type.

DecAID provides information on snag and down wood in three tolerance levels, 30%, 50% and 80%. The 30% tolerance level is typically used when considering landscapes that have exhibited extensive harvest activity. The 50% tolerance level is typically used when considering matrix allocations and 80% is typically used when considering late-successional reserves. These considerations are general guidelines and it is the responsibility of the biologist to interpret and use information from DecAID to best fit the needs of the area being examined. DecAID can provide

information that can supplement current Forest Plan Standards and Guidelines. At the 50% tolerance level, DecAID recommends retaining a snag density range of 10-18 snags per acre ≥ 10" DBH and 1-8 snags per acre ≥ 20" DBH. Data from DecAID shows that down wood cover used by wildlife at the 50% tolerance level ranges from 3-10% cover. DecAID also showed that at or above the 50% tolerance level, a vast majority of wildlife species were associated with percent cover (Mellen et al. 2003).

Pre-field exams were conducted in the project area to assess habitat potential. Pre-field exams involved a walk-thru and information was documented on down wood, snag abundance and habitat requirements of wildlife species. Data information from GIS applications was also used to evaluate current snag and down wood levels.

Current Conditions – Coarse Woody Debris

The Middle Santiam Planning Area is primarily early to mid-successional habitat (seral type 2 & 3) with the northern portion that includes the Middle Santiam Wilderness Area characterized as late-seral (seral type 4) habitat. For proposed units in the Middle Santiam Planning Area, vegetation condition can be characterized as one age class, with stands averaging 30-60 years old. Tree class size range from 9 to 13 inches in diameter and dominate tree species are Douglas fir and Western hemlock. Timber harvest has occurred extensively in the planning area except for lands designated as Wilderness or in the Special Interest Area. Previous harvest activity has created dense canopy closure and low diameter growth among tree species. Private inholdings are numerous in the Middle Santiam Planning Area and also exhibit an extensive harvest history. Few snags or down wood were retained in past harvest units. Broadcast slash burning in these units often destroyed any habitat structure that was left. Snag and down wood retention levels are very low and can be categorized in the 30% tolerance range by DecAID standards.

Desired Future Conditions - Coarse Woody Debris

Past management activities in the Middle Santiam Planning Area have resulted in overstocked second growth stands that are exhibiting increased mortality due to lack of nutrients and sunlight. This single story structure has also led to poor habitat conditions for many wildlife species. In a landscape that once exhibited diverse vegetative composition and heterogeneity, the need for down wood, snag and understory structure is crucial for species persistence.

Desired future conditions for this area should strive to meet Forest Standard and Guidelines at a minimum. Further effort should be taken with the consideration of the best available science and recommendations from DecAID. As forest conditions become more complex and diversified, so would wildlife species composition. Creating and retaining decayed wood elements along with the thinning of overstocked stands would in the long term provide a more diversified landscape for wildlife species. DecAID categorizes 3 tolerance levels to describe stand conditions. Goals to meet the 50% tolerance level would be appropriate for this area since it is currently below or at the 30% tolerance level. At the 50% tolerance level, DecAID recommends retaining a snag density range of 10-18 snags per acre ≥ 10" DBH and 1-8 snags per acre ≥ 20" DBH. Data from DecAID

shows that down wood cover used by wildlife at the 50% tolerance level ranges from 3-10% cover. DecAID also showed that at or above the 50% tolerance level, a vast majority of wildlife species were associated with percent cover (Mellen et al 2003). Since this area exhibits young trees 9-13" DBH on average, achieving the density range of 10-18 snags per acre ≥ 10" DBH and 1-8 snags per acre ≥ 20" DBH is not possible in a single entry due to the overstocking of small diameter trees. Several attempts would be needed to achieve vegetative diversity at this level.

Overall, the goal of this area should reflect a change in management that produces a more heterogeneous forest structure. Developing variability in forest structure is crucial to maintaining wildlife populations and reducing the threat of fire. Using DecAID as a guideline to create and maintain down woody debris along with Forest Standards and Guidelines can improve diversity and forest health in the long term. Consequently, limitations are present due to stand age, tree diameter and down wood components. These limitations would require attention to variable density thinning, possible future entries and time to achieve a more complex, multi-story heterogeneous stand structure along the landscape.

Direct and Indirect Effects - Coarse Woody Debris

Alternative 1- No Action

This alternative would not modify or disturb snag or down wood levels within the proposed units. Down wood in decay classes 1 and 2 is limited within all proposed harvest units. Natural processes over time would eventually increase both snag and down wood densities. Under Alternative 1, all conditions of the Middle Santiam Planning Area would remain the same without any management activities or modifications.

Alternative 2 & 3

Alternative 2 and 3 would involve light to moderate thinning in the Middle Santiam Planning Area and would briefly degrade habitat by reducing the canopy closure in treated areas to 50-60%. Retaining remnant old-growth trees (trees over 30 inches DBH, if present and are not considered hazardous or a safety issue) current snags and down wood and creating additional snags and down wood where needed would improve habitat for coarse woody debris dependent species and cavity excavators as the canopy increases. It is estimated that in about 10 years, the tree growth as a result of thinning would increase tree diameter, height and canopy closure. This would result in improved habitat over current conditions. Design criteria/mitigation measures to increase snag and down wood levels would be employed as required by current Standards and Guidelines and recommendations from DecAID where applicable. Currently, recommendations from DecAID to meet the 50% tolerance level cannot be obtained in proposed units due to overstocking of small diameter trees. Future entries would be needed to achieve such levels. Snag and down wood levels as required by the Forest Plan Standards and Guidelines could be achieved in proposed units of Middle Santiam Thin. Alternative 2 would leave at least 5 trees per acre or 7,745 trees in treated units across the landscape. Alternative 3 would leave at least 5 trees per acre or 7,060 trees in treated units across the landscape.

Therefore, Alternative 2 or 3 may impact individuals or their habitat, but the action would not likely contribute to a trend towards federal listing or loss of viability to a population or species. Both Alternatives would benefit all species habitat in the foreseeable future due to increased down wood and snag conditions.

Cumulative Effects- Coarse Woody Debris

The area analyzed for cumulative effects was the Middle Santiam Planning Area and proposed harvest units. Past timber harvest, road construction, fire suppression and road maintenance activities have contributed to cumulative effects of this area. Timber harvest, road building and natural disturbances have all impacted the amount of snags and down wood habitat within the Middle Santiam Planning Area. Currently, the proposed units in the Middle Santiam Planning Area show low down wood and snag levels. Past timber harvest and road building have reduced snag and down wood habitat while natural disturbances typically have increased snag and down wood levels. Current harvest prescriptions designed for these alternatives may initially reduce canopy closure; however over time, thinning treatments would promote forest vigor and health. Proposed actions would also create more down wood and snags within the project area through design criteria efforts to meet desired future conditions, Forest Plan Standards and Guidelines and recommendations from DecAID where applicable. Alternative 2 would leave at least 5 trees per acre or 7,745 trees in treated units across the landscape. Alternative 3 would leave at least 5 trees per acre or 7,060 trees in treated units across the landscape. In the reasonable foreseeable future, there are no additional habitat altering projects identified at this time within the Middle Santiam Planning Area.

Consistency with Direction and Regulations- Coarse Woody Debris

Treatment of snag and down wood habitat is consistent with direction and regulations outlined in the Regulatory Framework, Management Direction and Guidance section outlined in Appendix O.

B. Threatened and Endangered Species

Introduction– Threatened and Endangered Species

This project is consistent with current standards established for projects that would specifically affect the northern spotted owl and associated habitat. The standards were established for the Willamette Province by the Level 1 Consultation Team and are listed in the Batched Biological Assessment (BA) (USDA et al. 2006) that addresses spotted owl habitat modification projects proposed for implementation during FY/CY 2007 and 2008. The Middle Santiam Thin Project is among the projects identified in the BA, which also considered new information from the 5-year species status review and other recent documents (USDI 2004a, Anthony et al. 2004, Courtney et al. 2004). The literature updates our knowledge related to northern spotted owl biology, ecology, range-wide population decline and connected issues such as climate change on regional vegetation patterns, sudden oak death syndrome, West Nile virus, wildfire, barred owls and timber harvest as presenting individual and cumulative threats to the species.

Effects not specifically discussed in this document pertain to issues that cannot be addressed at the project scale, but are further discussed and analyzed in the 2007 – 2008 Habitat Modification BA and BO which provide a thorough analysis of new information pertaining to potential threats to this species in the Willamette Province (USDA et al. 2006, USDI 2006). A Biological Evaluation was conducted for all terrestrial Threatened, Endangered and Sensitive (TES) animal species within the project area (Young 2007). For a complete discussion of these species, refer to the BE located in the Analysis File. The BE provides documentation of pre-field reviews, field reconnaissance surveys and complete list of TE&S species reviewed including those species that have been determined to lack habitat within the project area. The S&G (FW-156 and FW 157) of the Forest Plan as amended reiterates the legal requirements for the completion of Biological Evaluations to determine the possible effects of the proposed activities would have on Threatened, Endangered, or Sensitive species and the consultation requirements of the Endangered Species Act (ESA) (Public Law 93-205) if any of the species are found in the project area. The following table (Table 17) summarizes the list of terrestrial Threatened and Endangered species which may have habitat present within the project area, the results of the surveys, risk assessment, the effects determination for the Action Alternatives and consultation status.

Table 17 - Biological Evaluation process for Willamette Threatened and Endangered species associated with potential effects from the Action Alternatives.

SPECIES	STEP 1	STEP 2	STEP 3	STEP 4	STEP 5
	Pre-field Review	Field Recon	Risk Assessment	Analysis Significance	USFWS Review
	Habitat Present (B, R, F, D)*	Occupancy Status	Conflicts with Action Alternatives	Effects or Impacts from Action Alternatives	Consultation
Northern Spotted Owl *Strix occidentalis caurina* **THREATENED STATUS**	B, R, F, D	Occupied	No Potential Conflict	NLAA	July 2006
Northern Bald Eagle *Haliaeetus leucocephalus* **THREATENED STATUS**	B, R, F, D	Unoccupied	No Conflict	NE	N/A

* *B = Breeding (nesting/denning) habitat* *R = roosting/cover habitat*
F = Foraging habitat *D = dispersal habitat*
N/A = Not Applicable
NE = No Effect
NLAA = Not Likely to Adversely Affect

2. Northern Spotted Owls – *Strix occidentalis*

Analysis Methods - Northern Spotted Owl

Using GIS and VEGIS applications, aerial photography and field visits, suitable northern spotted owl habitat was determined in the analysis area. Proposed harvest units were reviewed on-the-ground to verify tree size, canopy closure and existing snags and down wood. Based on proximity to known nest sites, habitat impacts to northern spotted owls were analyzed.

Current Conditions – Northern Spotted Owl

The northern spotted owl is listed as a Threatened species and is also a Management Indicator Species (MIS). This species is typically associated with old-growth forested habitats throughout the Pacific Northwest. Past management activities, such as timber harvest, have reduced or fragmented northern spotted owl habitat throughout its range. As a result, overall population densities have decreased, specifically in areas where habitat reduction is concentrated (USDA 2006). Northern spotted owls have been documented in a variety of forest types, primarily Douglas-fir (USDA 2006). Nest sites and roost sties are typically found in forests that exhibit complex structure and heterogeneity. These habitats are multi-storied with large diameter trees (20 DBH and greater) and high canopy closures (greater than 60 percent). Most spotted owls are territorial and dispersal of young depends on availability of suitable habitat. There are ten known owl activity centers with suitable habitat present (Table 18) that are within the influence of the proposed action.

Suitable habitat for the northern spotted owl has three main components: nesting, roosting, and foraging (NRF) habitat. In general, suitable habitat is 80 years of age or older, multi-storied with canopy closures exceeding 60 percent and with sufficient large snags and down wood to provide opportunities for nesting, roosting, and foraging. Late-seral forest is superior habitat and preferred by spotted owls over other habitat conditions (Thomas et al. 1990).

Table 18 - Suitable Northern Owl Habitat in Activity Centers

Owl Pair Number	Total Acres within 1.2 mile radius of activity center	Required Minimum Acres of Suitable Habitat Needed within 1.2 mile radius of activity center	Actual Acres of Suitable Habitat within 1.2 mile radius of activity center	Percent of Area in Suitable Habitat in activity center
0016	2895	1182	1274.1	44.0%
0647	2895	1182	2603.6	89.9%
0653	2895	1182	1775.4	61.1%
0670	2895	1182	1257.2	43.4%
0696	2895	1182	2344.8	81.0%
2957	2895	1182	914.9	31.6%
2975	2895	1182	2023.5	70.0%
4092	2895	1182	1251.7	43.2%
4401	2895	1182	2347.3	81.0%
4462	2895	1182	1837.2	63.5%
10 activity centers			**Average = 2139.86**	**Average = 60.7%**

Dispersal habitat allows spotted owl movement across the landscape between stands of suitable habitat and for juveniles to disperse from natal territories. This habitat generally lacks the optimal characteristics to support nesting and typically lacks multi-storied canopies, large trees or large snags and down wood. Dispersal habitat generally consists of mid-seral stands between 40 and 80 years of age with canopy closures of 50% or greater and trees with a mean diameter of 11 inches or more (USDI 2005). Most managed or natural forest stands 35-40 years old begin to develop dispersal habitat conditions. All proposed units within the Middle Santiam Planning Area exhibit poor dispersal habitat conditions regardless of the land designation. Proposed units are 30-60 years old with previous harvest activity. This activity has produced a high overstocking of trees, dense pole tree conditions and low levels of coarse woody debris. Dispersal conditions are possible through this area and proposed units; however, the likelihood of owls using this area as functional dispersal habitat is low due to the poor quality of the area.

The Middle Santiam Project Area is 34,670 acres and is comprised of the following land allocations: 33% Matrix, 25% Wilderness, 6% Late-Successional Reserve, 1 % 100-acre Late-Successional Reserve, 5% Special Interest Area, and 30% other (see management allocations on page 14). Approximately 1,412 to 1,549 acres are proposed for commercial thinning in the action alternatives and are located in matrix stands that are classified as dispersal or unsuitable northern

spotted owl habitat. The Planning Area does occur within the Late-Successional Reserve (LSR) network designated by the Northwest Forest Plan; however, no proposed activities would take place in this land designation. Four of ten activity centers are located within the LSR designation. The remaining activity centers are located in AOC and CHU habitat.

AOC- The Willamette National Forest has identified an Area of Concern (AOC) that encompasses portions of the Sweet Home, Detroit, and McKenzie River Ranger Districts. The land allocation is matrix and is unable to fully facilitate dispersal requirements of northern spotted owls (USDA 2006). This area has been considered to be a potential biological bottleneck area where dispersal to the north/south and east/west is difficult due to the lack of primary constituent elements. Approximately 15,873 acres of AOC are present in the Middle Santiam Planning Area. Proposed acres to be treated are considered unsuitable habitat or serve as dispersal habitat in poor condition.

CHU- Critical Habitat Units (CHU) were intended to provide large blocks of suitable habitat along the landscape that would provide the necessary elements to maintain stable, viable and interconnected populations. The physical and biological features of critical habitat essential to a species conservation are identified as primary constituent elements (USDA 2006). These elements are features that support nesting, roosting, foraging and dispersal conditions. Old-growth forest habitat is typically the most suitable habitat to provide such conditions. Approximately 11,500 acres of CHU are present in the Middle Santiam Planning Area. The proposed acres do not currently function as nesting, roosting or foraging habitat (*suitable habitat*). In addition, these acres do not serve as functional dispersal habitat due to the overstocking of trees and crowding in the understory and can be further classified as poor in quality.

Desired Future Conditions – Northern Spotted Owl

Desired future conditions for the northern spotted owl should strive for a well distributed network of high quality habitat on a landscape scale. High quality habitat should include a multi-story stand structure with old growth quality and canopy closures of at least 60%. Snag and down wood components should also be present to provide habitat for nesting, roosting and prey availability. Forest conditions are not static; therefore, future management activities should involve the enhancement of single story stands that exhibit a lack of structural diversity.

Forest Plan Standards and Guidelines outline four major structural components of old growth Douglas fir forests, which is the preferred habitat of the northern spotted owl. These attributes include the following: live old growth trees, standing dead trees (snags), fallen trees or logs on the forest floor and logs in the streams (USDA 1994). In addition, canopy gaps and patchy understories are important elements in the composition of old growth forests.

AOC- Desired future conditions for this area should strive to maintain dispersal characteristics of at least 40% canopy closure and foraging potential in at least 50% of each quarter township with trees 11 inches DBH and greater. Dispersal conditions are crucial to maintaining connectivity between higher quality areas. This area is currently poor in quality due to past management practices on private and public allocations that have led to overstocking of trees, small diameter

trees, low down wood and snag levels, along with high canopy closures. Future activities should focus on managing for connectivity between varying habitat quality and improving the existing conditions of habitat areas in poor quality. In addition, goals should lean towards maintaining dispersal conditions at a minimum but also managing for more old growth conditions as time allows, promoting connectivity.

CHU- Desired future conditions for this area should strive to maintain habitat that provides opportunity for nesting, roosting and foraging, as defined in the habitat objectives of the Northwest Forest Plan (USDA 1994). Past management activities have created low quality Critical Habitat Units. Future goals should focus on reducing or avoiding adverse effects of current management activities and lean towards practices that develop characteristics of suitable northern spotted owl habitat. These conditions would include creating a multi-story canopy structure with a large down wood and snag component. In addition, stands should have minimal edge effect and canopy gaps should be created to provide habitat variability. Stands should be at least 80 years old with canopy closures exceeding 60% with large overstory trees and a well developed shrub layer.

Direct and Indirect Effects- Northern Spotted Owl

Northern spotted owls may be affected if habitat is modified within their median home range (1.2 mile radius around the nest tree) or activity center. Habitat modification may occur in three different ways: (1) habitat degradation which affects the quality of suitable or dispersal habitat without altering the functionality of such habitat, (2) habitat downgrading which alters the functionality of suitable habitat so that it no longer supports nesting, roosting, and foraging, and (3) habitat removal which alters suitable or dispersal habitat to such an extent that the habitat no longer supports nesting, roosting, foraging, or dispersal (See Table 3).

Direct effects are considered short-term (< 10 years) in this context and are generally considered to range from insignificant and discountable negative effects to no effect as described below applied to habitat modification and disturbance. Indirect effects are considered long-term (generally > 10 years) in this context and are considered to range from none to beneficial for this proposed project.

Direct Effects - Habitat Modification

Alternative 1- No Action

Habitat

- This alternative would not modify suitable, dispersal or other land designations related to northern spotted owl habitat. Under Alternative 1, all conditions of the Middle Santiam Planning Area would remain the same without any management activities or modifications.

This alternative would have **no effect** to northern spotted owls or associated habitat.

Alternative 2- helicopter logging system

Suitable Habitat

- Northern spotted owl suitable habitat would not be modified or affected by the proposed actions of Alternative 2. All proposed thinning activities would take place in dispersal or unsuitable habitat only.
- In addition, during road maintenance along haul route approximately 5 hazard trees in Matrix-riparian reserve may be removed.

Effects Determination: There would be **no effect** to northern spotted owl suitable habitat.

Dispersal Habitat

- Dispersal Habitat Degraded (Light-Moderate Thin): Dispersal habitat proposed for light to moderate thinning amounts to 958 acres and consists of 709 acres upland (74 percent) and 249 acres riparian reserve (26 percent) habitat. Current canopy closures are 95% and greater. Proposed thinning activities would reduce the canopy closure to 50% or greater.
- Dispersal Habitat Downgraded (Light-Moderate Thin): None
- Dispersal Habitat Removed (Heavy Thin): None
- In addition, during road maintenance along haul route approximately 5 hazard trees in Matrix-riparian reserve may be removed.

Effects Determination: The effects determination for modification of dispersal habitat is a **may affect**, but **not likely to adversely affect** spotted owls or dispersal habitat.

Unsuitable Habitat

- Unsuitable northern spotted owl habitat proposed for light to moderate thinning is 591 acres. Current canopy closures are 95% and greater. Proposed thinning activities would reduce the canopy closure to 50% or greater.
- In addition, during road maintenance along haul route approximately 5 hazard trees in Matrix-riparian reserve may be removed.

Effects Determination: There would be **no effect** to northern spotted owl habitat since such activities would take place in unsuitable habitat.

Alternative 3- no helicopter logging system

Suitable Habitat

- Northern spotted owl suitable habitat would not be modified or affected by the proposed actions of Alternative 3. All proposed thinning activities would take place in dispersal habitat only.
- In addition, during road maintenance along haul route approximately 5 hazard trees in Matrix-riparian reserve may be removed.

Effects Determination: There would be **no effect** to northern spotted owl suitable habitat.

Dispersal Habitat

- Dispersal Habitat Degraded (Light-Moderate Thin): Dispersal habitat proposed for light to moderate thinning amounts to 899 acres and consists of 665 acres upland (74 percent) and 234 acres riparian reserve (26 percent) habitat. Current canopy closures are 95% and greater. Proposed thinning activities would reduce the canopy closure to 50% or greater.
- Dispersal Habitat Downgraded (Light-Moderate Thin): None
- Dispersal Habitat Removed (Heavy Thin): None
- In addition, during road maintenance along haul route approximately 5 hazard trees in Matrix-riparian reserve may be removed.

Effects Determination: The effects determination for modification of dispersal habitat is a **may affect**, but **not likely to adversely affect** spotted owls or dispersal habitat.

Unsuitable Habitat

- Unsuitable northern spotted owl habitat proposed for light to moderate thinning is 513 acres. Current canopy closures are 95% and greater. Proposed thinning activities would reduce the canopy closure to 50% or greater.
- In addition, during road maintenance along haul route approximately 5 hazard trees in Matrix-riparian reserve may be removed.

Effects Determination: There would be **no effect** to northern spotted owl habitat since such activities would take place in unsuitable habitat.

Indirect Effects – Habitat Modification

Alternative 1-No Action

Indirect effects associated with the no action alternative are considered disadvantageous to improving existing conditions within the Middle Santiam Planning Area. The No Action Alternative would allow existing low levels of down wood and snags, dense canopies and overstocking of trees to persist. Overtime, this area could exhibit extensive tree mortality, decreased habitat quality and decreased wildlife population levels for certain species.

Alternative 2 & 3

Indirect effects associated with habitat modification activities are considered beneficial for spotted owls for the following reasons. Estimates of down wood size and distribution for the project area when compared to DecAID data (Mellen et al. 2006) reveal conditions are at the 30 percent tolerance level or below throughout the area. Data are limited but suggest that dispersal habitat throughout the project area could approach suitability as foraging habitat through thinning activities. Implementing the silvicultural prescription as proposed would result in accelerating the transition from dispersal to foraging habitat as released trees respond by increasing size and structural diversity and as additional levels of larger down wood continue to accumulate. Proposed habitat modifications from Alternative 2 would provide 1549 acres of improved habitat, while Alternative 3 would provide 1412 acres in dispersal and unsuitable habitat conditions. Based on the silvicultural prescription and growth response projections, dispersal capability in thinned stands across the project area should recover within approximately 10 years.

Table 19 - Affected Acres of Dispersal Habitat in Northern Spotted Owl Activity Centers

Owl Pair #	Acres of Dispersal Habitat Within 1.2 Miles of an Activity Center	Affected Acres of Dispersal Habitat Within 1.2 Miles of an Activity Center								
		Alternative One			Alternative Two			Alternative Three		
		Acres Removed	Acres Downgraded	Acres Degraded	Acres Removed	Acres Downgraded	Acres Degraded	Acres Removed	Acres Downgraded	Acres Degraded
0016	108.0	0	0	0	0	0	46.2 (42.8%)	0	0	25.0 (23.1%)
0647	5.8	0	0	0	0	0	0	0	0	0
0653	157.0	0	0	0	0	0	48.8 (31.1%)	0	0	42.7 (27.2%)
0670	77.8	0	0	0	0	0	0	0	0	0
0696	0	0	0	0	0	0	0	0	0	0
2957	277.9	0	0	0	0	0	110.8 (39.9%)	0	0	110.8 (39.9%)
2975	0	0	0	0	0	0	0	0	0	0
4092	494.1	0	0	0	0	0	63.2 (12.8%)	0	0	63.2 (12.8%)
4401	263.6	0	0	0	0	0	19.9 (7.5%)	0	0	19.9 (7.5%)
4462	8.7	0	0	0	0	0	0	0	0	0
Totals		**0**	**0**	**0**	**0**	**0**	**288.9**	**0**	**0**	**261.6**

Direct Effects - Critical Habitat Units (CHU)

Alternative 1- No Action

Habitat

- This alternative would not modify suitable or dispersal habitat in northern spotted owl Critical Habitat Units (CHU). Under Alternative 1, all conditions of the Middle Santiam Planning Area would remain the same without any management activities or modifications.

This alternative would have **no effect** to northern spotted owls or associated CHU habitat.

Alternative 2- helicopter logging system

CHU Suitable Habitat

- Northern spotted owl CHU suitable habitat would not be modified or affected by the proposed actions of Alternative 2. All proposed thinning activities would take place in CHU dispersal or unsuitable habitat only.

Effects Determination: There would be **no effect** to northern spotted owl CHU suitable habitat.

CHU Dispersal Habitat

- Dispersal Habitat Degraded (Light-Moderate Thin): CHU dispersal habitat proposed for light to moderate thinning amounts to 252 acres. OR-14 contains 219 proposed acres and OR-15 contains 33 proposed acres. Current canopy closures are 95% and greater. Proposed thinning activities would reduce the canopy closure to 50% or greater.
- Dispersal Habitat Downgraded (Light-Moderate Thin): None
- Dispersal Habitat Removed (Heavy Thin): None

Effects Determination: The effects determination for modification of dispersal habitat is a **may affect**, but **not likely to adversely affect** spotted owls or CHU dispersal habitat.

CHU Unsuitable Habitat

- Unsuitable northern spotted owl habitat proposed for light to moderate thinning is 335 acres in OR-14 only. Current canopy closures are 95% and greater. Proposed thinning activities would reduce the canopy closure to 50% or greater.
- In addition, during road maintenance along haul route approximately 5 hazard trees in Matrix-riparian reserve may be removed.

Effects Determination: There would be **no effect** to northern spotted owl habitat since such activities would take place in unsuitable habitat.

Alternative 3- no helicopter logging system

CHU Suitable Habitat

- Northern spotted owl CHU suitable habitat would not be modified or affected by the proposed actions of Alternative 3. All proposed thinning activities would take place in CHU dispersal or unsuitable habitat only.

Effects Determination: There would be **no effect** to northern spotted owl CHU suitable habitat.

CHU Dispersal Habitat

- Dispersal Habitat Degraded (Light-Moderate Thin): Dispersal habitat proposed for light to moderate thinning amounts to 213 acres. OR-14 contains 202 proposed acres and OR-15 contains 11 proposed acres. Current canopy closures are 95% and greater. Proposed thinning activities would reduce the canopy closure to 50% or greater.
- Dispersal Habitat Downgraded (Light-Moderate Thin): None
- Dispersal Habitat Removed (Heavy Thin): None

Effects Determination: The effects determination for modification of dispersal habitat is a **may affect**, but **not likely to adversely affect** spotted owls or CHU dispersal habitat.

CHU Unsuitable Habitat

- Unsuitable northern spotted owl habitat proposed for light to moderate thinning is 286 acres in OR-14 only. Current canopy closures are 95% and greater. Proposed thinning activities would reduce the canopy closure to 50% or greater.
- In addition, during road maintenance along haul route approximately 5 hazard trees in Matrix-riparian reserve may be removed.

Effects Determination: There would be **no effect** to northern spotted owl habitat since such activities would take place in unsuitable habitat.

Indirect Effects – Critical Habitat Units (CHU)

Alternative 1- No Action

Indirect effects associated with the no action alternative are considered disadvantageous to improving existing conditions within the Middle Santiam Planning Area. The No Action Alternative would allow existing low levels of down wood and snags, dense canopies and overstocking of trees to persist. Overtime, this area could exhibit extensive tree mortality, decreased habitat quality and decreased wildlife population levels for certain species.

Alternative 2 & 3

Indirect effects associated with habitat modification activities are considered beneficial for spotted owls for the following reasons. Estimates of down wood size and distribution for the project area when compared to DecAID data (Mellen et al. 2006) reveal conditions are at the 30 percent tolerance level or below throughout the area. Data are limited but suggest that dispersal habitat throughout the project area could approach suitability as foraging habitat through thinning activities. Implementing the silvicultural prescription as proposed would result in accelerating the

transition from dispersal to foraging habitat as released trees respond by increasing size and structural diversity and as additional levels of larger down wood continue to accumulate. Proposed habitat modifications from Alternative 2 would provide 1549 acres of improved habitat, while Alternative 3 would provide 1412 acres in dispersal and unsuitable habitat conditions. Based on the silvicultural prescription and growth response projections, dispersal capability in thinned stands across the project area should recover within approximately 10 years.

Direct Effects - Area of Concern (AOC)

Alternative 1- No Action

Habitat

- This alternative would not modify suitable or dispersal habitat in northern spotted owl Area of Concern (AOC). Under Alternative 1, all conditions of the Middle Santiam Planning Area would remain the same without any management activities or modifications.

This alternative would have **no effect** to northern spotted owls or associated AOC habitat.

Alternative 2- helicopter logging system

AOC Suitable Habitat

- Northern spotted owl AOC suitable habitat would not be modified or affected by the proposed actions of Alternative 2. All proposed thinning activities would take place in AOC dispersal or unsuitable habitat only.

Effects Determination: There would be **no effect** to northern spotted owl AOC suitable habitat.

AOC Dispersal Habitat

- Dispersal Habitat Degraded (Light-Moderate Thin): AOC dispersal habitat proposed for light to moderate thinning amounts to 777 acres. Current canopy closures are 95% or greater. Proposed thinning activities would reduce the canopy closure to 50% or greater.
- Dispersal Habitat Downgraded (Light-Moderate Thin): None
- Dispersal Habitat Removed (Heavy Thin): None

Effects Determination: The effects determination for modification of dispersal habitat is a **may affect**, but **not likely to adversely affect** spotted owls or AOC dispersal habitat.

AOC Unsuitable Habitat

- AOC unsuitable northern spotted owl habitat proposed for light to moderate thinning is 287 acres. Current canopy closures are 95% and greater. Proposed thinning activities would reduce the canopy closure to 50% or greater.
- In addition, during road maintenance along haul route approximately 5 hazard trees in Matrix-riparian reserve may be removed.

Effects Determination: There would be **no effect** to northern spotted owl habitat since such activities would take place in unsuitable habitat.

Alternative 3- no helicopter logging system

AOC Suitable Habitat

- Northern spotted owl AOC suitable habitat would not be modified or affected by the proposed actions of Alternative 3. All proposed thinning activities would take place in AOC dispersal or unsuitable habitat only.
- In addition, during road maintenance along haul route approximately 5 hazard trees in Matrix-riparian reserve may be removed.

Effects Determination: There would be **no effect** to northern spotted owl AOC suitable habitat.

AOC Dispersal Habitat

- Dispersal Habitat Degraded (Light-Moderate Thin): Dispersal habitat proposed for light to moderate thinning amounts to 738 acres. Current canopy closures are 95% or greater. Proposed thinning activities would reduce the canopy closure to 50% or greater.
- Dispersal Habitat Downgraded (Light-Moderate Thin): None
- Dispersal Habitat Removed (Heavy Thin): None

Effects Determination: The effects determination for modification of dispersal habitat is a **may affect**, but **not likely to adversely affect** spotted owls or AOC dispersal habitat.

AOC Unsuitable Habitat

- AOC unsuitable northern spotted owl habitat proposed for light to moderate thinning is 261 acres. Current canopy closures are 95% and greater. Proposed thinning activities would reduce the canopy closure to 50% or greater.
- In addition, during road maintenance along haul route approximately 5 hazard trees in Matrix-riparian reserve may be removed.

Effects Determination: There would be **no effect** to northern spotted owl habitat since such activities would take place in unsuitable habitat.

Indirect Effects – Area of Concern (AOC)

Alternative 1- No Action

Indirect effects associated with the no action alternative are considered disadvantageous to improving existing conditions within the Middle Santiam Planning Area. The No Action Alternative would allow existing low levels of down wood and snags, dense canopies and overstocking of trees to persist. Overtime, this area could exhibit extensive tree mortality, decreased habitat quality and decreased wildlife population levels for certain species.

Alternative 2 & 3

Indirect effects associated with habitat modification activities are considered beneficial for spotted owls for the following reasons. Estimates of down wood size and distribution for the project area when compared to DecAID data (Mellen et al. 2006) reveal conditions are at the 30 percent tolerance level throughout the area. Data are limited but suggest that dispersal habitat throughout the project area could approach suitability as foraging habitat through thinning activities. Implementing the silvicultural prescription as proposed would result in accelerating the transition from dispersal to foraging habitat as released trees respond by increasing size and structural diversity and as additional levels of larger down wood continue to accumulate. Proposed habitat modifications from Alternative 2 would provide 1549 acres of improved habitat, while Alternative 3 would provide 1412 acres in dispersal and unsuitable habitat conditions. Based on the silvicultural prescription and growth response projections, dispersal capability in thinned stands across the project area should recover within approximately 10 years.

Disturbance

The northern spotted owl breeding season generally extends from March 1 to September 30 with the period between March 1 and July 15 considered critical from a disturbance perspective. Activities that generate noise above ambient levels have the potential to disturb nesting spotted owls and may result in the incidental take of young and adult birds. Disturbance can occur from any activity producing above-ambient noise within 0.25 mile (1.0 mile for blasting and 0.5 mile for aircraft) of owl nests during the nesting season. The Biological Opinion received (USDI 2006) allows timber harvest activities to occur after July 15 (or later if deemed necessary by an agency wildlife biologist) 0.25 miles (or further) from activity centers or unsurveyed suitable habitat. Proposed units located within 0.25 miles of known spotted owl activity centers or unsurveyed suitable nesting habitat would be delayed until July 15 or later to minimize disturbance to nesting spotted owls. Projects that occur between July 15 and September 30 and are within 0.25 miles of known spotted owl activity centers or unsurveyed suitable nesting habitat **may affect** (but are) **not likely to adversely affect** spotted owls. Disturbance from proposed actions conducted outside of the breeding period (October 1-February 28) within 0.25 miles from a known activity center or unsurveyed suitable habitat during any time of year or in surveyed unoccupied habitat during any time of the year would have **no effect** on northern spotted owls.

Direct Effects - Disturbance

Alternative 1- No Action

This alternative would not disturb any activity centers or unsurveyed suitable habitat for northern spotted owls in the Middle Santiam Planning Area. Under Alternative 1, all conditions of the Middle Santiam Planning Area would remain the same without any management activities or modifications.

This alternative would have **no effect** to disturbance associated with northern spotted owls.

Alternatives 2 and 3

Direct effects associated with project activities that may result in disturbance to spotted owls are considered as short-term and summarized as follows:

- Any activity proposed in the Middle Santiam Project resulting in disturbance between October 1 and February 28, or conducted beyond disturbance distances described in the Provincial BA (USDA et al. 2006), would have **no effect** on spotted owls.
- Disturbance activities such as use of chainsaws, heavy equipment and hauling associated with proposed thinning activities are considered to **may affect**, but are **not likely to adversely affect (MA-NLAA)** northern spotted owls if conducted from July 16 – September 30 within the disturbance distances described in the Provincial BA (USDA et al. 2006). No proposed units are within a 0.25 mile buffer of known activity centers. Proposed units do occur within 0.25 miles of unsurveyed suitable habitat. Helicopter yarding proposed under Alternative 2 would also result in a MA-NLAA situation during

this timeframe as long as the activity involved a Type I KMAX or any Type II-IV helicopter.

- No disturbance activities would be conducted between March 1 and July 15 within the distances described in the Provincial BA (USDA et al. 2006) for the Middle Santiam Thinning Project. Prescribed under burning is not proposed in any area of the Middle Santiam Thinning Project as well. As a result, there would be **no effect** to northern spotted owls concerning disturbance activities or prescribed under burning.

Indirect Effects - Disturbance

Alternative 1- No Action

This alternative would not disturb any activity centers or unsurveyed suitable habitat for northern spotted owls in the Middle Santiam Planning Area. Under Alternative 1, all conditions of the Middle Santiam Planning Area would remain the same without any management activities or modifications.

Alternatives 2 and 3

Indirect effects to northern spotted owls from disturbance associated with the Middle Santiam Thinning Project may occur as a result of design criteria measures to improve habitat conditions and resource opportunity projects. Design criteria measures such as soil tillage, snag and down wood creation and other projects such as firewood cutting and stream enhancement could result in disturbance if conducted within the defined disturbance distance during the spotted owl breeding season (USDA et al. 2006). Related activities would not be conducted within the defined disruption distance during the breeding season.

Cumulative Effects- Northern Spotted Owl

New information from the 5-year species status review has updated our current knowledge of the northern spotted owl and the effects of climate change on range-wide population decline, regional vegetation patterns, sudden oak death syndrome, West Nile virus and barred owls as presenting individual and cumulative threats to the species (USDI 2004a, Anthony et al. 2004, Courtney et al. 2004).

Continued habitat loss due to timber harvest, especially on Federal lands, has declined relative to expectations in 1990 (Courtney et al. 2004). Nonetheless, past habitat loss is a current threat when compiled with current management activities. Fragmentation of old-growth and mature habitat has contributed to poor demographic performance in certain parts of this species range. This fragmentation has also allowed edge effects to become more prevalent, and as a result, predation by great horned owls has increased. Barred owls have also benefited from fragmentation and there is raised concern about potential hybridization between barred owls and northern spotted owls. Hybridization levels may increase if northern spotted owl population levels decrease significantly (Courtney et al. 2004).

Connected issues such as climate change on regional vegetation patterns, sudden oak death syndrome and West Nile virus have also added to cumulative threats of the species (Courtney et al. 2004). With the onset of global warming, new problems arise with the potential effects to vegetation patterns. In addition, sudden oak death presents a possible future threat to northern spotted owl habitat because of its potential impact on forest tree dynamics and alteration of key habitat components, most specifically in the southern most portion of its range (Courtney et al. 2004). West Nile virus has also become an issue of concern as it has spread quite rapidly though the United States in recent years. The virus is now within the range of the northern spotted owl, although no known cases of infection are known at this time (Courtney et al. 2004).

Other factors such as fire, wind and volcanic activity have also been issues of concern and serve as potential sources of habitat loss. With the buildup of fuels in some areas of the Cascades, there is a potential for catastrophic fire events. Recent fire events such as the 2003 Biscuit Fire in southwest Oregon produced a 2.3 percent of northern spotted owl habitat loss (SEI 2004). Wind throw and volcanic activity were considered issues by the 5-year review species status review; however, such issues were insignificant in comparison to threats of wildland fires (Courtney 2004).

The area analyzed for cumulative effects was the Middle Santiam Planning Area and proposed harvest units. Past timber harvest, road construction, fire suppression and road maintenance activities have contributed to cumulative effects. Timber harvest, road building and natural disturbances have all impacted the amount of snags and down wood habitat within the Middle Santiam Planning Area. Past timber harvest and road building have reduced snag and down wood habitat while natural disturbances typically have increased snag and down wood levels. Current harvest prescriptions designed for these alternatives may initially reduce canopy closure; however over time, thinning treatments would promote forest vigor and health. Proposed actions would also create more down wood and snags within the project area through design criteria efforts to meet desired future conditions, Forest Plan Standards and Guidelines and recommendations from DecAID where applicable. In the reasonable foreseeable future, there are no additional habitat altering projects identified at this time within the Middle Santiam Planning Area.

Conclusion-Direct, Indirect and Cumulative Effects to Northern Spotted Owl and Associated Habitat

Past management activities, such as timber harvest, have reduced or fragmented northern spotted owl habitat throughout its range. As a result, overall population densities have decreased, specifically in areas where habitat reduction is concentrated (USDA 2006). The Middle Santiam Project Area has been identified as having an overstocking of young successional stands with poor habitat conditions in relation to the northern spotted owl. Proposed thinning activities are predicted to improve the area on a landscape level. No suitable habitat would be modified through proposed activities and those activities would instead focus on dispersal habitat in poor condition.

In conclusion, there would be **no effect** to northern spotted owl suitable habitat in any land designation, including the Area of Concern, Critical Habitat Units or Activity Centers. Modification of dispersal habitat in the Area of Concern, Critical Habitat Units or Activity Centers

in proposed thinning activities of the Middle Santiam Planning Area **may affect**, but are **not likely to adversely affect** northern spotted owls or dispersal habitat. Thinning activities would improve existing conditions and provide an opportunity for the landscape to shift towards more suitable foraging and dispersal habitat for northern spotted owls.

Consistency with Direction and Regulations – Northern Spotted Owl

This project is consistent with current standards established for projects that would specifically affect the northern spotted owl and its habitat. These standards were established for the Willamette Province by the Level 1 Consultation Team and are listed in the Batched Biological Assessment (BA) (USDA et al. 2006). This project also incorporates new information from the 5-year species status review and other recent documents (USDI 2004a, Anthony et al. 2004, Courtney et al. 2004). Knowledge of spotted owl biology, ecology and connected issues such as climate change on regional vegetation patterns, sudden oak death syndrome, West Nile Virus and barred owls were incorporated as presenting individual and cumulative threats to the species.

2. Northern Bald Eagle (*Haliaeetus leucocephalus*)

The northern bald eagle is listed as a Threatened species and is also listed as a Management Indicator Species (MIS). Northern bald eagles do not occur in the analysis area and would not be impacted by proposed project activities. Therefore, the proposed activity would have no effect on northern bald eagles.

Consistency with Direction and Regulations – Threatened and Endangered Species

This project is consistent with current standards established for projects that would specifically affect the northern bald eagle and its habitat. These standards were established for the Willamette Province by the Level 1 Consultation Team and are listed in the Batched Biological Assessment (BA) (USDA et al. 2006). The activities associated with this project are consistent with direction and regulations outlined in the Regulatory Framework, Management Direction and Guidance section outlined in Appendix O.

C. Sensitive Wildlife Species

Introduction and Analysis Methods – Sensitive Species

Twenty-one sensitive wildlife species in the R6 FS Sensitive program were evaluated to determine if individuals or habitat would be impacted by the Middle Santiam Planning Area activities (Table 4). Those with habitat and/or documented species presence are evaluated below. Analysis methods included field reconnaissance, habitat determination based on historic data and the use of current data and GIS applications.

Table 20 - Sensitive Wildlife Species on the Willamette Forest

Species	Suitable Habitat Present in Middle Santiam Planning Area?	Species Documented in Middle Santiam Planning Area?
Amphibians		
Cascade Torrent Salamander	Yes	No
Foothill Yellow-legged Frog	No	No
Oregon Slender Salamander	Yes	No
Oregon Spotted Frog	No	No
Birds		
American Peregrine Falcon	Yes	No
Black Swift	No	No
Bufflehead	Yes	No
Harlequin Duck	Yes	No
Northern Bald Eagle (Federally listed as Threatened)	No	No
Northern Spotted Owl (Federally listed as Threatened)	Yes	Yes
Tricolored Blackbird	No	No
Yellow Rail	Yes	No
Invertebrates		
Mardon Skipper	Yes	No
Mammals		
Baird's Shrew	Yes	No
California Wolverine	Yes	No
Pacific Fisher	Yes	No
Pacific Fringe-tailed Bat	No	No
Pacific Pallid Bat	No	No

Species	Suitable Habitat Present in Middle Santiam Planning Area?	Species Documented in Middle Santiam Planning Area?
Pacific Shrew	Yes	No
Mollusks		
Crater Lake Tightcoil (also a Survey and Manage species)	Yes	Suspected
Reptiles		
Northwestern Pond Turtle	No	No

Current Conditions- Sensitive Species

1. **Oregon Slender Salamander (*Batrachoseps wrighti*)-** The Oregon slender salamander is most commonly found among the down wood of mature and second growth Douglas fir forests (Csuti et al. 1997). Individuals may live in partially decayed wood and under bark. This species is typically absent from recent clear cuts, but is sometimes found in talus areas where moisture pockets exist (Csuti et al. 1997). No known records exist for this species in the Middle Santiam Planning Area; however, habitat does exist.

2. **Cascade Torrent Salamander (*Rhyacotriton cascadae*)-** The cascade torrent salamander is most commonly found in cold, clear springs, seeps and cold rocky stream beds where perennial water is present. This species tends to remain within the spray zones of waterfalls and splash zones of streams (Csuti et al. 1997). Such microhabitats tend to occur in conifer forests. No known records exist for this species in the Middle Santiam Planning Area; however, habitat does exist.

3. **American Peregrine Falcon (*Falcon peregrinus anatum*)-** The American peregrine falcon inhabits cliffs and rocky outcrops that tend to overlook fairly open areas with ample food supply (Csuti et al. 1997). This species may forage in a variety of forest types. Numerous potential and occupied habitat sites exist on the Forest. No known records or nest sites exist for this species in the Middle Santiam Planning Area on Forest Service ownership lands; however, habitat does exist. One sighting was made in 2006 on private land; however, the source is unreliable and cannot be confirmed.

4. **Bufflehead (*Bucephala albeola*)-** Bufflehead ducks tends to summer on wooded lakes and rivers in the Cascade Range or other mountain lake areas (Csuti et al. 1997, Gilligan et al. 1994). No known records or nest sites exist for this species in the Middle Santiam Planning Area; however, habitat does exist.

5. **Harlequin Duck (*Histrionicus histrionicus*) -** The harlequin duck is most commonly found in fast flowing rivers and streams with rocky boulders and dense riparian vegetation present (Csuti

et al. 1997, Gilligan et al. 1994). Summer months are spent inland, while winter months are spent in coastal habitats. No known records or nest sites exist for this species in the Middle Santiam Planning Area; however, habitat does exist.

6. **Northern Spotted Owl (*Strix occidentalis*) -** Please see the Federally Threatened and Endangered section of this document for information.

7. **Yellow Rail (*Coturnicops noveboracensis*) -** The yellow rail tends to inhabit freshwater marshes and wet meadows with sedges and willow present in the vegetation composition (Csuti et al. 1997, Gilligan et al. 1994). Summers months are spent inland, while winter months are spent in grassland and coastal habitat. This species is very secretive and little is known of its habits in Oregon (Csuti et al. 1997). No known records or nest sites exist for this species in the Middle Santiam Planning Area; however, habitat does exist.

8. **Mardon Skipper (*Polites mardon*)–** The mardon skipper is a grassland dependent species with a severely disjunct range. Populations have been documented in Southern Washington, Southern Oregon and Northern California. This species tends to be found between 1800 and 5600 feet in the Washington portion of its range (Seitz et. al.2006). Although no known records exist for this species on the Forest or in the Middle Santiam Planning Area, habitat does exist.

9. **Baird's Shrew (*Sorex bairdii permiliensis*) -** Baird's shrew are generally found in moist coniferous forests with a down wood and decaying ground litter component (Csuti et al. 1997). This species also inhabits riparian areas and upland Douglas fir/Western hemlock forests and damp meadows. No known records exist for this species in the Middle Santiam Planning Area; however, habitat does exist.

10. **California Wolverine (*Gulo gulo*)-** The wolverine is typically found in high elevation areas in open forests and tends to avoid young dense forest habitat (Csuti et al. 1997). Wolverines are solitary mustelids and have very large home ranges. Dens are typically chosen in cave, rock crevices and hollowed log habitat (Csuti et al. 1997). No known records exist for this species in the Middle Santiam Planning Area; however, habitat does exist in small amounts. In addition, due to the large home range of this species and the proximity of the Planning Area to the Cascade crest, this species would be considered.

11. **Pacific Fisher (*Martes pennanti*)-** Fishers are found in a variety of densely forested habitats at low to mid-elevations (Verts et al. 1998). Tree cavities and other down wood are a key habitat component for this species (Csuti et al. 1997). No known records exist for this species in the Middle Santiam Planning Area; however, habitat does exist.

12. Pacific Shrew (*Sorex pacificus*)- Pacific shrews are generally found in moist coniferous forests with a down wood and decaying ground litter component (Csuti et al. 1997). This species also inhabits riparian areas and damp meadows. No known records exist for this species in the Middle Santiam Planning Area; however, habitat does exist.

13. Crater Lake Tightcoil (*Pristiloma arcticum crateris*) - Please see the Survey and Manage section of this document for further information regarding this species.

Direct and Indirect Effects- Sensitive Species

1. Oregon Slender Salamander (*Batrachoseps wrighti*)-

Alternative 1- No Action

This alternative would not modify down wood levels or associated habitat within the proposed units. Under Alternative 1, all conditions of the Middle Santiam Planning Area would remain the same without any management activities or modifications.

Alternative 2 & 3

Alternative 2 and 3 would involve light to moderate thinning in the Middle Santiam Planning Area and would briefly degrade habitat by reducing the canopy closure in treated areas to 50-60%. Retaining remnant old-growth trees (trees over 30 inches DBH, if present), current down wood and creating additional down wood where needed would improve habitat for the Oregon slender salamander over time. It is estimated that in about 10 years, the tree growth as a result of thinning would increase tree diameter, height and canopy closure. This would result in improved habitat and microclimate conditions. Design criteria measures to increase down wood levels would be employed as required by current Standards and Guidelines and recommendations from DecAID. Therefore, Alternative 2 or 3 may impact individuals or their habitat temporarily, but the action would not likely contribute to a trend towards federal listing or loss of viability to the population or species.

2. Cascade Torrent Salamander (*Rhyacotriton cascadae*)-

Alternative 1- No Action

This alternative would not modify any habitat within the proposed units. Under Alternative 1, all conditions of the Middle Santiam Planning Area would remain the same without any management activities or modifications.

Alternative 2 & 3

Alternative 2 and 3 would involve light to moderate thinning in the Middle Santiam Planning Area and would briefly degrade habitat by reducing the canopy closure in treated areas to 50-60%. All perennial and intermittent water sources in proposed units of the Middle Santiam Planning Area have protection buffers of at least 50 feet, which meet current Standards and Guidelines. This buffer is anticipated to keep existing canopy closures, thereby, causing

little to no impact to stream temperatures. Design criteria to ensure the persistence of the cascade torrent salamander would be employed as required by current Standards and Guidelines; therefore, Alternative 2 or 3 would have no impact to the cascade torrent salamander or associated habitat.

3. American Peregrine Falcon (*Falcon peregrinus anatum*)-

Alternative 1- No Action

This alternative would not modify any habitat within the proposed units. Under Alternative 1, all conditions of the Middle Santiam Planning Area would remain the same without any management activities or modifications.

Alternative 2 & 3

Alternative 2 and 3 would involve light to moderate thinning in the Middle Santiam Planning Area and would briefly degrade habitat. No known sites or designated management areas exist for the falcon in the Middle Santiam Planning Area. Design criteria measures to ensure the persistence of the American peregrine falcon would be employed as required by current Standards and Guidelines; therefore, Alternative 2 or 3 would have no impact to the American peregrine falcon or associated habitat.

4. Bufflehead (*Bucephala albeola*)-

Alternative 1- No Action

This alternative would not modify any habitat within the proposed units. Under Alternative 1, all conditions of the Middle Santiam Planning Area would remain the same without any management activities or modifications.

Alternative 2 & 3

Alternative 2 and 3 would involve light to moderate thinning in the Middle Santiam Planning Area and would briefly degrade habitat outside of proposed protection buffers. All perennial and intermittent water sources in proposed units of the Middle Santiam Planning Area have protection buffers of at least 50 feet, which meet current Standards and Guidelines. Design criteria measures to ensure the persistence of the bufflehead would be employed as required by current Standards and Guidelines; therefore, Alternative 2 or 3 would have no impact to bufflehead or associated habitat.

5. Harlequin Duck (*Histrionicus histrionicus*)-

Alternative 1- No Action

This alternative would not modify any stream or associated habitat within the proposed units. Under Alternative 1, all conditions of the Middle Santiam Planning Area would remain the same without any management activities or modifications.

Alternative 2 & 3

Alternative 2 and 3 would involve light to moderate thinning in the Middle Santiam Planning Area and would briefly degrade habitat outside of proposed protection buffers. All perennial and intermittent water sources in proposed units of the Middle Santiam Planning Area have protection buffers of at least 50 feet, which meet current Standards and Guidelines. Design criteria measures to ensure the persistence of the harlequin duck would be employed as required by current Standards and Guidelines; therefore, Alternative 2 or 3 would have no impact to harlequin ducks or associated habitat.

6. Northern Spotted Owl (*Strix occidentalis*)-

Please see the Federally Threatened and Endangered section of this document for further information.

7. Yellow Rail (*Coturnicops noveboracensis*)-

Alternative 1- No Action

This alternative would not modify any freshwater marshes or wet meadows within the Planning Area. Under Alternative 1, all conditions of the Middle Santiam Planning Area would remain the same without any management activities or modifications.

Alternative 2 & 3

Alternative 2 and 3 would involve light to moderate thinning in the Middle Santiam Planning Area and would briefly degrade habitat outside of proposed protection buffers. All perennial and intermittent water sources in proposed units of the Middle Santiam Planning Area have protection buffers of at least 50 feet, which meet current Standards and Guidelines. No meadow habitat would be altered. Design criteria to ensure the persistence of the yellow rail would be employed as required by current Standards and Guidelines; therefore, Alternative 2 or 3 would have no impact to yellow rails or associated habitat.

8. Mardon Skipper (*Polites mardon*) –

Alternative 1- No Action

This alternative would not modify any grassland meadows within the Planning Area. Under Alternative 1, all conditions of the Middle Santiam Planning Area would remain the same without any management activities or modifications.

Alternative 2 & 3

Alternative 2 and 3 would involve light to moderate thinning in the Middle Santiam Planning Area and would briefly degrade habitat outside of proposed protection buffers. All perennial and intermittent water sources and grassland meadows in proposed units of the Middle Santiam Planning Area have protection buffers of at least 50 feet, which meet current Standards and Guidelines. As a result, no grassland meadow habitat would be altered. Design criteria to ensure the persistence of the mardon skipper would be employed as required by current Standards and Guidelines; therefore, Alternative 2 or 3 would have no impact to mardon skippers or associated habitat.

9. Baird's Shrew (*Sorex bairdii permiliensis*)-

Alternative 1-No Action

This alternative would not modify down wood levels or habitat within the proposed units. Under Alternative 1, all conditions of the Middle Santiam Planning Area would remain the same without any management activities or modifications.

Alternative 2 & 3

Alternative 2 and 3 would involve light to moderate thinning in the Middle Santiam Planning Area and would briefly degrade habitat by reducing the canopy closure in treated areas to 50-60%. Retaining remnant old-growth trees (trees over 30 inches DBH, if present), current down wood and creating additional down wood where needed would improve habitat for Baird's shrew over time. It is estimated that in about 10 years, the tree growth as a result of thinning would increase tree diameter, height and canopy closure. This would result in improved habitat and microclimate conditions. Design criteria to increase down wood levels would be employed as required by current Standards and Guidelines and recommendations from DecAID. Therefore, Alternative 2 or 3 may impact individuals or their habitat temporarily, but the action would not likely contribute to a trend towards federal listing or loss of viability to the population or species.

10. California Wolverine (*Gulo gulo*)-

Alternative 1- No Action

This alternative would not modify down wood levels or habitat within the proposed units. Under Alternative 1, all conditions of the Middle Santiam Planning Area would remain the same without any management activities or modifications.

Alternative 2 & 3

Alternative 2 and 3 would involve light to moderate thinning in the Middle Santiam Planning Area and would briefly degrade habitat by reducing the canopy closure in treated areas to 50-60%. Retaining remnant old-growth trees (trees over 30 inches DBH, if present), current down wood and creating additional down wood where needed would improve habitat

for wolverines over time. It is estimated that in about 10 years, the tree growth as a result of thinning would increase tree diameter, height and canopy closure. This would result in improved habitat and microclimate conditions. Design criteria to increase down wood levels would be employed as required by current Standards and Guidelines and recommendations from DecAID. Therefore, Alternative 2 or 3 may impact individuals or their habitat temporarily, but the action would not likely contribute to a trend towards federal listing or loss of viability to the population or species.

11. Pacific Fisher (*Martes pennanti*)-

Alternative 1- No Action

This alternative would not modify down wood levels or any habitat within the proposed units. Under Alternative 1, all conditions of the Middle Santiam Planning Area would remain the same without any management activities or modifications.

Alternative 2 & 3

Alternative 2 and 3 would involve light to moderate thinning in the Middle Santiam Planning Area and would briefly degrade habitat by reducing the canopy closure in treated areas to 50-60%. Retaining remnant old-growth trees (trees over 30 inches DBH, if present), current down wood and creating additional down wood where needed would improve habitat for the Pacific fisher over time. It is estimated that in about 10 years, the tree growth as a result of thinning would increase tree diameter, height and canopy closure. This would result in improved habitat and microclimate conditions. Design criteria to increase down wood levels would be employed as required by current Standards and Guidelines and recommendations from DecAID. Therefore, Alternative 2 or 3 may impact individuals or their habitat temporarily, but the action would not likely contribute to a trend towards federal listing or loss of viability to the population or species.

12. Pacific Shrew (*Sorex pacificus*)-

Alternative 1- No Action

This alternative would not modify down wood levels or any habitat within the proposed units. Under Alternative 1, all conditions of the Middle Santiam Planning Area would remain the same without any management activities or modifications.

Alternative 2 & 3

Alternative 2 and 3 would involve light to moderate thinning in the Middle Santiam Planning Area and would briefly degrade habitat by reducing the canopy closure in treated areas to 50-60%. Retaining remnant old-growth trees (trees over 30 inches DBH, if present), current down wood and creating additional down wood where needed would improve habitat for Pacific shrew over time. It is estimated that in about 10 years, the tree growth as a result of thinning would increase tree diameter, height and canopy closure. This would result in

improved habitat and microclimate conditions. Design criteria to increase down wood levels would be employed as required by current Standards and Guidelines and recommendations from DecAID. Therefore, Alternative 2 or 3 may impact individuals or their habitat temporarily, but the action would not likely contribute to a trend towards federal listing or loss of viability to the population or species.

13. Crater Lake Tightcoil (*Pristiloma arcticum crateris*)-

Please see the Survey and Manage section of this document for further information regarding this species.

Cumulative Effects- Sensitive Species

Past management actions related to timber harvest activity are generally responsible for the current condition of habitat throughout the project area. These actions have affected the overall diversity of forested habitat largely by reducing the amount of old growth and increasing the amount of early to mid-seral habitat. There are no foreseeable actions that would negatively affect old growth habitat in this area. The activities associated with Middle Santiam Thin would improve existing seral conditions and guide managed stands towards an old growth regime. The effects from this project on seral stage development that influences suitability for sensitive species such as those dependent on down wood and decayed ground litter would be inconsequential relative to the cumulative effects from past actions. Current science, the changing trend in timber management and activities associated with this project should improve habitat conditions in the long term.

The area analyzed for cumulative effects was the Middle Santiam Planning Area and proposed harvest units. Past timber harvest, road construction, fire suppression and road maintenance activities have contributed to cumulative effects. Timber harvest, road building and natural disturbances have all impacted the amount of snags and down wood habitat within the Middle Santiam Planning Area. Past timber harvest and road building have reduced snag and down wood habitat while natural disturbances typically have increased snag and down wood levels. Current harvest prescriptions designed for these alternatives may initially reduce canopy closure; however over time, thinning treatments would promote forest vigor and health. Proposed actions would also create more down wood and snags within the project area through design criteria efforts to meet desired future conditions, Forest Plan Standards and Guidelines and recommendations from DecAID where applicable. In the reasonable foreseeable future, there are no additional habitat altering projects identified at this time within the Middle Santiam Planning Area.

Consistency with Direction and Regulations – Sensitive Species

This project is consistent with current standards established for projects that would specifically affect sensitive species and associated habitat. The activities associated with this project are consistent with direction and regulations outlined in the Regulatory Framework, Management Direction and Guidance section outlined in Appendix O.

D. Survey & Manage (S&M) and Other 2001 Record of Decision (ROD) Species

Introduction and Analysis Methods – Survey & Manage Species

The following species listed in Table 21 were compiled from the 2003 Annual Species Review (IM-OR-2004-034) and incorporates those vertebrate and invertebrate species whose known or suspected range includes the Willamette National Forest. Pre-disturbance surveys and management of known sites required by protocol standards that comply with the 2001 Record of Decision and Standard and Guidelines for Amendments to the Survey and Manage, Protection Buffer and other Design criteria Standards and Guidelines (USDA, USDI 2001) were either completed or not required for the Middle Santiam Planning Area. The following list includes two Category A and one Category C species. There are no known category B, D, E or F species to consider in this area.

Table 21 - Survey and Manage Species in the Middle Santiam Planning Area

Species	S&M Category	Survey Triggers			Survey Results			Site Mgmt
		Within Range of the Species?	Project Contains Suitable habitat?	Project may negatively impact species/ habitat?	Surveys Required?	Survey Date	Sites Known or Found?	
Vertebrates								
Great Gray Owl (*Strix nebulosa*)	A	Yes	Yes	No	No[1]	N/A[2]	No	N/A
Red Tree Vole (*Arborimus longicaudus*)	C	Yes	Yes	No	No[3]	N/A	No	N/A
Mollusks								
Crater Lake Tightcoil (*Pristiloma arcticum crateris*)	A	Yes	Yes	May Impact	No[4]	N/A	No	N/A

1= Surveys are not required. No proposed activities would take place in great gray owl habitat.

2= Not applicable

3= Surveys are not required. No proposed activities would take place in red tree vole habitat.

4= Surveys are not required. No proposed activities would take place in Crater Lake tighcoil habitat or would not negatively affect 5% or more of the habitat components in the project area.

Current Conditions-Survey and Manage Species

1. **Great Gray Owl (*Strix nebulosa*)-** The great gray owl is most common in coniferous forests adjacent to meadows. Surveys to determine occupancy are required in habitat that is above 3000 feet in elevation, within mature stands with greater than 60% canopy cover and within 1000 feet of meadows larger than 10 acres. Known nest sites require a 1320 foot protection buffer and natural meadows require a 300 foot no-harvest buffer. Under the 2001 amendment to the Northwest Forest Plan, the status of the great gray owl changed from a protection buffer species to a Category C Survey and Manage species (USDA, USDI 2001). The species was changed to a Category A species following the 2002 Annual Species review where it remains and is considered rare. Pre-disturbance surveys are practical if habitat is present.

   Suitable habitat for great gray owls exists within the Middle Santiam Planning Area; however, the nearest meadow occurs over 0.5 miles from any proposed unit. No great gray owl sightings or activity has been documented in the Middle Santiam Planning Area.

2. **Red Tree Vole (*Arborimus longicaudus*)-**The red tree vole is endemic to moist coniferous forests of Western Oregon and extreme Northwest California. Old growth forest conditions with Douglas fir as the dominate tree species tends to be the preferred or optimal habitat of red tree voles (Biswell et al. 2002). The red tree vole was initially listed as a Survey and Manage species in the 1994 Northwest Forest Plan ROD. In the 2001 ROD, the red tree vole was classified as a category C species. Under that classification it was considered uncommon, where pre-disturbance surveys were considered practical and where survey requirements applied across the known or suspected range of the species. Under the 2003 Annual Species Review, the status of red tree voles remained the same for the Northern Mesic Zone. The Middle Santiam Planning Area is within the Northern Mesic Zone where habitat disturbing activities require survey if the stand or a portion of the stand has a QMD (Quadratic Mean Diameter) of 16 inches DBH or greater. No proposed units in the Middle Santiam Planning Area have QMD levels of 16 inches DBH or greater; therefore these units are not considered suitable red tree vole habitat.

3. **Crater Lake Tightcoil (*Pristiloma arcticum crateris*)-** The Crater Lake tightcoil is typically found within 10 meters of perennially wet areas surrounded by mature conifer forests. The Crater Lake tightcoil (PRARC) has been listed as a Survey and Manage species under the 1994 Northwest Forest Plan. In the 2001 ROD, it was classified as a Category B species. The status of this species was changed to a Category A species following the 2002 Annual species review where it remains and is considered rare. Pre-disturbance surveys are practical if habitat is present. This species is also included on the Regional Forester's Sensitive Species List.

   Suitable habitat for this species exists in numerous locations throughout the Middle Santiam Planning Area. Suitable habitat is defined as perennially wet areas within riparian reserves (USDA, USDI 2003). No cut buffers of 50 feet in these areas provide design criteria efforts to protect the species and to avoid disturbance by maintaining microclimate conditions.

Surveys are also not required in suitable habitat areas if the no cut buffer is employed or if suitable habitat elements are dispersed throughout the project area so that less than 5% of those habitat components in that area are negatively affected (USDA, USDI 2003). As a result, surveys are not required for culvert replacement or repair unless extensive fill is required. No culvert replacement or repair is anticipated to have extensive fill in the Middle Santiam Planning Area or negatively impact Crater Lake tightcoil habitat more than 5% over the project area; therefore, surveys are not required. All skyline yarding would take place in intermittent class 4 streams; therefore, surveys are not required.

4. Other ROD Species and Habitat

Cavity nesting birds (white-headed woodpecker, black-backed woodpecker, pygmy nuthatch and flammulated owl) - These four species occur primarily on the eastern slope of the Cascade Range in Washington and Oregon and on the periphery of the northern spotted owl distribution range. These species are not typically associated with westside Oregon Cascade habitat but rather inhabit dry open ponderosa forests (Csuti et al. 1997, Marshall et al. 2003). Therefore, these species are not considered to have the potential to occur in the Middle Santiam Planning Area.

Bat roosts (caves, mines and abandoned wooden bridges and buildings) - Sites commonly used by bats for roost sites and hibernacula include caves, mines, snags and decadent trees, wooden bridges and old buildings. Provisions for retention of large snags and decadent trees are included in the standard and guideline for green tree patches in the Matrix. Caves and abandoned mines, wooden bridges and buildings require additional protection measures to ensure their habitat value is maintained. One cave was identified within the Middle Santiam Planning Area and would receive a 250 foot no harvest buffer as required in the Northwest Forest Plan. No other caves, abandoned mines, wooden bridges or buildings were found in the Middle Santiam Planning Area that would provide suitable bat habitat.

Direct and Indirect Effects - Survey and Manage Species

1. Great Gray Owl (*Strix nebulosa*)-

Alternative 1- No Action

This alternative would not modify or disturb any habitat associated with great gray owls nor impact any individuals. Under Alternative 1, all conditions of the Middle Santiam Planning Area would remain the same without any management activities or modifications.

Alternative 2 & 3

Proposed thinning activities in Alternative 2 or 3 would not modify or disturb any habitat associated with great gray owls. All suitable habitat is located more than 0.5 miles from proposed units; therefore, Alternative 2 or 3 would have **no impact** to great gray owls or associated habitat.

2. Red Tree Vole (*Arborimus longicaudus*)-

Alternative 1- No Action

This alternative would not modify or disturb any habitat associated with red tree voles nor impact any individuals. Under Alternative 1, all conditions of the Middle Santiam Planning Area would remain the same without any management activities or modifications.

Alternative 2 & 3

Proposed thinning activities in Alternative 2 or 3 would not modify or disturb any habitat associated with red tree voles. All proposed units within the Middle Santiam Planning Area do not meet the required Quadratic Mean Diameter (QMD) which determines suitable red tree vole habitat. All units are located in stands that have a QMD lower than 16 inches DBH. Therefore, Alternative 2 or 3 would have **no impact** to red tree voles or associated habitat.

3. Crater Lake Tightcoil (*Pristiloma arcticum crateris*)-

Alternative 1- No Action

This alternative would not modify or disturb any habitat associated with Crater Lake tightcoil habitat nor impact any individuals. Under Alternative 1, all conditions of the Middle Santiam Planning Area would remain the same without any management activities or modifications.

Alternative 2 & 3

Proposed thinning activities in Alternative 2 or 3 may modify or disturb habitat associated with Crater Lake tightcoil. Culvert replacement is anticipated on 36 sights that may have Crater Lake tightcoil individuals. Surveys are currently not required for culvert replacement/repair or on skyline yarding in intermittent stream channels as supported by the current survey protocol for terrestrial mollusk species (USDA, USDI 2003). All perennial water sources in proposed units of the Middle Santiam Planning Area have protection buffers of at least 50 feet, which meet current Standards and Guidelines. Therefore, Alternative 2 or 3 **may impact** individuals or their habitat temporarily, but the action would **not likely** contribute to a trend towards federal listing or loss of viability to the population or species.

4. Other ROD Species and Habitat

Cavity nesting birds (white-headed woodpecker, black-backed woodpecker, pygmy nuthatch and flammulated owl)-

These four species occur primarily on the Eastern slope of the Cascade Range in Washington and Oregon and on the periphery of the Northern spotted owl distribution range. These species are not typically associated with Westside Oregon Cascade habitat but rather inhabit dry open Ponderosa forests (Csuti et al. 1997, Marshall et al. 2003). Therefore, these species are not considered to have the potential to occur in the Middle Santiam Planning Area.

Bat roosts (caves, mines and abandoned wooden bridges and buildings)-

Alternative 1- No Action

This alternative would not modify or disturb any habitat associated with bat roosts nor impact any individuals. Under Alternative 1, all conditions of the Middle Santiam Planning Area would remain the same without any management activities or modifications.

Alternative 2 & 3

Proposed thinning activities in Alternative 2 or 3 would not modify or disturb any habitat associated with bat roosts. One cave was identified within the Middle Santiam Planning Area and will receive a 250 foot no harvest buffer as required by the Northwest Forest Plan. No other caves, abandoned mines, wooden bridges or buildings were found in the Middle Santiam Planning Area that would provide suitable bat habitat. Design criteria to ensure the persistence of bats would be employed as required by current Standards and Guidelines; therefore, Alternative 2 or 3 would have **no impact** to bats or associated habitat.

Cumulative Effects - Survey and Manage Species

Past management actions related to timber harvest activity are generally responsible for the current condition of habitat throughout the project area. These actions have affected the overall diversity of forested habitat largely by reducing the amount of old growth and increasing the amount of early to mid-seral habitat. There are no foreseeable actions that would negatively affect old growth habitat in this area. The activities associated with Middle Santiam Thin would improve existing seral conditions and guide managed stands towards an old growth regime. The effects from this project on seral stage development that influences suitability for Survey and Manage species such as the red tree vole and the great grey owl would be inconsequential relative to the cumulative effects from past actions. Survey and Mange species, such as the Crater Lake tighcoil, that are dependent on perennially wet areas surrounded by mature conifer forest may experience a temporary impact through culvert replacement, but those impacts are of short duration and would not likely lean towards a loss of population viability. Current science, the changing trend in timber management and activities associated with this project should improve habitat conditions in the long term.

The area analyzed for cumulative effects was the Middle Santiam Planning Area and proposed harvest units. Past timber harvest, road construction, fire suppression and road maintenance

activities have contributed to cumulative effects. Timber harvest, road building and natural disturbances have all impacted the amount of snags and down wood habitat within the Middle Santiam Planning Area. Past timber harvest and road building have reduced snag and down wood habitat while natural disturbances typically have increased snag and down wood levels. Current harvest prescriptions designed for these alternatives may initially reduce canopy closure; however over time, thinning treatments would promote forest vigor and health. Proposed actions would also create more down wood and snags within the project area through design criteria efforts to meet desired future conditions, Forest Plan Standards and Guidelines and recommendations from DecAID where applicable. In the reasonable foreseeable future, there are no additional habitat altering projects identified at this time within the Middle Santiam Planning Area.

Consistency with Direction and Regulations – Survey and Manage Species

This project is consistent with current standards established for projects that would specifically affect Survey and Manage species and associated habitat. The activities associated with this project are consistent with direction and regulations outlined in the Regulatory Framework, Management Direction and Guidance section outlined in Appendix O.

E. Management Indicator Species

Introduction and Analysis Methods – Management Indicator Species

The Willamette National Forest Plan has identified a number of terrestrial wildlife species with habitat needs that are representative of other wildlife species with similar habitat requirements for survival and reproduction. These species have been chosen due to specific habitat requirements that may be significantly influenced by management practices, and therefore, can facilitate in providing guidance to maintain viable populations of other species in similar habitat (Table 22). These Management Indicator Species (MIS) include northern spotted owl, bald eagle, peregrine falcon, cavity excavators, pileated woodpecker, American marten, and big game (mule deer, black-tailed deer and elk) and can be found in the Willamette NF FEIS Land and Resource Management Plan Chapter III, page 69 (USDA 1990). These species have the potential to occur in or near the Middle Santiam Thin project area. Northern spotted owls, bald eagles and peregrine falcons are addressed in the Threatened and Sensitive Species section.

A wildlife biologist conducted a pre-field and field review to analyze current conditions. No information currently exists on stand exam information regarding snag and down wood retention levels. An estimate of the current DecAID tolerance level was made based on the general stand age, harvest history and fire regime history. DecAID was also used to provide recommendations for appropriate future levels of snags and down wood in the Middle Santiam Planning Area. The Westside Lowland Conifer-Hardwood Forest Habitat Type was chosen as the appropriate habitat type and Small/Medium Tree Vegetation Condition as the appropriate tree size in the DecAID model.

Table 22 - Willamette National Forest Management Indicator Species (Terrestrial only).

Indicator Species	Habitat Features	Selection Criteria
Northern Spotted Owl	Old-growth and mature conifer	- Ecological Indicator - Represents limited habitat - Federal Register of Threatened and Endangered Species
Bald Eagle	Old-growth conifers near large bodies of water	- Federal Register of Threatened and Endangered Species
Peregrine Falcon	Cliff nesting habitat near abundant prey.	- Ecological Indicator - Represents limited habitat
Cavity Excavators	Dead and decaying trees	- Ecological Indicator - Represents limited habitat
Pileated Woodpecker	Old-growth and mature conifer	- Ecological Indicator - Represents limited habitat
American Marten	Old-growth and mature conifer	- Ecological Indicator - Represents limited habitat
Big Game (Deer and Elk)	Winter Range	- Commonly hunted

Current Conditions – Management Indicator Species

1. Primary Cavity Excavators and Pileated Woodpeckers - Avian species that are dependent on dead and decaying trees are referred to as cavity excavators or nesters. Snags (dead and dying trees) and down wood are important structural components of forest communities and are used by avian species in a variety of ways. Hollow trees and snags are uncommon but are especially valuable habitat, providing thermally regulated nest sites, over-wintering enclosures and food storage sites. Primary cavity excavators require dead and defective trees for nesting, roosting and foraging. Cavities constructed and abandoned by primary cavity excavators can be later used by other species known as, secondary cavity nesters (western bluebirds, tree swallows and violet-green swallows).

Primary cavity excavator species identified as ecological indicators on the Forest are listed in the table below (Table 23). The red-breasted nuthatch, northern flicker, hairy woodpecker and pileated woodpecker were observed in field reconnaissance in 2006. Other species have the potential to occur within the Middle Santiam Planning Area due to similar habitat requirements.

Table 23 - Willamette National Forest Primary Cavity Excavators.

Primary Cavity Excavator Species	Found on the Sweet Home Ranger District?	Observed within the Middle Santiam Thin Planning Area?	Potential to occur within the Middle Santiam Thin Planning Area?
Red-breasted Nuthatch	Yes	Yes	Yes
Northern Flicker	Yes	Yes	Yes
Hairy Woodpecker	Yes	Yes	Yes
Downy Woodpecker	Yes	No	Yes
Lewis' Woodpecker	Yes	No	Yes
Black-blacked Woodpecker	Yes	No	No
Three-toed Woodpecker	Yes	No	Possible
Red-breasted Sapsucker	Yes	No	Yes

The pileated woodpecker has been selected from the group of primary cavity excavators as "Featured" species based on a higher selection of habitat needs (USDA 1990). The pileated woodpecker is the largest of woodpeckers, and due to its large size, requires trees 24 inches DBH and larger to accommodate nesting efforts (Csuti et al. 1997). Pileated woodpeckers have large home ranges of 1000 acres or more and may forage in open areas (Mellen 1987). This species requires older forests to persist and tends to inhabit stands 70 years or older (Csuti et al. 1997). Habitat for the pileated woodpecker has been designated in the form of a Management Area (9b) on the Willamette National Forest and is 9,513 acres in size. This area has been designated to provide stands of mature forest habitat necessary for viable pileated woodpecker populations and species with similar habitat needs (USDA 1990). The Middle Santiam Thin Planning Area holds 307.53 acres of the pileated woodpecker Management Area (9b). No proposed activities would occur in the pileated woodpecker Management Area (9b). In addition, there are no known nest sites within any proposed harvest units.

The Middle Santiam Planning Area is primarily early to mid-successional habitat (seral type 2 & 3) with the northern portion that includes the Middle Santiam Wilderness Area characterized as late-seral (seral type 4) habitat. For proposed units in the Middle Santiam Planning Area, vegetation condition can be characterized as one age class, with stands averaging 30- 55 years old. Tree class size ranges from 9 to 13 inches in diameter and dominate tree species are in the Douglas fir and Western hemlock series. Timber harvest has occurred extensively in the planning area except for lands designated as wilderness. Previous harvest activity has created dense canopy closure and low diameter growth among tree species. Private inholdings are numerous in the Middle Santiam Planning Area and also exhibit an extensive harvest history. Few snags or down wood were retained in past harvest units. Broadcast slash

burning in these units often destroyed any habitat structure that was left. Snag and down wood retention levels are very low and can be categorized in the 30% tolerance range by DecAID standards.

The Willamette Forest Plan requires snags be retained in harvest units and throughout the drainage to maintain at least 40% of the potential population of cavity excavators. Snags in decay classes I, II, or III and greater than 20 feet tall should be considered when meeting Forest Plan requirements. Snags in decay class IV and V should be retained when ever possible. For green-tree and snag retention patches on Matrix lands, the Forest Plan requires a minimum 15% of regeneration harvest unit acres be retained over multiple rotations for species that require very old forests. This standard does not apply to commercial thinning units. The Forest Plan also requires 240 linear feet of downed logs per acre, at least 20 inches in diameter and greater than 20 feet long, be retained in harvest units on Matrix lands.

2. American Marten (*Martes pennenati*)- American martens are associated with forested habitats of any elevation and typically do not inhabit woodland areas. The American marten relies on mature and old-growth forests to provide feeding, resting and breeding areas (USDA 1990). Although mature forests with closed canopies are preferred, openings in the forest with sufficient down wood would also be utilized as habitat (Csuti et al 1997). Habitat for the American marten has been designated in the form of a Management Area (9c) on the Willamette National Forest and is 14,568 acres in size. This area has been designated to provide stands of mature forest habitat necessary for viable American marten populations and species with similar habitat needs (USDA 1990). The Middle Santiam Thin Planning Area holds 120.2 acres of the American marten Management Area (9c). No proposed activities would occur in the American marten Management Area (9c). In addition, there are no known records of sightings within any proposed harvest units.

The Middle Santiam Planning Area is primarily early to mid-successional habitat (seral type 2 & 3) with the northern portion that includes the Middle Santiam Wilderness Area characterized as late-seral (seral type 4) habitat. Proposed units in the Middle Santiam Planning Area vegetation condition can be characterized as one age class, with stands averaging 30- 55 years old. Tree class size ranges from 9 to 13 inches in diameter and dominate tree species are in the Douglas fir and Western hemlock series. Timber harvest has occurred extensively in the planning area except for lands designated as wilderness. Previous harvest activity has created dense canopy closure and low diameter growth among tree species. Private in holdings are numerous in the Middle Santiam Planning Area and also exhibit an extensive harvest history. Few snags or down wood were retained in past harvest units. Broadcast slash burning in these units often destroyed any habitat structure that was left. Snag and down wood retention levels are very low and can be categorized in the 30% tolerance range by DecAID standards. The Willamette Forest Plan requires 240 linear feet of downed logs per acre, at least 20 inches in diameter and greater than 20 feet long, be retained in harvest units on Matrix lands.

3. Big Game - Big game species within the planning area include Roosevelt elk, black-tailed deer and mule deer. Roosevelt elk and black-tailed deer use the area from spring through early winter or until the snow depth drives them out. Mule deer migrate from the east side of the Cascades during the early summer and return in late fall. Roosevelt elk, black-tailed deer and mule deer utilize similar habitats on the forest. All three species migrate using summer and winter ranges. Elk appear to be more sensitive to the effects of forest management and are used to represent the habitat requirements of all three species (USDA. 1990, p. III-76). Deer and elk use natural openings (such as wet meadows) extensively for foraging, breeding and calving. To function as prime habitat, these openings must be surrounded by sufficient cover to offer security from predation, inclement weather and human disturbance. Most big game use of openings occurs within 300 feet of hiding cover and most big game use of hiding cover occurs within 900 feet of forage areas (Wisdom, et al. 1986). As such, small openings scattered across a forested landscape create the most secure habitat for big game.

Current deer and elk use within the planning area is concentrated in forage openings, adjacent cover areas, wetlands and connective travel corridors. Portions of the area with dense over story cover and few natural or man-made openings have little use except for travel corridors and cover when elk are intensely hunted. Forage sites within the planning area are typically young plantations with open road access

Habitat for big game has been designated in the form of Emphasis Areas on the Willamette National Forest and management objectives for habitat quality have categorized in 3 levels: low, moderate and high (USDA 1990). Low emphasis areas require no specific management practices and quality would depend on other management activities. Moderate emphasis levels require that some management practices may be evaluated for their effect on elk and subsequently, some activities may be needed to maintain habitat quality. Activities may include road closures and forage improvement. High emphasis areas are sites that have less than 1.5 miles of road per section. These areas have high quality forage and are typically evenly distributed. Intense management is recommended and maintaining optimal cover in the winter range may be required some land allocations (USDA 1990). Winter range areas are typically below 3500ft in elevation and are areas where elk congregate during the cold season.

The Middle Santiam Planning Area contains all or a portion of four Big Game Emphasis Areas (Table 24). In addition, approximately 25% of the Middle Santiam Planning Area contains winter range as designated in the Forest Plan. All proposed harvest units currently provide thermal and hiding cover for deer and elk. This project has the potential to modify big game habitat effectiveness through the placement of harvest units, prescriptions and management of new or existing roads. These HEI (Habitat Effectiveness) indices would be used as criteria to compare alternative effects on big game habitat effectiveness.

Table 24 - Big Game Emphasis Areas in the Middle Santiam Thin Planning Area.

Big Game Emphasis Area (BGEA)	Acres within the Planning Area	Area Percentage within the Planning Area	Emphasis Level
Bachelor	12,711	36.7 %	Low
Middle Santiam	5,498	15.9%	Moderate
Tommy	11,967	34.6%	Moderate
Single	4,396	12.7%	High

A Model to Evaluate Elk Habitat in Western Oregon (Wisdom, et al. 1986) is used to evaluate elk habitat quality and project effects on this quality. Habitat values considered in the model are forage quality, cover quality, open road density and the spacing of forage and cover areas. A mathematical equation is then used to integrate the four habitat variables to obtain an overall value of habitat effectiveness (HEI). Habitat effectiveness scores for individual variables and for overall effectiveness indices are given 5 ratings of habitat condition (see Table 25).

Table 25 - Habitat Effectiveness (HEI) Definitions

Habitat Effectiveness Scores for Individual Variables	Habitat Condition
1.0	Optimal
0.6 - 0.9	Highly Viable
0.4 - 0.5	Viable
0.2 - 0.3	Marginal
0.05 - 0.1	Possibly Non-Viable

Table 26 - Current Elk Habitat Effectiveness Values- Summer

Big Game Emphasis Area	Size & Spacing (HES)	Road Density (HER)	Cover Quality (HEC)	Forage Quality (HEF)	Habitat Effectiveness Index (HEI)
Bachelor	0.86	0.12	0.54	0.25	0.34
Middle Santiam	0.67	0.99	0.85	0.19	0.57
Tommy	0.91	0.36	0.71	0.44	0.56
Single	0.90	0.50	0.78	0.37	0.60

Table 27 -Current Elk Habitat Effectiveness Values- Winter

Big Game Emphasis Area	Size & Spacing (HES)	Road Density (HER)	Cover Quality (HEC)	Forage Quality (HEF)	Habitat Effectiveness Index (HEI)
Bachelor	0.79	0.39	0.81	0.13	0.42
Middle Santiam	0.62	1.00	0.91	0.05	0.41
Tommy	0.89	0.10	0.67	0.33	0.38
Single	0.87	0.55	0.87	0.31	0.60

Bachelor BGEA- Current summer HE values for Bachelor BGEA are variable. Sizing and spacing is considered highly viable and cover quality viable. Forage is marginal and road density is possibly non-viable. However, the overall HE rating is 0.34, indicating marginal habitat conditions. Winter HE values are of higher quality and the overall habitat condition rating is viable. Most available forage within the management area occurs in managed stands that were clear-cut 20 years ago. Forage quantity would decline as these stands grow into hiding cover. Open road density within this management area is currently 3.76 miles of open road per square mile; however, this number should be used with caution due to the large amount of private land within the Planning Area. (See Tables 24 & 25 for BGEA comparisons.)

Middle Santiam BGEA- Current summer HE values for Middle Santiam BGEA are less variable. Sizing and spacing, road density, and cover quality are considered highly viable. Forage quality drives down the overall HE rating and is of possibly non-viable condition. The overall rating of this BGEA is 0.41, indicating that habitat conditions are viable. Winter range ratings are quite similar to summer habitat conditions and are also in the viable habitat condition. Open road density within this management area is currently 0.01 miles, which is due to the content of wilderness and roadless area acreage. (See Tables 24 & 25 for BGEA comparisons.)

Tommy BGEA- Current summer HE values for Tommy BGEA are also quite variable due to private land allocations. Sizing and spacing and cover quality are highly viable while road density and forage quality are viable. The overall habitat condition of this BGEA is 0.56, indicating a viable habitat condition. Winter range habitat conditions are slightly lower with an overall habitat condition of 0.38, indicating marginal habitat quality. Open road density within this management area is currently 2.5 miles of open road per square mile; however, this number should be used with caution due to the large amount of private land within the Planning Area. (See Tables 24 & 25 for BGEA comparisons.)

Single BGEA- Current summer HE values for this BGEA are slightly variable with size and spacing and cover quality in highly viable condition. Road density is viable, whereas forage quality is marginal. The overall habitat condition of this area is 0.60 and highly viable. Winter HE values are very similar to summer conditions and are also highly viable with a 0.60 rating. Open road

density for this area is 2.5 miles of open road per square mile. (See Tables 26 & 27 for BGEA comparisons.)

Desired Future Conditions - Management Indicator Species

1. **Primary Cavity Excavators and Pileated Woodpeckers-** To maintain populations of snag-dependent wildlife, snags need to be provided in each successional stage of a plant community (Brown 1985). The significance of snags and down wood providing habitat for cavity dependent species has become an increasingly important issue as new information becomes available. DecAID shows that as down wood percent cover increases throughout a habitat type (Westside Lowland Conifer-Hardwood Forest Western Cascades, Small/Medium Tree condition was used for analysis purposes) there is a general increase in cumulative wildlife species composition. Northern flying squirrels, Townsend's chipmunk and Western red-backed salamanders were several species that showed a notable increase in cumulative species composition, indicating that down wood percent cover can be an integral part of maintaining species viability (Mellen et al. 2006). DecAID also shows that cumulative species composition did not significantly change as down wood composition increased in tolerance levels for certain species. Pacific shrew, Trowbridge's shrew, and Townsend's vole showed a relatively stable cumulative species composition as tolerance levels increased. Data from DecAID shows similar results with snag density levels. Brown creepers and bushy-tailed woodrats maintained stable cumulative species composition as snag density (snags ≥ 10" DBH) increased (Mellen et al. 2006).

   Due to the over-stocking of tree species and over all low structural diversity of the Middle Santiam Planning Area, future conditions should strive to obtain at least a 50% tolerance level described in the DecAID model in the future. This would not be possible in a single entry due to the overstocking of small diameter trees. Desired future conditions would also include developing high diversity areas with a multi-story canopy structure, abundant snag and down wood levels, along with enhancing habitat richness and connectivity. In addition, desired future conditions for this project area would be to maintain at least Forest Plan Standards and Guidelines with consideration of DecAID information to further mitigate actions where applicable.

2. **American Marten (*Martes pennenati)-*** The significance of down wood habitat has become an increasingly important issue as new information becomes available. DecAID shows that as down wood percent cover increases throughout a habitat type (Westside Lowland Conifer-Hardwood Forest Western Cascades, Small/Medium Tree condition was used for analysis purposes) there is a general increase in cumulative wildlife species composition. Northern flying squirrels, Townsend's chipmunk and Western red-backed salamanders were several species that showed a notable increase in cumulative species composition, indicating that down wood percent cover can be an integral part of maintaining species viability (Mellen et al. 2006). DecAID also shows that cumulative species composition did not significantly change as down

wood composition increased in tolerance levels for certain species. Pacific shrew, Trowbridge's shrew, and Townsend's vole showed a relatively stable cumulative species composition as tolerance levels increased (Mellen et al. 2006).

Due to the over-stocking of tree species and over all low structural diversity of the Middle Santiam Planning Area, future conditions should strive to obtain at least a 50% tolerance level described in the DecAID model. This would require multiple entries over time. Desired future conditions would also include developing high diversity areas with a multi-story canopy structure, abundant snag and down wood levels, along with enhancing habitat richness and connectivity. In addition, desired future conditions for this project area would be to maintain at least Forest Plan Standards and Guidelines with consideration of DecAID information to further mitigate actions where applicable.

3. **Big Game** - Habitat would be managed to maintain viable populations. Distribution of habitat would provide for species viability and maintenance of populations throughout their historic range on the Forest. Currently, the Middle Santiam Planning Area is composed of primarily thermal, hiding and forage except for land designated as wilderness. This area is classified as optimal. Future management activities should focus on maintaining all cover and foraging types. This would involve decreasing open road mileage and shifting dominate cover types, such as hiding and thermal, to more optimal cover type conditions.

Direct and Indirect Effects- Management Indicator Species

1. Primary Cavity Excavators and Pileated Woodpeckers

Alternative 1- No Action

This alternative would not modify or disturb snag or down wood levels within the proposed units. Under Alternative 1, all conditions of the Middle Santiam Planning Area would remain the same without any management activities or modifications.

Alternative 2 & 3

Alternative 2 and 3 would involve light to moderate thinning in the Middle Santiam Planning Area and would briefly degrade habitat by reducing the canopy closure in treated areas to 50-60%. Retaining remnant old-growth trees (trees over 30 inches DBH, if present), current snags and down wood and creating additional snags and down wood where needed would improve habitat for the pileated woodpecker and other cavity excavators as the canopy increases. It is estimated that in about 10 years, the tree growth as a result of thinning would increase tree diameter, height and canopy closure. This would result in improved habitat over current conditions. No proposed actions would take place in the 9b Pileated Woodpecker Management Area. Design criteria to increase snag and down wood levels would be employed as required by current Standards and Guidelines and recommendations from DecAID. Therefore, Alternative 2 or 3 **may impact** individuals or their habitat temporarily, but the

proposed actions would **not likely** contribute towards a loss of viability to the population or species.

2. American Marten (*Martes pennenati*)

Alternative 1- No Action

This alternative would not modify or disturb snag or down wood levels within the proposed units. Under Alternative 1, all conditions of the Middle Santiam Planning Area would remain the same without any management activities or modifications.

Alternative 2 & 3

Alternative 2 and 3 would involve light to moderate thinning in the Middle Santiam Planning Area and would briefly degrade habitat by reducing the canopy closure in treated areas to 50-60%. Retaining remnant old-growth trees (trees over 30 inches DBH, if present), current snags and down wood and creating additional snags and down wood where needed would improve habitat for the pine marten as the canopy increases. It is estimated that in about 10 years, the tree growth as a result of thinning would increase tree diameter, height and canopy closure. This would result in improved habitat over current conditions. No proposed actions would take place in the 9c American Marten Management Area. Design criteria to increase snag and down wood levels would be employed as required by current Standards and Guidelines and recommendations from DecAID. Therefore, Alternative 2 or 3 **may impact** individuals or their habitat temporarily, but the proposed actions would **not likely** contribute towards a loss of viability to the population or species.

3. Big Game

Alternative 1- No Action

The quality of thermal cover in proposed units would eventually increase under Alternative 1 as natural mortality thins the dense stocking levels, releases dominant trees and allows a shrub/herbaceous layer to develop in small openings. Thermal cover is most valuable to big game when stand canopies are dense enough to intercept and hold a substantial amount of snow with dispersed openings for secluded foraging.

Road densities would remain the same as they are currently, but some local roads may close over time through vegetative growth and lack of maintenance. This alternative would also result in less forage than the action alternatives because the dense canopy closure does not allow light to the forest floor to produce abundant forage.

Alternative 2 & 3

Alternatives 2 & 3 provide an opportunity to improve big game hiding and thermal cover by reducing tree density and allowing more structural diversity to develop sooner than could be expected in Alternative 1. Reducing the canopy cover allows more sunlight to reach the forest floor to promote shrub and herbaceous vegetation growth. The development rate of complexity

is greater in action alternatives than would occur naturally under Alternative 1 barring any major natural disturbance. Either Alternative would actually improve habitat conditions in the long term. In addition, approximately 3 miles of open road would be decommissioned, thus further improving the overall habitat quality for elk. Therefore, Alternative 2 or 3 would have **no impact** to big game in the Middle Santiam Planning Area.

Cumulative Effects- Management Indicator Species

Past management actions related to timber harvest activity are generally responsible for the current condition of habitat throughout the project area. These actions have affected the overall diversity of forested habitat largely by reducing the amount of old growth and increasing the amount of early to mid-seral habitat. There are no foreseeable actions that would negatively affect old growth habitat in this area. The activities associated with Middle Santiam Thin would improve existing seral conditions and guide managed stands towards an old growth regime. The effects from this project on seral stage development that influences suitability for management indicator species such as those dependent on down wood and decayed ground litter would be inconsequential relative to the cumulative effects from past actions. Current science, the changing trend in timber management and activities associated with this project should improve habitat conditions in the long term.

The area analyzed for cumulative effects was the Middle Santiam Planning Area and proposed harvest units. Past timber harvest, road construction, fire suppression and road maintenance activities have contributed to cumulative effects. Timber harvest, road building and natural disturbances have all impacted management indicator species habitat within the Middle Santiam Planning Area. Current harvest prescriptions designed for these alternatives may temporarily impact management indicator species habitat; however over time, thinning treatments would promote forest vigor and health. Proposed actions would also create more stand structural diversity within the project area to meet desired future conditions and Forest Plan Standards and Guidelines.

Consistency with Direction and Regulations – Management Indicator Species

This project is consistent with current standards established for projects that would specifically affect Management Indicator Species and associated habitat. The activities associated with this project are consistent with direction and regulations outlined in the Regulatory Framework, Management Direction and Guidance section outlined in Appendix O.

F. Migratory Birds

Introduction and Analysis Methods – Migratory Birds

The Pacific Northwest supports the highest abundance of birds in any coniferous forest system in North America (Altman 1999). Neo-tropical migrants comprise the largest portion of the bird community and have been absent from resource management plans (Altman 1999). Past management activities have created homogeneity across the landscape and as a result, neo-tropical migrant populations have been on the decline. In addition, fire suppression has added to the decrease in habitat variability. Species such as the olive-sided flycatcher, western wood pewee, brown creeper and varied thrush have exhibited significant population decline as a result of habitat loss and fragmentation (Altman 1999).

Land bird species exhibit a dramatic response to the height, seral stage, canopy structure and spatial distribution associated with forest habitat where greater numbers of birds are associated with more complex heterogeneous forested landscapes (Altman 1999). In addition, the importance of habitat associated with hardwood trees and shrubs has been widely documented in published literature as one of the leading factors influencing bird community composition in conifer-dominated landscapes that typify the Middle Santiam Planning Area (Csuti et al. 1997, O'Neil et al. 2001, Marshall et al. 2003). Such habitat in this project area is generally located in riparian reserves, but is scattered across upland settings as well.

No formal surveys were completed to assess neo-tropical migrant populations. GIS applications were used to assess habitat and literature was researched to obtain recent studies in the Pacific Northwest that would reflect the same conditions as the Middle Santiam Planning Area. Hagar et al. (2004) analyzed survey data that documented the presence of associated species during an intensive young stand study (YSS) that included Douglas fir dominated managed stands in an area similar to the Middle Santiam Planning Area. Data analysis (YSS) revealed the following for neo-tropical migrants:

- Bird species richness (number of species/stand) was positively affected by thinning and increased to the greatest extent in stands that were heavily thinned.
- No species regularly detected prior to thinning were absent during post-treatment surveys regardless of thinning intensity.

Current Conditions- Migratory Birds

The Middle Santiam Planning Area has undergone extensive management activities which have left the area in a homogenous state. Along with large amounts of private land allocations, this area exhibits a high overstocking of trees with tree mortality on the rise. Stands across the landscape are less than 80 years old and have canopy closures of 80% or greater with an average DBH of 9-11 inches. Northern flickers, dark-eyed juncos, hermit warblers, varied thrushes, winter wrens and yellow-rumped warblers were among the species observed in the Middle Santiam Planning Area.

Desired Future Conditions- Migratory Birds

Desired future conditions for migratory birds would involve management practices that ensure long-term viability of healthy populations. Identifying areas that express extreme homogeneity and employing management activities that would introduce variability across the landscape would be the first step in maintaining viable populations. Efforts should focus on creating a multi-story, complex canopy structure with habitat components such as, down wood, snags and small openings. Maintaining meadow and riparian areas should be a primary focus as well. A strategy should be implemented that takes into consideration the recommendations from the Partners in Flight Conservation Strategy which has identified at least 20 focal species.

Direct and Indirect Effects- Migratory Birds

Alternative 1- No Action

This alternative would not modify or disturb any habitat associated with migratory birds, including snag or down wood levels within the proposed units. Under Alternative 1, all conditions of the Middle Santiam Planning Area would remain the same without any management activities or modifications.

Alternative 2 & 3

Alternative 2 and 3 would involve light to moderate thinning in the Middle Santiam Planning Area and would briefly impact habitat by reducing the canopy closure in treated areas to 50-60%. Retaining remnant old-growth trees (trees over 30 inches DBH, if present), current snags and down wood and creating additional snags and down wood where needed would improve habitat for certain migratory species. It is estimated that in about 10 years, the tree growth as a result of thinning would increase tree diameter, height and canopy closure. This would result in improved habitat over current conditions and create a more heterogeneous condition across the landscape.

Design criteria to increase snag and down wood levels would be employed as required by current Standards and Guidelines and recommendations from DecAID. Therefore, Alternative 2 or 3 may impact individuals or their habitat, but the proposed actions would not likely contribute towards a loss of viability to the population or species.

Cumulative Effects- Migratory Birds

Past timber management within the Middle Santiam Planning Area has resulted in homogeneity across the landscape. As a result, there has been a significant decrease in some species of neo-tropical migrants. The Middle Santiam Thinning Project would create more diversity across the landscape and allow more species to utilize the increased variety of habitats. This diversity would involve creating an open forest canopy with a multi-story structure to encourage a shrub/herbaceous layer. Disturbance in these areas, however, would be spatially distributed across the project area and temporally distributed throughout multiple breeding seasons further reducing the likelihood of disturbance to individuals.

The area analyzed for cumulative effects was the Middle Santiam Planning Area and proposed harvest units. Past timber harvest, road construction, fire suppression and road maintenance activities have contributed to cumulative effects. Timber harvest, road building and natural disturbances have all impacted the amount of snags and down wood habitat within the Middle Santiam Planning Area. Past timber harvest and road building have reduced snag and down wood habitat while natural disturbances typically have increased snag and down wood levels. Current harvest prescriptions designed for these alternatives may initially reduce canopy closure; however over time, thinning treatments would promote forest vigor and health. Proposed actions would also create more down wood and snags within the project area through design criteria efforts to meet desired future conditions, Forest Plan Standards and Guidelines and recommendations from DecAID where applicable. In the reasonable foreseeable future, there are no additional habitat altering projects identified at this time within the Middle Santiam Planning Area.

Consistency with Direction and Regulations – Migratory Birds

This project is consistent with current standards established for projects that would specifically affect migratory bird species and associated habitat. The activities associated with this project are consistent with direction and regulations outlined in the Regulatory Framework, Management Direction and Guidance section outlined in Appendix O.

Vegetation - General

Introduction – Vegetation – General

The Middle Santiam River 5th field watershed has been altered by almost 60 years of timber management. The majority of the second growth stands within the project areas were established after logging in the 1950s and 1960s. These stands created larger contiguous patches (100-200 acres) of even-aged closed canopy forest on the landscape. The more recent harvests of the 1970s to 1990s created smaller (20-40 acres) patches in a dispersed pattern across the landscape. Interspersed among these managed stands are older, late-successional stands.

The young, managed stands proposed for treatment are in a condition based on stocking levels, average stand diameters, and crown ratios that would respond and benefit from commercial thinning. Commercial thinning is proposed to improve the growth and maintain the health of the residual trees by reducing the competition between trees, developing the understory and diversifying the species composition by opening up the tree canopies, and providing for an intermediate harvest of merchantable size trees from the excess trees which would normally die out from competition.

Analysis Methods – Vegetation – General

The preliminary analysis of the vegetation conditions at the stand level was done using the GIS Vegetation layer and the related VEGIS database.

ArcGIS was used to do the GIS mapping and analyses. The GIS Vegetation Seral Stage layer was also used to prepare maps of the stand conditions for the project area. In addition, the GIS Management Area layer was overlaid with the GIS Vegetation Seral Stage layer to determine the management direction appropriate for a given stand. The GIS layer was also used to identify and classify stands into structural development stages based on year of origin of the stands.

The VEGIS database was used to review the past treatment history of the stands and to gather other stand parameters, such as slopes, aspect, elevation, and plant association series. The analysis of this information eventually identified stands that would potentially be available for commercial thinning. The second screening was to perform a quick walk through of these stands by an experienced Forester to ground truth the GIS and VEGIS analysis.

A third level of analysis was then completed by collecting data using both the stand exams. This data was entered into the Forest Vegetation Stimulator (FVS) (USDA, 2002) for growth and yield modeling. Stand treatment options were analyzed in FVS and developed using relative density, trees per acre, basal area, and canopy closure for the individual stand data.

Current Conditions – Vegetation - General

The proposed units are located in both western hemlock and Pacific silver fir plant associations. Stands evaluated for silvicultural treatment are 28 to 56 years old and range in size from 9 to 13 inches in diameter. Stand exam data shows existing basal areas vary from 105 - 249 ft sq./acre with relative densities of approximately 40 to 80% (the reason for this wide variation in basal area and relative densities could be sampling error).

It appears from database research and field exams, that all of the stands were originally planted primarily with Douglas-fir which was common for the time period. Subsequently, significant numbers of other tree species have naturally regenerated within the units. Western hemlock and western redcedar are the most common species following Douglas-fir with lesser amounts of western white pine, Pacific silver fir, and other species in some units. Most of these stands were pre-commercially thinned and some have been pruned and fertilized.

The stands are classified as being in the stem exclusion structural stage. This seral stage is characterized as having high tree densities, closed canopies, low light levels, and generally sparse understory vegetation. The growth and vigor of these stands is greatly diminished due to inter-tree competition for light, water and nutrients. Because of this competition, many individual trees are experiencing a high level of stress which greatly diminishes individual tree growth and vigor which makes individuals and stands susceptible to disturbance agents.

Large down wood and snags are not abundant in any stands due to past harvest practices, but these stands do include small diameter snags and down wood that have resulted from suppression mortality.

Ground vegetation is predominately salal and Oregon grape, with lesser amounts of vine maple, Alaska huckleberry and Pacific rhododendron. This vegetation does not vary greatly throughout the project area.

The following table displays characteristics for a sample of the stands proposed for treatment with this project:

Table 28 - Individual stand characteristics for the Project

Unit #	Acres	Quadratic Mean Diameter of Trees > 7" DBH	Stand Age	Existing Canopy Closure	Trees per Acre > 7”	Basal Area (sq ft/ac)	Relative Density
3	24	12.4	56	86	238	199	58
4	14	13.0	51	86	238	224	72
5	52	10.8	52	81	235	234	57
6	59	12.3	49	74	159	146	51
7	13	8.7	49	83	325	138	50
8	17	10.5	49	88	282	172	55
9	21	9.9	49	80	264	143	49
10	40	11.5	50	84	262	196	62
14	98	9.9	40	85	314	179	68
15	81	10.8	48	78	212	143	45
16	7	12.1	47	76	177	145	44
19	43	9.2	38	96	497	249	85
22	59	11.8	40	81	244	196	65
23	33	9.3	42	74	198	105	40
24	30	11.3	28	84	219	158	55
25	51	10.9	45	87	288	195	80
26	58	10.9	39	84	264	178	74
28	29	11.2	47	78	246	179	69

Unit #	Acres	Quadratic Mean Diameter of Trees > 7" DBH	Stand Age	Existing Canopy Closure	Trees per Acre > 7”	Basal Area (sq ft/ac)	Relative Density
29	28	9.8	41	85	318	176	69
30	31	13.5	39	88	225	232	68
32	20	10.8	51	79	216	139	46
33	13	9.6	41	91	343	180	63
34	23	12.7	39	82	191	173	68
35	45	11.5	38	78	206	157	61
36	10	10.8	39	85	229	150	50
37	15	10.8	49	69	215	139	48
41	38	11.1	46	88	303	207	66
42	16	11.7	49	90	295	228	72
47	28	10.4	51	90	394	239	76
48	58	10.9	55	93	370	247	77
49	49	9.2	51	89	437	206	72
52	38	9.4	36	81	259	123	41

Desired Future Condition (DFC) – Vegetation - General

The desired future condition of the project area is derived from direction in the amended Forest Plan. Common attributes of the desired future condition for all management areas include: healthy, vigorous stands; stands with a natural array of native species, stands that are resistant to disturbance agents, and fuel levels at or below Forest Plan standard and guidelines. The differing components of the desired future condition for Riparian Reserves, Critical Habitat Unit, Area of Concern, and the Middle Santiam River Corridor, are described in the following paragraphs.

Riparian Reserves: The desired future condition for the Riparian Reserve is described in the LRMP as: providing a continuous and diverse habitat for riparian dependent species and high quality water. The waterbodies and associated riparian area would contribute to the diversity and dispersion of fish, wildlife, and plants. Vegetation would be managed to provide for diverse stands of conifer and hardwood vegetation which provide habitat for riparian-dependent species. The amount of large woody debris, both down and standing would be maintained at or above current levels. In areas where this material has been depleted as a result of past harvesting, the amount would increase either through rehabilitation projects, or as a result of natural mortality, or both. The canopy closure would be at least 50% or about 90 trees per acre.

Critical Habitat Unit (CHU): The desired future condition of the CHU would have a structural diversity that would become more diverse over time until it is older, multi-storied and has sufficient snags and down wood to provide opportunities for nesting, roosting and foraging for northern spotted owls. The canopy closure would generally exceed 60 percent (or about 110 trees per acre).

Area of Concern (AOC): The desired future condition for the AOC at a minimum would provide dispersal habitat consisting of forested stands that have adequate tree size and canopy closure to provide some degree of protection to spotted owls from avian predators and to allow the owls to forage at least occasionally. In each quarter township 50% of the area would contain trees 11 inches in diameter with at least 40% canopy closure (about 70 trees per acre) (50-11-40 rule). This would provide habitat connectivity to facilitate juvenile owl dispersal from natal areas and genetic exchange between blocks of nesting roosting and foraging habitat.

Middle Santiam River Corridor: Desired Future Conditions for the managed stands located in the Middle Santiam River Corridor are late-successional forest characteristics which would include the development of large diameter trees, multi-storied canopies, horizontal patchiness, and species diversification. The managed stands within the corridor would be providing large trees for snags and down wood.

Scale of Analysis

The scale of analysis used for the direct and indirect effects was determined to be the treatment units which are responsive to the changes of the proposed action.

The scale of analysis for the cumulative effects was determined to the project area which consists of two sixth field watersheds.

Direct and Indirect Effects – Vegetation - General

Alternative 1 (No Action):

There are no direct effects to vegetation in the No Action Alternative. Indirect effects are:

1. There would be no reduction in current tree stocking levels to enhance the growth and vigor of the remaining trees and to reduce future losses from disturbance agents such as fire, insects, and disease.
2. Acceleration of late-successional stand characteristics within Critical Habitat Unit to enhance the development of roosting, nesting and foraging habitat diversity for the northern spotted owl would not be realized as rapidly as in the action alternatives.
3. The development of additional dispersal habitat for spotted owls within the AOC and the Middle Santiam River Corridor would not be accelerated.
4. Thinning would not occur therefore long-term fuel buildup would not be reduced.
5. Commercial wood products would not be provided.

Alternatives 2 and 3

The following table is a summary and comparison of vegetative effects by alternatives.

Table 29 -Direct and Indirect Effects of All Alternatives- Vegetation General

Effect	Alternative 1 – No Action	Alternative 2	Alternative 3
Total Acres Thinned	0	1549	1412
Acres of the thinning that are within Riparian Reserves	0	400	383
Acres of Gaps left within thinned stands (Dominant Tree Release – DTR's)	0	25	25
Acres of Skips (unthinned area of stands)	2490	965	966
Volume from commercial timber harvest (Appendix A)	0	30,000 CCF	28,000 CCF
Trees per acre >6" DBH	159 – 493 with average being 298	90-130	90-130
Approximate spacing of trees (see Table 30)	12.9 feet	21 feet	21 feet
Relative Density (see Table 28 and Figure 15	62%	27%	27%
Canopy Closure (for trees >6" DBH) (see Figure 17)	86%	50-70%	50-70%

The following table displays the direct effects of the Action Alternatives on a sample of the stands proposed for treatment in this project:

Table 30 -Direct Effect of Action Alternatives on Trees per Acre (TPA) stand Relative Density, and tree spacing.

Unit Number	Existing Trees Per Acre	Post Treatment Trees Per Acre	Existing Relative Density	Post Treatment Relative Density	Existing Spacing in feet	Post Treatment Spacing in feet
1	237	82	59	22	14	23
4	236	82	73	31	14	23
5	273	96	66	31	13	21
6	159	82	52	32	17	23
7	324	123	52	23	12	19
8	282	91	57	20	12	22
9	264	111	51	24	13	20
10	260	98	63	27	13	21
14	312	115	69	32	12	19
15	212	97	46	23	14	21
16	176	86	44	23	16	22
19	494	105	86	25	9	20
22	243	100	66	33	13	21
23	202	99	42	24	15	21
25	288	99	81	36	12	21
26	263	99	75	37	13	21
27	307	139	59	31	12	18
28	249	112	69	38	13	20
29	324	115	70	32	12	19
30	223	72	69	26	14	25
32	216	96	47	23	14	21
33	340	96	65	23	11	21
34	192	77	69	35	15	24
35	205	94	62	34	15	22
36	228	83	52	22	14	23
37	215	127	49	31	14	19
41	273	98	59	25	13	21
41	302	97	67	24	12	21
42	293	88	73	26	12	22
47	392	120	76	26	11	19
48	367	97	77	23	11	21
49	436	134	73	26	10	18
52	258	105	43	18	13	20
Averages	**274**	**100**	**62**	**27**	**13**	**21**

The proposed stand treatments have been designed to meet the purpose and need to increase growth and vigor of residual trees, and to accelerate development of structural and compositional complexity in young, densely-stocked, uniformly-spaced, managed stands in the Middle Santiam River watersheds. The proposed treatment would also provide prevention and protection against disturbance agents. Thinning would maintain growth rates and promote stem quality and tree vigor,

diversifies the species composition and stand structure, provides commercial wood products, and reduces long-term fuel buildup.

Alternative 2 treats 1549 acres and Alternative 3 treats 1412 acres. Thinning would maintain or improve overall stand growth and health by reducing competition for limiting resources such as light, water, and soil nutrients, this would result in larger diameter growth more rapidly (see Figure 16). Reduced residual stand densities and competition allows residual trees to maintain a higher growth rate than would occur with no thinning (see Figures 15 and 16).

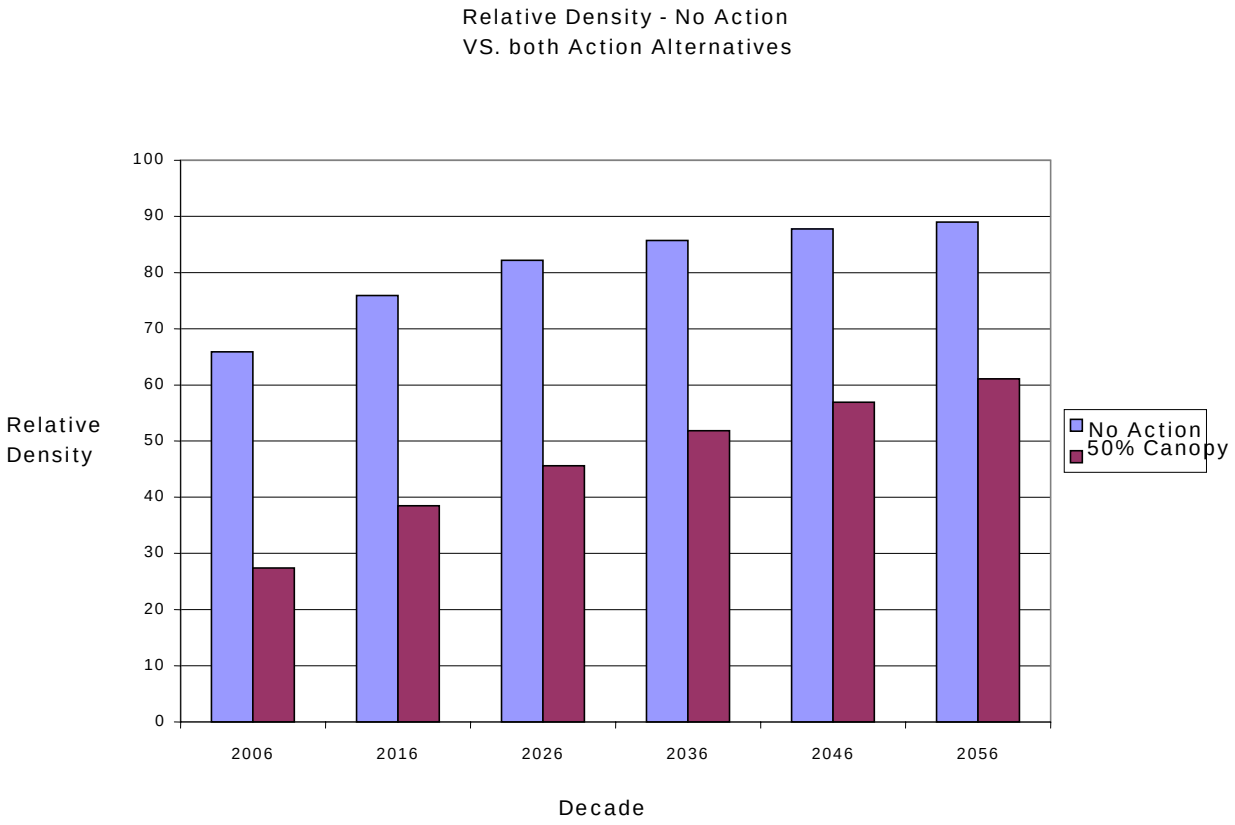


Figure 15 - Relative Density – Indirect effect of the No Action Alternative compared to both Action Alternatives over time.

Figure 15 illustrates the effect of the no action and action alternatives over time on relative density. The threshold of 55% relative density is the point where timber stands move from the stand initiation to stem exclusion phase. In the stem exclusion seral stage timber stands are experiencing competition-based mortality and are at risk from disturbance agents due to stress. Both action alternatives are combined.

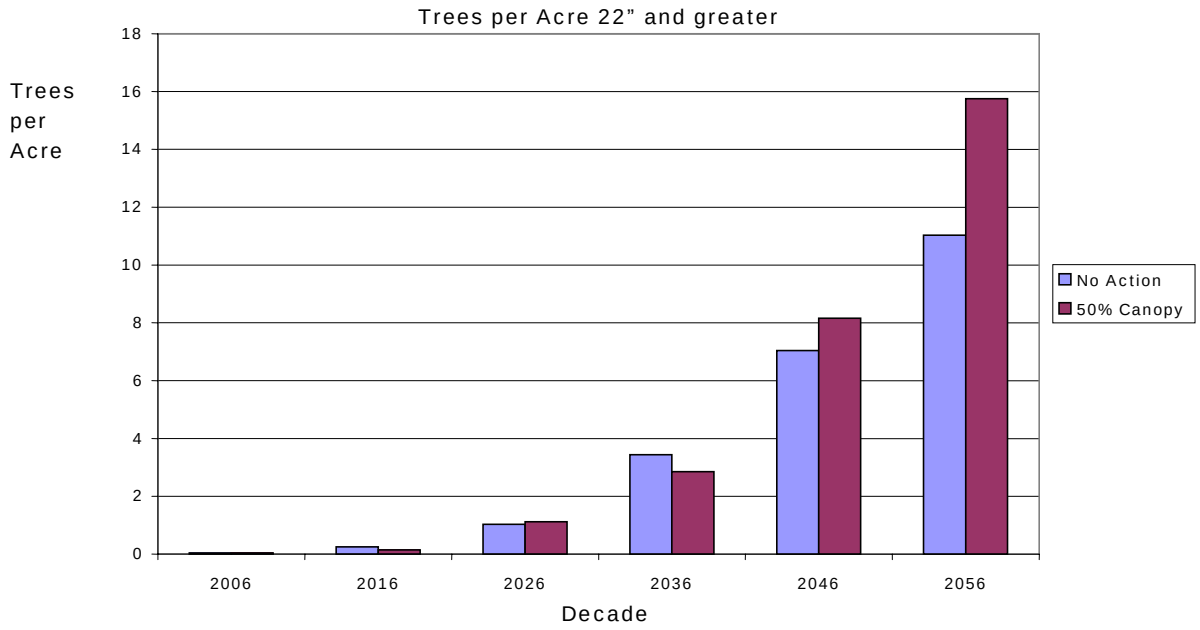


Figure 16-Trees 22" DBH and greater. **This figure demonstrates the Indirect Effect of the No Action and Action Alternatives over time on large diameter tree growth. Both Action Alternatives are combined.**

Included in the thinning acres mentioned earlier, are 400 acres of thinning in the secondary shade zone of the Riparian Reserves in Alternative 2 and 383 acres in Alternative 3. Again, treatments are designed to meet the purpose and need to ensure the health and growth of these stands, to diversify the stand structure, and to accelerate their development of late-successional forest characteristics.

Both Alternatives would also regenerate 25 acres in small Dominant Tree Release (DTR) cuts. These small DTR cuts are located in the CHU and AOC. No DTR's would be created in the Riparian Reserves. The purpose of these selection cuts is to enhance structural diversity. The DTR cuts would introduce spatial heterogeneity into the stand's structure. These DTR cuts also begin the development of late successional structure

Assuming that the onset of competition based mortality is indicated by exceeding a threshold of 55% relative density; the FVS model predicts that all treated stands in each action Alternative would be below the density threshold and stay in that condition for the next four decades (see Figure 15).

The thinning would open up the tree canopy allowing more sunlight and precipitation to reach the forest floor (see Figure 17). This would result in changes in the microclimate (increased air and soil temperatures, relative humidity's, and air movement) (Chan, 1995), under the main canopy for a short term (10-20 years) until the canopy closes back in. These changes in microclimate stimulate an increase in favorable growing conditions for most plant species. The thinning will also open up the tree canopy allowing more sunlight and precipitation to reach the forest floor (see Figure 5). This would move these stands into the understory re-initiation stage

because the increased sunlight would accelerate the development of an additional canopy and brush layers.

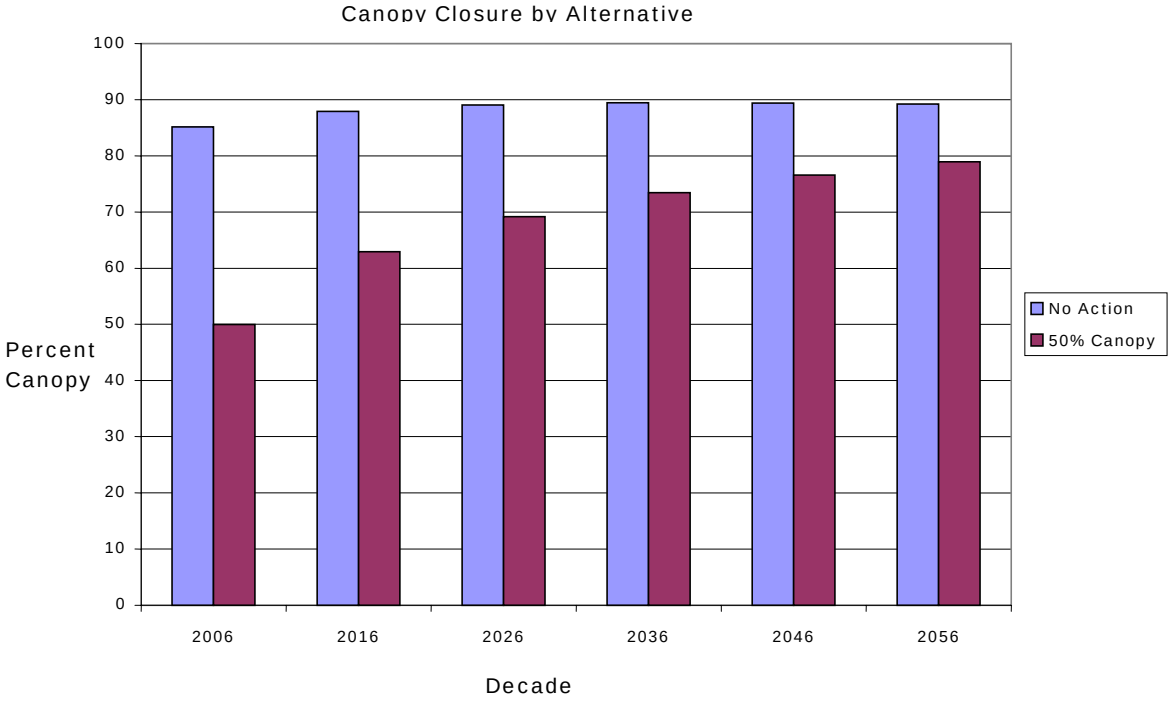


Figure 17 -Canopy Closure by Alternative. This figure demonstrates the Indirect Effect of the No Action and Action Alternatives on the amount of canopy closure over time. Both Action Alternatives are combined.

Thinning would promote the development of diverse, multi-layered stands (Bailey and Tappeiner, 1998, Muir et all 2002), primarily by providing conditions that favored the establishment of shrubs, hardwoods, and conifer in the understory after thinning, and by releasing saplings and intermediate-crown class trees in the stand.

Thinning would maintain or enhance stand level, plant species diversity. Species richness for herbaceous species and total species richness across trees, shrubs, and herbaceous vegetation (Bailey et al 1998) were greater in thinned stands than in un-thinned and old-growth stands. A portion of the increased species richness was associated with exotic species, but grasses and nitrogen-fixing species also were more abundant in thinned stands.

Thinning promotes crown differentiation by allowing overstory trees to develop deep canopies and larger diameter branches in open stand (McGuire et al 1991) thereby enhancing late successional structure.

Thinning reduces the densities and promotes greater diameter growth of residual trees that increases the stability of these stands over time by making them more resistant to windthrow. However, the heavier thinning could possibly make the residual trees more susceptible to windthrow initially (Garman, et al. 2003). Following thinning, some trees may blow down as a result of increased exposure to wind. Windthrow creates canopy gaps and supplies coarse woody material as a fine-scale distance (Hayes et al 1997).

Cumulative Effects Vegetation – General

Analysis Area: The area analyzed for cumulative effects was the project area.

Alternative 1 – No Action -

Past harvest, fire suppression, planting trees, pre-commercial thinning, fertilization may have cumulatively changed the stand structure, species composition, growth to where they are today.

Due to the existing homogeniety of existing stands, these effects would be similar in all management areas. Some of the cumulative effects of adopting Alternative 1 would be that the trees in these stands will start to exhibit low or declining diameter growth and a reduction in live crown ratios. Suppression related mortality will increase without treatment. Low light levels in unthinned stands will suppress development of shade tolerant trees, reduce the development of additional conopy layers, and supress or remove the shrub understory vegetation . The diameter and volume of trees harvested in the future will be reduced without treatment.

Forgoing treatment will make these stands more suceptible to agents of disturbance. Deferring treatment to a later date will increase the stands likelihood that they will respond more poorly to later treatments and to experience increased windthrow after treatment. Due to the height-to-diameter ratio of many trees in these stands, susceptibility from snow breakage can be expected to continue. Identified root rot pockets would remain untreated. These stands will exhibit increased vunerabilty to wildfire.

Previous road construction has removed 394 acres of vegetation within the analysis area. Under this Alternative there is no net gain in future vegetated acres due to road closures.

Alternatives 2 and 3

As a result of past management actions, the current seral stage distribution in the planning area is 5,163 acres of stand initiation, 9,464 acres of stem exclusion, 7,829 acres of understory re-initiation, 12,210 acres of late-successional and a negligible amount non-forested acres. The only reasonably foreseeable future action affecting vegetation is timber stand improvement treatments such as pre-commercial thinning on 463 acres of managed plantations. This pre-commercial thinning would not change the seral class condition in treated stands.

The cumulative effects on seral stage distribution in the analysis area that would be caused by the alternatives being considered are displayed below. Table 31 displays the acres and percent of each development stage in the project area.

Table 31 - Project Area Seral Stage and Effect by Alternative

Development Stage	Current Conditions	Alternative 1 (No Action)	Alternative 2	Alternative 3
Stand Initiation	5163 ac (14.9%)	5163 ac (14.9%)	5193 ac (15.0%)	5193 ac (15.0%)
Stem Exclusion	9464 ac (27.3%)	9464 ac (27.3%)	7915 ac (22.8%)	8052 ac (23.2%)
Understory Re-Initiation	7829 ac (22.6%)	7829 ac (22.6%)	9348 ac (27.0%)	9211 ac (26.6%)
Old Growth	12210 ac (35.2%)	12210 ac (35.2%)	12210 ac (35.2%)	12210 ac (35.2%)
Non Forested	Negligible acres	Negligible acres	Negligible acres	Negligible acres

Alternatives 2 and 3 will have slight cumulative effects on percentage of the analysis area's acres in each seral stage. The proposed treatments will move these stands backwards on the successional pathway. Alternative 2 moves approximately 1549 acres of the analysis area from the stem exclusion to the understory re-initiation phase. Alternative 3 moves approximately 1412 acres of the analysis area from the stem exclusion to the understory re-initiation phase. The patch cuts in Alternatives 2 and 3 move 25 acres of the land base from the stem exclusion to the stand initiation phase. Both Alternatives change the number of trees per acre > 6" DBH and canopy density, in treated stands.

Cumulative effects to growth rates would be to reallocate growth to the residual stand. This reallocation would increase the population of large diameter trees in the treated stands (see Figure 16). This cumulative effect would be the same for thinning in all action alternatives.

There is about 7,408 acres of private or other ownership land in the analysis area. A majority of these lands are industrial forest lands. The majority of the private lands are in the stand initiation and stem exclusion stages.

Conclusions – Vegetation - General

The primary forest health issues occurring in this project are directly related to the high relative density found in all stands. The No-Action alternative would perpetuate this condition.

The No Action alternative would achieve the desired future condition for the Riparian Reserves, AOC, CHU, and Middle Santiam River Corridor over a time period greater than with either Action Alternative. The No Action Alternative puts the area at a much higher risk to disturbance agents. A much swifter and far less risky silvicultural pathway to the desired future condition would be initiated through treatments proposed in the action alternatives rather than the No Action alternative.

Both action alternatives would meet the stated purpose and need for this project area. The thinning treatments reduce the competition in treated areas. This moves these stands backwards along the successional pathway from stem exclusion to the stand initiation stage. The reallocation of growth after treatment hastens the development of larger diameter trees. There is development of late-successional forest characteristics that is achieved through patch cutting 10% of some of the

stands. Combined, all of the treatments promote the development of large trees, multi-storied canopies, horizontal patchiness, and species diversification.

The distribution of seral conditions over the project area would not change substantially following implementation of this project (see Table 31) however, the prescribed treatments of both Action Alternative would move these stands toward the desired conditions of sustained growth and development of late-successional forest conditions.

The criterion for measuring the effectiveness of each Alternative in meet the Purpose and Need was discussed earlier. Table 32 illustrates this.

Table 32 - Purpose and Need Objective Measurment Criteria by Alternative

Criterion	Alternative 1	Alternative 2	Alternative 3
Increase growth and vigor of residual trees	None	Yes	Yes
Accelerated Late Successional Structure/Complexity	None	Yes - On 1549 Acres	Yes - On 1412 Acres
Amount of Wood Products Produced	None	30,980 CCF	28,240 CCF

Consistency with Direction and Regulations – Vegetation - General

The commercial thinning treatments are consistent with standards and guidelines in the Forest Plan as they relate to commercial thinning (MA-14a-13) and the land allocations. All thinning treatments; with the exception of 12 acres in Unit 26, would take place on land classified as suitable for timber production. Thinning maintains or enhances species diversity through the development of understory vegetation. The stands have not reach culmination of mean annual increment, therefore no regeneration harvest is planned. The exception to this is the DTR's established to improve late seral structure in the uplands of the CHU and AOC. Evaluations of adjacent plantations verify the ability to restock these areas in 5 years. Therefore the proposed thinning treatment and DTR's are consistent with the requirements of NFMA (16USC 1604 (g) (3)).

Treatments prescribed for stands in the project area are consistent with direction:

1. Thinning would improve tree growth and vigor. This would generate resistance to disturbance agents in individual stands and across the project area.
2. Species diversity would be increased by biasing towards the removal of Douglas fir in most units treated.
3. Both vertical and horizontal spatial diversity would be increased using a variety of thinning and DTR prescriptions in the Matrix, Riparian Reserves, AOC, and CHU. This would create late seral structure.
4. No stands would be thinned past 50% canopy closure.
5. No DTR's would be created in the Riparian Reserves.
6. No treatments would occur in the primary shade zone of the RR.
7. This treatment would not cause the project area to go below the threshold of 50 – 11 – 40 as directed for AOC management.

Additionally, the project is consistent with the competing vegetation direction. In the thinning units, competing and unwanted vegetation is not a concern due the age of the stands, seral stage condition of the stands, and the proposed treatment type. These stands are 28-56 years old and are dominant in size and height to any competing vegetation. Over the long term, the canopy cover would expand back to where the shading would control the levels of any potential competing vegetation during the next rotation.

Competing vegetation may come into effect in the small DTR cuts. These small patch cuts are planned to be reforested. The prevention strategy was selected. This strategy includes timely planting of conifers in the small patch cuts after the thinning operations are completed.

Vegetation - Sensitive and Survey and Manage Botanical Species

Introduction-Sensitive and Survey and Manage Botanical Species

Sensitive and survey and manage botanical species, including vascular plants, lichens, fungi and bryophytes contribute to the overall diversity of the Middle Santiam and many of these species are considered old-growth related. Two project objectives relate explicitly to sensitive botanical species; these are encouraging development of diverse species composition including hardwoods and other minor species, and encouraging development of connectivity to aid in dispersal and genetic exchange that contributes to species viability. A number of survey and manage and sensitive species, particularly lichens, are disproportionably found on hardwoods and Pacific yew, and most are dispersal limited. Dispersal and geneflow of some late-successional species are currently being restricted by the extensive harvest of private and federal lands in the checkerboard (Middle Santiam Watershed Analysis, 1996). Many of the sensitive species are also designated as survey and manage species (refer to the 2001 Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Design criteria Standards and Guidelines and Appendix D to determine which species are sensitive, survey and manage or both).

Basis for evaluating effects-Sensitive and Survey and Manage Botanical Species

- Measurement criteria – Presence/absence
- Scale of analysis, both direct/indirect effects and cumulative effects – Distribution within the watershed and rangewide if there may be effects that push a species toward listing under the Endangered Species Act (ESA)

Existing Condition- Sensitive and Survey and Manage Botanical Species

Prior to the 2005/2006 sensitive species surveys, five Region 6 sensitive botanical species had been documented in this portion of the Middle Santiam watershed, along with five survey and manage species. Three sensitive lichen species (also survey and manage) had been documented in the watershed. These species are epiphytic lichens that are generally found in or near old-growth forests. The species are *Peltigera pacifica, Pseudocyphellaria rainierensis* and *Nephroma occultum*. In addition, there is one sensitive fungi population of *Bridgeoporus nobilissimus* in the project area. This species produces a perennial conk on large diameter noble fir *(Abies procera*) stumps and snags. There is also one sensitive vascular plant, *Ophioglossum pusillum*, in the project area. This species inhabits meadows and wetlands. There are three survey and manage fungal species known to occur in the project area: *Albetrellus ellisii, Polyzellus multiplex,* and *Sarcodon fuscoindicus*. Finally, there are two survey and manage lichens documented here: *Leptogium rivale* and *Nephroma bellum*. *Leptogium rivale* is an aquatic lichen found in cold water streams. *Nephroma bellum* is a small epiphytic lichen found on trees and shrubs. All of these populations appear to be stable, and would not be affected by activities within the Middle Santiam Thin project area.

Seventy-three Region 6 sensitive plant, lichen and fungal species were evaluated to determine if they or their habitat would be impacted by this project. Many sites of sensitive lichen species were found in or adjacent to the planned thinning units.

Habitat exists for 49 of the 73 species. Of the 49 species, 17 are fungi for which no surveys were conducted. Fungi are listed in Survey and Manage Categories B and D, for which surveys are considered impractical (USDA, USDI 2001). Surveys were done for the remaining 32 species. The species that were found and the number of populations located are listed in Table 1 in the botanical report in Appendix F. Fifty three sensitive lichen populations were located of the following three species*: Nephroma occultum* (two sites*), Peltigera pacifica* (four sites), and *Pseudocyphellaria rainierensis* (47 sites). All three species are on both the sensitive and survey and manage lists. Additionally, 19 populations of *Pseudocyphellaria mallota* were located. This species is listed on Oregon Natural Heritage Program's List 2 and is expected to be added to the sensitive species list in the winter of 2007. *Leptogium rivale* is an aquatic lichen found in seven streams; it is also a survey and manage species. It was not transferred to the Sensitive Species Program because it is presumably protected by Riparian Reserves. It is now on Oregon Natural Heritage Program's List 4, their Watch List. One population of the sensitive plant *Ophioglossum pusillum* was located in a wetland in between two of the thinning units. Further information about these species is found in the Biological Evaluation.

Direct and Indirect Effects- Sensitive and Survey and Manage Botanical Species

Introduction: Persistence of lichen species may be threatened by host tree removal, windthrow, changes in microsite conditions, changes in epiphyte ecology and competition in more open stands, and by dispersal limitations in more widely spaced stands (USDA, USDI 2003). In some cases thinning may be beneficial to these epiphytes by enhancing tree species diversity, including Pacific yew and bigleaf maple, two tree species known for their abundant lichen communities. Changes in hydrology, including water temperature and sediment may affect *Leptogium rivale*, an aquatic lichen found on submerged rocks in clear, cold streams (USDA, USDI 2003).

Documented sites were evaluated and those deemed at risk from the proposed action would be protected under all alternatives.

<u>Alternative 1 – No Action</u>

Alternative 1 would provide the most benefit to survey and manage and sensitive fungi because most of them form mycorrhizal relationships with conifers and thinning has been shown to have negative short term (5-7 years) impacts to fungi (Pilz et al 2003).

Under Alternative 1, No-action, no acres would be thinned and the stands would undergo a slow decline before presumably opening up enough to provide an understory. Windthrow, snowdown, and insect and disease pockets would create openings. Coarse woody debris would be abundant as trees die due to overcrowding. Indirect effects to sensitive fungi would likely be minimal.

The proposed stands provide potential habitat for a number of plant species. Three plant species, *Botrychium minganense*, *Botrychium montanum* and *Cimicifuga elata* inhabit forested habitat. Potential habitat for these plants would deteriorate as the dense canopies of Douglas-fir close in and darken the forest floor. The *Botrychium* species require the presence of western redcedar, which is currently a minor component of the stands. Without thinning, the western redcedar would be suppressed by the dominant Douglas-fir and would not provide habitat for these species. *Cimicifuga elata* prefers more open stands with a well developed hardwood component. The development of these stand characteristics would be delayed in the absence of thinning.

Alternatives 2 and 3

Due to design criteria in the action alternatives, no direct effects to known lichen sites are anticipated. It is likely that individual sites of fungi may be negatively affected in the short term by host tree removal, physical disturbance, soil compaction, and disruption of mycelial networks if the fungi are present (Kranabetter and Wylie 1998, Ameranthus and Perry 1994). Twelve of the sensitive fungi are mycorrhizal and require a host plant. Reductions in the number of fruiting bodies of chanterelles, a common mycorrhizal species, were noted after initial thinning but appear to rebound after several years (Pilz et al 2003). One hundred thirty seven more acres are thinned in Alternative 2 than in Alternative 3. Given this, Alternative 2 would likely have a slightly greater direct impact on fungi if they occur in these stands. Although individual and short term impacts may occur, it is not likely to result in a trend toward Federal listing or loss of viability for survey and manage and sensitive fungi species.

Indirect effects to survey and manage and sensitive species and their habitats vary. The harvest prescriptions are primarily thinning to 50% canopy closure (or about 90 trees per acre) without the creation of gaps. Minor forest tree species are favored in the prescription over Douglas-fir. This may lead to an increase in stand complexity and diversity over the long term (20-100 years). In the short term, the proposed action may reduce habitat for sensitive mycorrhizal fungi due to host tree removal and a reduction in moisture retention capabilities due to the drying effect of overstory removal. There is an optimal amount of organic debris and of moisture and too little or too much of either can be detrimental (Harvey, et.al. 1981; O'Dell, et.al. 1999). Further, one tree species that is being favored by the thinning prescriptions is western red-cedar (*Thuja plicata*) and this species does not support ectomycorrizal species. A large proportion of western red-cedar in a stand reduces contact between root systems of host trees (Kranabetter and Kroeger 2001). Four of the stands would have ¼ acre gaps on 10% of the stand. Species richness of ectomycorrhizal fungi decreases exponentially as gap size increases (Durell et. al. 1999).

Soil compaction resulting from harvesting equipment and the creation of temporary access roads can reduce host tree root growth and root tip availability for fungi (Amaranthus, et.al. 1996; Amaranthus and Perry 1994; Williamson and Neilson 2000). One mile of new temporary road will be constructed in the action alternatives, two miles of non-system spur roads will be reconstructed, and 275-280 landings will be used. Additional compaction may occur during the grapple piling of fuels. Thinning may also affect lichens by removing substrate and altering the microclimate (Sarr

et. al. 2005). Some survey and manage lichens are thought to be dispersal limited rather than sensitive to microclimatic changes (Sillett 1995). Despite these possible effects, thinning would take place in such a way to enhance late-successional characteristics over the long term. This includes greater diversity in stand structure and stand species. Kranabetter and Kroeger (2001) note that thinning prescriptions that leave some stand basal area with good tree vigor may accommodate both commercial timber harvest and mycorrhizal fungi. The addition of understory trees and shrubs may benefit the sensitive mycorrhizal species. Duff retention and coarse woody debris creation would benefit both the sensitive mycorrhizal and saprophytic species (Lindblad 1998). Western redcedar underplanting in and around alder swales would eventually create habitat for sensitive *Botrychium* species. Alternative 2, which treats 137 more acres than Alternative 3, may have an increased beneficial effect over the long term.

Buffers around sensitive lichen species protect the sites from direct disturbance but may have indirect adverse effects as the trees grow and a dense canopy results.

Cumulative Effects - Survey and Manage and Sensitive Botanical Species

The area analyzed for cumulative effects was the Middle Santiam watershed. About 46,000 acres of old-growth forest was clear-cut in the Middle Santiam watershed from 1950 to 1990. These forests certainly contained multiple populations of survey and manage and sensitive botanical species. Fungal diversity declines with clear-cutting and fire (Byrd, et al 2000, Bruns, et al 2002) and all of the stands were burned after harvest. *Pseudocyphellaria rainierensis*, *Nephroma occultum* and other survey and manage species were most certainly present in some of those old-growth stands. Numerous western redcedar stumps attest to the past presence of a greater amount of cedar that may have provided habitat for the *Botrychium* species. There has been no timber sale activity in the Middle Santiam for nearly 10 years on Forest Service lands, however, nearly 45% of the acreage in the watershed is owned by private timber companies that have continual harvest activities.

Despite the large amount of past harvest activity there are 17,626 acres of mature and old-growth forests still remaining in the watershed. These forests serve as refugia for many survey and manage and sensitive species that would be able to re-colonize the younger stands as they mature and become more complex is structure and diversity.

Conclusions and rationale for conclusions- Sensitive and Survey and Manage Botanical Species

In the long-term (20-100 years) habitat for survey and manage and sensitive botanical species would be enhanced in the action alternatives. Many species would re-colonize the younger stands as they mature and become more complex is structure and diversity.

Monitoring- Sensitive and Survey and Manage Botanical Species

Five to ten percent of the survey and manage and sensitive lichen sites would be monitored one year after harvest to determine that the buffer width is adequate to protect the species.

Vegetation - Invasive Plants

Introduction- Invasive Plans

An invasive plant is defined as "a non-native plant whose introduction does or is likely to cause economic or environmental harm or harm to human health" (Executive Order 13122). An estimated 420,000 acres of Forest Service lands in Region 6 are infested with invasive plants (USDA 2004). Invasive non-native plants, including invasive weeds, are a threat to native plant communities. These species thrive in a new environment because they arrive without the complement of predators, disease, and other ecosystem components found in their native region of the world. Most of these species take advantage of disturbance gaps such as logged units, roads, rock quarries, burned areas, and trails. Weed seeds and other propagules can be introduced into an area by a variety of agents, most notably wind, highway and off-road vehicles, and construction equipment. They can also disperse by way of water, animals, and humans. Once established, these populations serve as a seed source for further dispersal, generally along roads and trail corridors.

One of the project objectives for Middle Santiam Thin is "minimizing the spread of existing non-native/invasive weeds and avoid introduction of any additional species or populations of non-native plants/invasive weeds into the area for the long term".

Basis of analyzing effects- Invasive Plants

- Measurement criteria – Presence/absence.
- Type of analysis – Risk Assessment
- Scale of analysis, both direct/indirect and cumulative effects – The Donaca Creek, Pyramid Creek, and Headwaters Middle Santiam River subwatersheds of the Middle Santiam Watershed.

Current Condition-Invasive Plants

Roads serve as invasive species corridors due to their disturbed soils, greater light levels, and vehicle traffic (Parendes 1997). There are currently 180 miles of road in the analysis area. Thirty-two invasive weed species have been documented in the watershed. The most serious weed infestations in the Middle Santiam Thin sale area are yellow toadflax (*Linaria vulgaris*), Scotch broom (*Cytisus scoparius*), false brome *(Brachypodium sylvaticum*), Himalayan blackberry (*Rubus armeniacus*), evergreen blackberry (*Rubus laciniatus*), St. John's-wort (*Hypericum perforatum*) and ox-eye daisy (*Chrysanthemum luecanthemum*).

Yellow toadflax is a perennial species with showy yellow flowers and a spreading woody root system. It is a native of Eurasia and was introduced as an ornamental. There is a large population in a mesic meadow in Unit 42.

Scotch broom is an established weed that favors roadsides and early seral plantations. It is shaded out in late-successional stands. Scotch broom is capable of fixing its own nitrogen using rhizobium in its roots. This allows it to thrive in habitats that are otherwise compromised, such as compacted soil and wastelands. There are large populations on landings in Units 15 and 36, and it is

scattered along Roads 2047 and 2047-852. The seeds of Scotch broom can persist in the soil for decades and germinate if the soil is disturbed.

False brome is a highly invasive grass that has the capability to dominate the forest floor to the exclusion of native species. It has a broad ecological amplitude that allows it to succeed in heavy shade or in openings, such as meadows and roadsides. It does not appear to have forage value for big game and so receives little or no grazing pressure. It contains a neurotoxin endophyte in its leaves (Bitty, pers. comm.). Possible design criteria include deleting infested areas from units, leaving a no harvest strip along roadsides, pre-treating the sites with herbicides or hot foam. False brome is found in Units 19, 28, 30, 36 and along Roads 2041, 2047, and an unnumbered spur adjacent to Unit 1.

Himalayan and evergreen blackberries prefer open areas and roadsides but also persist and spread under the forest canopy. Both species are spread by birds and other animals that eat the berries and both species spread vegetatively by root tipping. These species are found along the roads in or adjacent to Units 9, 12, 16, 18, 19, 20, and 27.

St. John's-wort and ox-eye daisy are well established weeds of roads, meadows, and rocky openings. Both species are found along roads in all of the units and several meadows and other special habitats within the units. This wide distribution is likely due to the initial ground-based harvest, which was extensive and covered areas that would not be considered suitable for that logging system today.

Timber sale contracts are now required to include provisions to minimize the introduction and spread of invasive plants. Weed populations in the units and along transportation routes must be mapped on the sale map and equipment-cleaning areas need to be identified.

Thinning may enhance habitat for all of these weed species by opening up the canopy and creating seed germination sites by disturbing the soil. In addition, new weed species may be introduced on logging and slash treatment equipment. Alternatives that harvest the most acres and construct the greatest length of road have a higher risk of weed invasion.

Direct and Indirect Effects- Invasive Plants

Alternative 1 – No Action

The No Action Alternative has the least risk of spreading weeds. Few weed species can survive the deep dark conditions that would result from foregoing thinning in these stands. Although opportunities for funds would not be generated, there is less risk that weeds would spread into the closed canopy stands, not only due to light limitations but also because there would be no equipment in the stands that could potentially spread weed seeds.

Alternatives 2 and 3

Direct effects of timber harvest on weed introduction and persistence are due to a combination of soil disturbance and transport of seed. In the action alternatives, the areas that would be permanently opened up to light and disturbance would be most at risk, e.g., roads and landings. These areas are disproportionately subject to ground disturbance and exposure to vehicles and

equipment that may bring seed in. Risk decreases in areas where roads and landings are closed, rehabilitated, and seeded with desirable species.

In both Alternative 2 and 3, a 100-foot containment buffer would be left around false brome in Unit 19 to maintain a dense canopy adjacent to the road (see individual unit prescriptions and maps in Appendix A). This buffer would prevent this population from spreading by maintaining a dense canopy and limiting mechanical disturbance that could spread the existing weed seed bank into the stand. Although care will be taken to treat existing sites prior to thinning, there remains a seed bank in the soil of unknown longevity. All other sites of false brome in the analysis area were small, on roads and all have been treated with herbicide. There are large populations of scotch broom on landings in Unit 15 and 25 and a smaller population in Unit 36. The landing in Unit 25 would not be used and would be buffered by 50 feet. In order to reduce the spread of the other populations the purchaser would be required to place filter cloth over the two landings and subsequently cover them with at least six inches of gravel.

Alternative 2 has a slightly higher risk of increasing weed sites than Alternative 3 because it treats 137 additional acres where potential soil disturbance could provide seed beds. However, the 137 acres would be harvested by helicopter, a logging system that tends to create the least amount of disturbance and which does not introduce weed seed. Five helicopter landings would be constructed under Alternative 2. Five thousand three hundred twenty five feet of new, native-surface, temporary spur road is built in both action alternatives. This is in addition to the 11,675 feet of existing spur roads that would be opened up. This additional disturbance increases risk of weed establishment. Roads are well documented as vectors of weeds (Parendes 1997). Further, 365 acres would be grapple piled for fuel reduction in Alternative 2 and 3 causing more soil disturbance.

In the Risk Matrix below (Table 33), Alternative 2 shows the highest risk of promoting invasive weeds due to a larger level of ground disturbance and habitat modification represented by more disturbance via ground-based, skyline harvest, and helicopter harvest. Due to the increase of acres in Alternative 2 over Alternative 3, more money generated from this timber sale would be available for weed surveys and control after thinning occurs.

Table 33 – Comparison of Invasive Weed Introduction and Establishment by Alternative

Activity	Alt. 1	Alt. 2	Alt. 3
Acres treated (1549 in Alt. 2 and 1412 in Alt. 3)	0	3	3
Construct new native-surface temporary road (5325' in Alt. 2 and 3)	0	2	2
Reopen existing non-system roads (11,675' in Alt. 2and 3)	0	3	3
Road maintenance (73.6 miles of haul routes for both Alts. 2 and 3)	0	2	2
Subsoil skid roads (55 acres in both Alt. 2 and Alt. 3)	0	3	3
Helicopter landings (5 in Alt. 2)	0	3	0
Landings, new and existing (280 in Alt 2 and 275 in Alt.3)	0	3	3
Acres of grapple piling (207 acres in Alt. 2 and 207 acres in Alt. 3)	0	2	2
Sale-generated dollars collected for mitigation	2	0	0
Totals	**2**	**21**	**18**

Assigned risk values of 0 = no risk; 1 = small risk; 2 = moderate risk; and 3 = large risk. Derived from relative risk of invasive weed introduction and establishment by alternative based on the level of weed promoting activities within each alternative.

Cumulative Effects – Invasive Plants

The area analyzed for cumulative effects is the analysis area and the road system accessing the analysis area. Ground-disturbing activities such as ground-based yarding systems used during timber harvest, road construction and reconstruction, vehicular traffic and recreation use contribute to the incremental increase in invasive weeds. Analysis included reviewing all proposed harvest units in the field to determine existing weed infestations. The pattern of known invasive weed sites was then reviewed along with the mechanisms for introduction, establishment and/or expansion of invasive weeds and comparing this with similar past, present and future foreseeable actions to determine potential impacts.

The impact of non-native invasive weeds on native plant communities is cumulative. The more disturbance and activity any given area is subject to, the more the risk of invasive weed introduction, establishment, and/or expansion. Past road construction and maintenance (approximately 180 miles in the analysis area), timber harvest (approximately 26,215 acres on Forest Service lands), checkerboard ownership pattern, and recreation use have resulted in numerous weed sites. The prevalence of ground-based harvest in the past likely resulted in numerous weed populations getting established within the stands. This project would open and reclose approximately 2.2 miles of non-system road, construct one mile of new temporary road,

and thin between 1412 and 1549 acres. Road maintenance, vehicular traffic, and harvest on private lands would continue in the foreseeable future and may spread or introduce weed seed, leading to new infestations.

Conclusions and rationale for conclusions- Invasive Plants

The spread of invasive weeds would be minimized through preventative measures taken prior to, during, and after thinning operations. Both action alternatives provide design criteria that would reduce the long-term likelihood of expanded weed populations. These include buffers around known weed sites, logging equipment washing, post-treatment survey and control and pretreatment of existing weed sites. The canopy in the treated stands is expected to close in 10 to 20 years, and this would further reduce habitat for some weed species. False brome, a species that can flourish in the understory even in closed canopy stands, has the highest likelihood of expanding despite design criteria. Diligence would be required to keep this highly invasive species from overtaking the understory over the long-term. These efforts would be required whether the stands are thinned or not because the species is so tolerant of low light conditions.

Monitoring- Invasive Plants

The proposed harvest units and associated road system would be monitored for invasive weeds for five years after harvest is complete.

Geology/Soils

Current Condition- Geology/Soils

Displacement occurs with three separate timber harvest activities: yarding, slash treatment, and road building and maintenance. Yarding activities on the existing plantations have for the most part occurred with the appropriate suspension requirements. Suspension requirements deal with how much the log will be suspended above ground during yarding. Slash treatments usually maintained some amount of duff though the current duff retention standards may not have been achieved. Whether these two activities resulted in detrimental displacement in the past is very difficult to determine. Stand, shrub and brush growth, as well as duff accumulation over the decades has provided an effective ground cover. At the point in time, little physical evidence can be found to indicate that these two timber management activities resulted in significant, long-term detrimental soil displacement or off-site soil movement.

Road development in this project area is extensive, and most large blocks of forest have been accessed. Most major road systems were constructed in the 1960s and 1970s with older road construction standards, though most roads are located on stable benches, flats or ridges. However, the road system was constructed when few location and construction controls were in place. Consequently, several areas with extensive side cast construction exist, and several road locations cross actively unstable or potentially highly unstable soil areas. The amount of new road construction slowed considerably in the late 1980s, and with subsequent entries reconstruction began to dominate. Newer roads, when required, were constructed to different and better standards. Road grades were steepened and pitched to better fit roads to the terrain. Cuts and fills were minimized, and drainage controls were added to promote long term slope stability. Most road cuts and fills have naturally vegetated over the years. Because the Middle Santiam is a naturally sediment rich system, erosion from roads is not generally considered a concern, except in a few localized areas.

Compaction- The major source of compaction (and also much disturbance) is ground-based skidding equipment. Unrestricted tractor yarding and tractor piling are not considered an option on those landtypes where sideslopes are gentle enough (generally less that 30%) to support tractor usage (BMP T-9 and VM-1, and FW-107). The silty nature of the fine- grained soils, and evidence that significant soil moisture is available most of the year indicate that any type of unrestricted tractor yarding and piling (even low ground pressure) would lead to unacceptable soil compaction and/or disturbance. Restricted tractor yarding from predesignated skid roads (LTSR) is considered an option if the adversely affected area is less than 20% of the activity area (BMP T-11). In units that will be yarded with ground-based equipment, skid roads would be predesignated, approved in advance of use by the Timber Sale Officer and generally 150 to 200 feet apart. With a processor/forwarder system the skid roads are usually only about 50 to 60 feet apart, but the number of trips for each individual road are substantially less than with conventional skidding. Reducing the effective weight of the tractors by a) yarding over frozen ground or over deep, solid

snow pack (24 inches of dense snow or equivalent; b) by buffering with slash mats or c) reducing the number of trips over a piece of ground are other means to reduce the risk of soil compaction and displacement (BMP VM-4).

Monitoring has shown that when designated skid roads are properly utilized in conjunction with line pulling and directional falling, compaction from ground-based tractor operations generally remains at about 9 to 13%. Residual compaction from the original harvest of these plantations needs to be considered. In most cases, the original units were cable or skyline yarded, though suspension may have been limited. In some instances, ground-based systems were utilized, especially on the flatter ground.

Nutrient Loss- A wide variation also exists in the amount of decomposing organic matter now found in these plantations. Most of the plantations were harvested within old growth stands that did not have much fire history after the initial conflagrations that established them, hundreds of years ago. The initial harvests occurred prior to the establishment of standards to pile unmerchantable material (PUM), which required that larger waste material (usually 8 inches wide and 10 feet long or greater) be removed from the units to reduce fire intensity. Consequently, a considerable tonnage of materials was left on many units. On the other hand, these stands were generally broadcast burned after harvest, prior to the establishment of duff retention standards. This meant that the slash burns consumed a considerable amount of the above ground organic matter in many areas. Still in all, a wide range in the above ground tonnage of decomposing organic matter exists with amounts generally varying by aspect, side slope, and fire intensity. The variety exists both between and within units.

Instability- The Middle Santiam drainage is considered one of the most actively unstable basins within the West Cascades. Slope instability from slump / earthflow complexes and debris chutes has been naturally active in the last 300 years or more. Some of the largest active earthflows in the West Cascades occur in this watershed. Active slope instability from both debris chutes and slump / earth flow complexes occurs in most subwatersheds. Within this project, Units 3, 9, 26, 28, 40 contain actively unstable or potentially unstable terrain. In addition, Units, 11, 26, 30 and 36 border actively unstable areas, primarily larger slump / earthflows. These units were harvested before the implementation of the National Forest Management Act of 1976, which excluded unstable terrain from timber management. Potentially highly unstable and actively unstable terrains are now considered unsuited for timber harvest. If harvest is proposed, the primary objective on these lands is the maintenance of long-term slope stability. In this case thinning enhances the growth of leave trees and promotes a healthier stand with firmer roots and greater evapotranspiration activity.

The recent intense rainstorms from 1996 to 2000 generated considerable debris chute type slope instability in this portion of the Middle Santiam basin. Numerous debris chutes swarms developed on both the private and federal land. They began as road side cast failures, in-unit slope failures or from unmanaged stands and terrains. For example, Units 27 and 36 both contain debris chute channels from failures that occurred much higher on the slopes. In addition, several small scale

slumps, usually less than an acre in size, also failed from both managed and unmanaged slopes. Interestingly, the numerous major, large scale, slump / earthflows in the project area did not display any direct response to the major rain storms that occurred in the last few years of the twentieth century.

Desired Future Condition- Geology/Soils

The major short-term impacts to soil productivity from harvest activity, as discussed in the Willamette National Forest Final Environmental Impact Statement (FEIS 1990), include displacement, compaction, nutrient loss, and instability.

Displacement -- Displacement is defined as the removal of more than 50% of the topsoil or humus enriched soil horizons from an area of 100 square feet which is at least 5 feet in width. Displacement can occur with timber management during road or landing construction, yarding, or the mechanical treatment of slash, such as machine piling. Contract requirements which reduce or eliminate displacement are the primary way to minimize this concern.

Compaction-- Compaction is defined as an increase in soil bulk density of 15% or more and/or by a reduction of macropore space of 50% over the undisturbed soil. Excessive soil compaction from heavy, mechanized equipment used during logging can decrease soil productivity by restricting root growth, reduce rainfall infiltration rates, and increasing over land flow and run off. Prior management on some units, conducted before any requirements were established, created compaction conditions which now approach or exceed the currently accepted standards and guidelines. Activities which minimize further compaction such as skyline logging, utilizing existing compacted areas as much as possible, or reducing existing compaction through mechanical means (subsoiling) are proposed.

Nutrient Loss --The primary mechanism for nutrient loss is uncontrolled wild fire. Fire recurrence intervals of 100 to 200 years are apparent in the natural system, with shorter intervals recorded in some critical high lightning areas. The actual thinning or harvest of these units is not as much concern for long term soil productivity as the concomitant slash accumulation and the potential for wild fire. On the other hand, No Action is not considered beneficial for long-term soil productivity either. Overstocked stands would rapidly see density increase, growth slow, and mortality rise. Fuel accumulations from blow down, snow down, and bug kill provide an ever increasing amount of fuel loading. Activities, which reduce stocking levels, improve stand vigor, and eliminate excessive fuel loading are favored.

Instability -- Slope instability is also a natural ecological component of the Cascade Range ecosystem. Debris chute failure recurrence is generally associated with more episodic large fire and / or flood events. Slump / earth flow instability is more steady state and may extend for centuries. Slope failures of either type carry large wood and rock to stream systems. This material is needed to

both create suitable structure for sediment storage and provide the gravels required for fish and other aquatic habitat. On the other hand, numerous failures, without the associated boulder or log structure, can overload a system with sediment and destroy functioning habitat. Activities which do not exacerbate existing unstable areas or promote long-term stability are favored.

Direct and Indirect Effects- Soils/Geology

Scale of Analysis: For the soils resource the scale of analysis for both direct / indirect effects and cumulative effects is almost always the "unit", i.e. the stand polygon proposed for silvicultural treatment. The unit of measure for evaluating those effects is generally considered the percent of the "unit" affected. The summing of acres for various units, such as the total acres of skyline logging in a given alternative, is not an evaluation criterion for soils impacts. Impacts are evaluated on a unit-by-unit basis, and are generally the same in any given unit for all action alternatives, unless otherwise noted.

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

The following sections discuss in more detail (1) how the proposed action may affect the soil resource or (2) mitigations that can be utilized to avoid potentially undesirable effects. In most situations, preventing soil impacts is the most effective and feasible way of ensuring long-term soil productivity.

Alternative 1 (No Action)

In areas already compacted or disturbed by the initial entries, the soil building process would continue to return the soil to near pre-harvest conditions though this could take decades. Short-term impacts from harvest, such as soil disturbance, compaction, and slash accumulation with potential treatment would not occur.

Instability from slope failures would be little affected in the short run. In the longer-term, suppression of growth because of the tree density would restrict canopy development. This could reduce the water uptake of the stand and begin to adversely affect water regimes. This might result in increased instability in some areas.

All Action Alternatives

All action alternatives have the same basic effects and the same soil protection measures, as described on a unit-by-unit basis.

Displacement- The logging suspension requirement (either "one end" or "full" log suspension above the ground during yarding), for a proposed unit is mandated in the LMRP to protect the soil from excessive disturbance or displacement (FW-107 and BMP T-12). The area near tail trees and landings is generally excluded from this suspension constraint. Unless otherwise stated or

mitigated, all designated streams require full suspension or yarding away from the stream course during the yarding process (MA-15-27). To adequately protect the soil resource, the primary yarding objective for all units would either be skyline with partial or "one end" suspension or a ground-based system with designated skid roads, or some combination of the two.

Ground-based yarding systems may be employed on those acres in each unit where slopes are gentle enough (generally 30% or less) for ground-based systems. Ground-based yarding systems, such as processor / forwarder, conventional line pulling or shovel, could be utilized in small parts to almost all of Units 1, 2, 3, 8, 9-12, 14, 17, 18, 19, 21-29, 32-38, 41-44, 46, 47, 48, 49, and 52. Many of these units have small areas adjacent to roads, benches at skyline landings, or along flatter ridges, where a ground-based system, could be effectively utilized. All areas where ground-based yarding might occur are well away from active drainages, or skid roads would cross ephemeral swales only during dry periods and at right angles. All ground-based yarding would require pre-designated skid roads (LTSR-Located Tractor Skid Road), and/or line pulling and directional falling, as appropriate. In all cases, existing skid or haul roads would be utilized before any additional new skid or forwarder roads are developed. Skyline yarding with one end or partial suspension would be used in portions or all of almost all units, except Unit 40, where full suspension is required in order to minimize disturbance to the actively unstable soils.

In conclusion, disturbance from yarding would be well within the Regional standard of 20% or less and significant adverse impacts are not anticipated. With appropriate suspension during logging, soil disturbance is minimal and off site erosion is essentially non-existent. During harvest, the retention of stream adjacent trees and the requirement of full suspension yarding over stream courses would minimize or eliminate off-site erosion.

Compaction- Evidence of compaction from previous entries is still present. Transects through Units10 and 22 show existing compaction levels at greater that 20%. Three transects in Unit 10 indicated primary skid roads occupy about 20%+, 26% to 30%, and 30%+ of the area. These values are approximate as the unit is very brushy in some locations. Also, these results do not take into account the graveled system roads and small gravel stockpile site within the unit. Three transects in Unit 22 ranged from 20%, 22% and 25%. On the other hand, existing compaction values in Unit 41 and Unit 42 (north half), both proposed for ground-based harvest were only about 10% to 12%. The flatter areas of many units often contain numerous spur or truck roads, though from a unit perspective, these areas do not aggregate into excessive compaction levels. Examples include Units 5, 6, 15, 19, 21, 25, 29, 35, 36, 37 and 42 as well as many others.

Ground-based systems would again be utilized in portions of some of these units. The evident skid or haul roads would be reused before any new skid roads are implemented.

The thinning treatment entry into Units 10 and 22 provides an opportunity to subsoil the existing skid roads as much as is practical in order to reduce compaction. The objective of subsoiling these units is to bring these units into compliance with the current standards by reducing over all compaction below the 20% level. Based on previous experience, this effort should be successful in Unit 22. In Unit 10, the overall compaction would certainly be reduced from

prethinning levels, but the 20% objective may or may not be achieved. This is in order to reduce the amount of root pruning of leave trees and to avoid excessive amounts of exposed soil. These units will be monitored closely during project implementation and will be subsoiled following harvest activities.

Skyline operations in thinning units with small wood and intermediate supports usually impacts less than 1% of the unit area. Skyline yarding is proposed for those units that were originally tractor harvested on terrain that is now considered too steep to operate. In many units, little new spur road would be required. As a mitigating measure, at the completion of harvest activities, some subsoiling is proposed in order to reduce compaction on temporary, non-rocked roads, heavily-used skid roads, and landings. Skyline landings are primarily planned at old existing landings, road turnouts, and road junctions. In summary, with the use of designated skid roads, the reuse of the existing skid road system, and the subsoiling of primary landings and skid roads, compaction is not anticipated to exceed the 20% value in any unit (except perhaps Unit10) and should be below the 15% level (or lower) in most units. Therefore it is not cumulatively significant.

Some units require temporary roads to access suitable landing sites for either ground-based or skyline yarding systems. In all cases, these temporary roads are located on gentle stable side slopes in common material. No full bench construction is required and for the most part no active drainages are crossed. Some units are accessed by opening old logging roads constructed many decades ago. In most cases, use of these old roads would allow for drainage structure improvements and fill stabilization. Some units are accessed by using newer Forest Service roads that now require some additional work to maintain adequate road drainage and surface integrity. A discussion of the temporary road access for each unit is included in the individual unit prescriptions in Appendix A in the Soils Report in Appendix I. In summary, development of the transportation system for this sale would maintain slope stability, would produce little or no off site erosion, and would provide opportunity to rehabilitate old road courses.

Nutrient Loss- For all action alternatives, within the managed plantations, slash would either be scattered in the units or piled and burned. Piling may occur by hand or with machine. Machine piling occurs with a grapple not with a dozer. Grapple piling requires only one pass of the machine across the landscape, and the machine works while sitting on slash. Extensive monitoring of machine piling operations indicates that little or no additional compaction or displacement occurs. On typical thinning, hand piles or machine piles number about 40 per acre and occupy about 20 square feet per pile for a total of about 800 square feet per acre or about 1.8% per acre. Burning the piled slash may develop sufficient heat to affect the underlying soil. However, pile burning is usually done when duff and soil moistures are higher, and this helps reduce the downward heat effects to the soil. Consequently, pile burning is considered a minor effect and not cumulative because of the limited overall acreage involved.

Another aspect of long term nutrient availability and ectomycorrhizal formation is the amount of larger woody material retained on site. Management activities would be planned to maintain enough large woody debris (dead and down) to provide for a healthy forest ecosystem and ensure

adequate nutrient cycling (FW-085). At this time, site specific needs would be considered commensurate with wildlife objectives as outlined in FW-212a and FW-213a (as amended).

In summary, duff retention objectives would be provided on a unit-by-unit basis in the unit summary table. Concentrations of larger down logs that were produced with the initial harvest should be left undisturbed as much as possible. Consequently, with the retention of adequate duff and woody debris, potential adverse impacts to long-term soil productivity are not anticipated.

Instability- Within this project, Units 3, 9, 26, 28, 40 contain actively unstable or potentially unstable areas. In addition, Units 9, 11, 26, 30 and 36 border actively unstable areas. For the most part, actively unstable areas would be avoided with unit placement. With regard to Units 3, 26, and 28, they contain small areas of older, stablilized debris chute scars. Failure depths are within the rooting zone. Thinning would enhance the growth and root development of leave trees thus enhancing rooting strength in these areas. No specific mitigation is proposed for these areas. Thinning prescriptions should be the same as the adjacent parts of the unit.

Slope instability within the proposed thinning units that avoid potentially highly unstable or actively unstable terrain, is not considered likely. Potential adverse off-site effects from the harvest are not anticipated, and the potential for significant adverse cumulative effect is quite low.

The specific purpose for thinning a portion of Unit 26 (eastern 12 acres of the unit) is to promote and enhance growth on the leave trees in this actively unstable earthflow. Full suspension logging was proposed to minimize disturbance to the numerous exposed soil slopes and drainage channels present in this area.

In the short-term, until residual trees begin to grow and respond to the thinning, there is a slight potential to adversely affect slope stability after the initial removal of thinned trees proposed on an active earthflow. Immediately after the thinning and until trees have begun to grow in response to the thinning, there are fewer trees on the site taking up water and otherwise stabilizing the earthflow. This risk is considered very low as there was no field evidence to indicate increased instability after the large storm events in 1996-1999 when the trees were a lot smaller and the water was more prevalent than in a normal year.

In addition, there is some uncertainty in the proposed treatment to positively affect earthflow movement rates. Some scientific studies contend that forested slopes can affect the water balance when the trees transpire during the summer months so in the wet season slopes can tolerate a larger storm event before “a critical saturated condition develops” (Gray, 1970). On the other hand Ziemer (1981) contends that “once rainfall satisfies the soil moisture deficit and the soil becomes saturated, tension-induced intergranular pressures (which stabilize the soil) disappear.”

Even though there is some uncertainty in the science, the district has tested this type of treatment in a Flam and Owl Thinning Sale unit in the Adaptive Management Area. The treatment occurred about ten years ago and monitoring so far has shown that the thinning has not increased the rate of slope instability since harvest (see monitoring report in Appendix I). In addition, trees have shown wider growth rings in the last 4-6 years which indicates increased growth and vigor. Using what was learned in the Adaptive Management Area, the thinning technique was applied to

another unit in Sheep Soda Thin about two years ago. Monitoring has shown similar results with respect to not increasing slope instability but it has been too soon since the treatment to see much response in the tree growth and vigor.

Field review of these units and other previously thinned units in the past several years on both stable and unstable landtypes has shown no increase in either slope instability or erosion in either uplands or Riparian Reserves. For both these existing units, as well as the proposed activity, thinning may or may not slow earthflow movement rates. These sites are actively unstable and will likely remain so. However, thinning would create healthier stands with bigger trees that have larger crowns and more roots. Promoting a healthy, vigorous stand makes the stands less vulnerable to insects or diseases, windthrow and breakage from snowloading. There is usually less mortality within vigorous stands and a lighter fuel loading which makes the stand less susceptible to wildfires. Insects, diseases, windthrow and wildfires could weaken or kill the stand on this site which is important for stability here.

Having a vigorous stand on this site would result in increases in crown size and root systems that expand and deepen. These vigorous trees would take up soil moisture with greater efficiency than would a stagnated stand. If more water is taken up during the growing season by this vigorous vegetation, then according to some research by Gray 1970, going into the rainy season the earthflow may be able to tolerate a larger storm before a critical saturated condition develops than it would if less water were taken up by a stagnated stand prior to entering the rainy season.

Thinning would also create bigger trees to eventually provide for larger woody debris for the stream channels that cross this earthflow. “Large woody material here would contribute to sediment storage capacity and dissipation of stream energies which can contribute to stabilizing these stream channels.”

Falling and leaving the trees on site was considered to meet tree growth response objectives. However, this would create fuel loadings that exceed forest-wide standards. These high fuel loadings would create a fire hazard that was not considered acceptable in this sensitive soil area. Consequently, trees felled during the thinning operation would be removed from the site. Removing these trees would also minimize build up of bark beetle populations that could potentially jeopardize the stand as well.

In summary, the thinning on this earthflow is expected to improve long-term slope stability or at least reduce the potential for adverse off-site effects from future failures.

Cumulative Effects- Soils/Geology

At this time, no single unit measure of long-term soil productivity is widely used. Information on the survival and growth of planted seedlings may indicate short-term changes in site productivity. However, the relationship of short-term changes to long-term productivity is not fully understood at present. Experience indicates that the potential impacts on soils are best evaluated on a site specific, project-by-project basis. The major soils concerns - compaction, nutrient loss, displacement and instability - are most effectively reviewed, for both short and long-term effects, at the project level. As proposed, unacceptable cumulative effects on the soils resource are not

anticipated from any of the action alternatives for this project (BMP W-5). Consequently, the utilization of soil protection measures and best management practices as defined in the soils report in Appendix I would generally preclude the need for additional cumulative effects analysis. Deviations from the standards and guidelines would be the primary trigger for a cumulative effects review, and no deviations are planned.

Conclusions- Soils/Geology

The soils design criteria are designed to maintain long term soil productivity and provide a level of erosion control that is consistent with the standards and guidelines of the Willamette National Forest's Land and Resource Management Plan (1990) and Oregon State Department of Environmental Quality guidelines. All prescriptions or design criteria discussed in this report are designed to meet or exceed the requirements outlined in the General Water Quality Best Management Practices Handbook (Pacific Northwest Region, November 1988). Prescriptions for soil protection and watershed considerations take into account past and predicted future land management activities. Standard contract language should provide sufficient erosion control measures during timber sale operations (BMP T-13). Revegetation of areas disturbed by harvest activities (such as landings, temporary roads, and equipment storage areas) is required with an appropriate seed mix (BMP T-14, T-15, and T-16).

Monitoring Requirements- Soils/Geology

As the proposed project is initiated, it would be monitored to evaluate implementation efficiency, prescription adequacy, and to update sale area rehabilitation needs or protection. Primary implementation monitoring would be conducted at the contract administration phase of the project by the Timber Sale Officer. The logger would be required to maintain adequate suspension during the harvest process. In addition, numerous other contract requirements dealing with such items as erosion control, hazardous material use and fire restrictions would be enforced. Duff retention would be monitored as part of any post sale activity that may affect the soil resource, such as spot or pile burning or grapple piling. *For further information see Soils Report in Appendix I.*

Hydrology, Stream Channels, Water Quality and Riparian Reserves

Introduction – Hydrology, Stream Channels, Water Quality and Riparian Reserves

The proposed project area is located in 6th field watersheds: Headwaters Middle Santiam River subwatershed, 20,791 acres, (HUC 170900060102) and Donaca subwatershed, 14,138 acres, (HUC 170900060103). These subwatersheds are part of the larger Middle Santiam River 5th field watershed (66,750 acres), in Linn County, Oregon. The proposed units lie between 1800 and 4500 feet in elevation placing them within the rain-on snow-zone for this geographic setting.

Annual precipitation for the area averages from 60 inches in the valley segments to 120 inches on peaks and ridges. The Middle Santiam project area hydrology is similar to other documented watersheds within the Western Cascades. Peak flows occur during rain and rain-on-snow events in the transient snow zone. Intense precipitation is episodic and often generates peak flows which are a major disturbance mechanism for stream channels and associated riparian areas.

Currently the Middle Santiam River is listed on the State of Oregon's 303d list for excessive water temperature in the summer months. All activities proposed have considered this and the individual units were designed to help reduce near stream temperature through time.

A key feature of the NW Forest Plan is that Watershed Analysis be performed as a systematic way to characterize aquatic, riparian and terrestrial features in a watershed. The Middle Santiam Watershed Analysis was completed in April 1996 by the USFS.

Analysis Methods – Hydrology, Stream Channels, Water Quality and Riparian Reserves

The main method of analysis utilized involved field review of the proposed units, the surrounding area and streams. Field review included walking through and around the perimeter of the proposed units. Streams and wet areas encountered were recorded on either a map base or aerial photo. These were then transferred to integration maps for discussion and development of site-specific prescriptions. Stability, slope, soil types, vegetation, aspect, and juxtaposition of the units were all considered in developing a prescription to protect and/or enhance the hydrology, stream channels, water quality and Riparian Reserves in the proposed project.

Stream, slope, and vegetative conditions were compared to information found in the 1996 Middle Santiam Watershed Analysis (WA) to determine if changes occurred since the drafting of that document. Conditions appeared to be responding typically for Cascade environments and the only discovery made to modify the WA determination was the listing of the Middle Santiam River as temperature impaired for summer rearing of salmonids. All prescriptions were designed to ensure that waters are protected and enhanced through management activities to help the waters of the state recover.

Aggregate Recovery Protocol (ARP) and standard observations of past activities within the watershed were used to determine hydrology, stream channel, and water quality responses to disturbances of the proposed action. Since the ARP levels are currently below desired midpoints values, an Intensive Assessment was completed, as required by the Forest Plan, to determine the effects of the proposed actions. This assessment included reconnoitering all of the stream channels

and locating wet areas within the project area. Site-specific prescriptions were developed for each stream after consideration of the stream's capacity to handle changes in flow, wood loading and solar radiation. The juxtaposition of wet areas to the streams and the potential effects to ground water exchange between the two were also considered. Channel condition types were then utilized from the Forest Plan to help determine downstream risks and professional judgment was used to prescribe buffer widths and riparian prescriptions.

Since the Middle Santiam River was on the State's 303 (d) list for temperatures that exceed State Water Quality standards for salmonid rearing during summer, a Sufficiency Analysis for Stream Temperature was completed. Criteria from the Sufficiency Analysis were utilized to ensure the protection of flowing stream channels from increased solar radiation. Primary shade zones were established and excluded from all treatment on perennial streams. Secondary shade zones were established and maintained at 50 percent canopy closure or greater. Shade nomographs were utilized to determine the benefits of thinning in Riparian Reserves at this time.

An interdisciplinary process was then utilized to determine the desired condition of the stands, and the Riparian Reserves, and their response to treatment. All actions were considered in relation to the prescription and risks were evaluated using models, past management track records, and professional judgment.

Current Conditions – Hydrology, Stream Channels, Water Quality and Riparian Reserves

1. **Hydrology:** The dominant hydrologic mechanism here is rain, and rain-on-snow events. The entire Middle Santiam watershed is within the rain-on-snow or transient snow zone. Precipitation drives the flow levels of tributary streams to Middle Santiam River.

   Minor, less than 1 acre, wet areas exist which meter some flows to tributary streams. These wet areas are associated with geologic changes such as earthflows that are found within the Middle Santiam Watershed. Smaller wet areas associated with the broken topography punctuate the landscape creating water storage areas and vegetative diversity.

   Water storage in these watersheds is associated with deeper upland soils, colluvial deposits, flood plains, earthflow perimeters (historic sag ponds). These areas create small forested wetlands. Colluvial soils, ancient earthflow terraces, and flood plains act like sponges, retaining water and releasing it slowly during periods of low precipitation. General storage is moderate due to the age and hummocky nature of the soils.

   Minimum flows within the Middle Santiam are regulated by water storage features which allow flow to persist during drought periods. Summer flows come from water stored in the broad alluvial floodplains along the main channel of Middle Santiam River and the colluvial and glacial soils found throughout its tributaries along with the hummocky broken ground associated with earthflows. Theses storage areas provide opportunity for hyporheic interactions with the stream (this is the subsurface movement of water through depositional areas). Proposed units within the project area are adjacent to these types of features. Vegetation is the primary user of water with in the watershed with main use occurring between April and

October (typical growing season). Diurnal fluctuations in stream flow are the result of vegetative transpiration rates associated with diurnal changes in light and climatic conditions.

For more information on hydrology in this area see Middle Santiam Watershed Analysis pages 19-25.

2. **Stream Channels**: The Middle Santiam watershed contains naturally unstable areas associated with large earthflows and debris torrents. The topography of the area is defined by these features. Deeply incised parallel streams are found within the project area as evidenced by first to third order stream channels. This pattern of parallel streams is the result of young geologic terraces and earth flow activity shaping the landscape. Soils of glacial and volcanic origin are altered by erosion creating the drainage pattern. These parallel systems join to form a dendritic pattern lower down within third order and larger order streams in the watershed. Stream channels are associated with valley walls greater than 65 percent slope and transition into valley bottoms dominated by terraces. A stepped valley profile exists. Channel substrate contains bedrock and boulders in the steeper portions and boulder, cobble and gravels in the lower gradient reach. Channels exhibit very little sinuosity in the project area and contain numerous wet areas associated with their margins. Rosgen type Aa+, A, B, and G channels are present within the proposed project area. Channel banks are maintained by roots of the adjacent vegetation.

   Headwater channels have low sediment storage capacity due to steep channel gradients. Sediment storage capacity increases as streams transition into the valley regions due to addition of structure and lower gradient. Streams within the proposed project could be typified as being transport streams. Portions of Cougar, Tommy, Ethyl, Lake, Bachelor, Holman, Jude, and South Pyramid Creeks do contain depositional reaches associated with earthflow and rock outcrops constricting the channel and causing sediment to fall out upstream. Debris torrents have influenced the development of the first and second order stream channels and extend into third order channels in this planning area.

   Stream channels in this watershed have developed to handle high flows and high sediment loads because of the natural instability of the area and past management activities related to the checkerboard land ownership pattern with alternating sections of private and federal ownership. The historic morphological characteristics of stream valleys in Middle Santiam project area are similar to existing conditions. The basic stream patterns and channel gradients are largely influenced by the underlying geology. The channels have not changed a great deal since reference time frames, 100 years ago.

   For more information on stream channels in this area see Middle Santiam Watershed Analysis pages 20-24.

3. **Water Quality:**

Beneficial uses, dependent on aquatic resources, in this planning area are; resident fisheries use; aquatic non-fish species use; riparian dependent species use; water-related recreation; and water-related fire suppression and road maintenance needs. Waters from this site flow into tributaries to or the Middle Santiam River and then into Green Peter Reservoir.

Water quality parameters critical to beneficial users are temperature, type and timing of sediment input and chemical contaminants. Stream segments are listed under 303(d) classification with the State of Oregon, due to exceeding the temperature criterion of

17.8 0 C (64.4 0F) for salmonid migration and rearing (December 2003 Temperature criteria adopted by the Environmental Quality Commission and approved by USEPA in March 2004). The Middle Santiam's river-mile 5.3 (Green Peter Reservoir), to 37.1(headwaters), are listed in the draft 2004 listing for summer temperature.

Natural sediment loads are high for the Middle Santiam due to the number and size of earthflows in the watershed. Turbidity levels seasonally exceed 500 NTU's and are dependent upon the flow regimes that scour the toes of the earthflows. Water quality is therefore expected to vary as a result of these sediments through the wet periods of the year. Historically this has occurred throughout time and has created a sediment rich system.

For more information on water quality in this area see Middle Santiam Watershed Analysis pages 19-25.

4. **Riparian Reserves**: Riparian reserves currently consist of vegetation that ranges throughout all size classes. Four hundred acres of the estimated 1250 acres of reserves analyzed in the project area are of a size class and species distribution that warrants thinning at this time. Trees are small in diameter and are loosing crown characteristics of a thrifty stand. The areas outside of the proposed thinning stands are variable in density and species composition and would not benefit from thinning at this time.

Riparian Reserve widths for this planning area are based on the interim widths established in the Northwest Forest Plan as outlined in the table below:

Table 34 – Riparian Reserve Widths

Stream Category	Pacific-Silver Fir Plant Association (site-potential tree = 150 ft.)	Western hemlock Plan Association (site-potential tree = 172 ft.)
	Riparian Reserve Width	**Riparian Reserve Width**
• Fish-bearing streams • Lakes and natural ponds	Two site-potential trees or 300 feet either side of stream. Total width = 600 feet	Two site-potential trees or 344 feet either side of stream. Total width = 688 feet
• Permanently flowing non-fish-bearing streams; • Wetlands greater than 1 acre; • Seasonally flowing or intermittent streams and wetlands less than 1 acre	One site-potential tree or 150 feet either side of stream. Total width = 300 feet.	One site-potential tree or 172 feet either side of stream. Total width = 344 feet.

Desired Future Conditions – Hydrology, Stream channels, Water quality and Riparian Reserves

Conditions desirable for Hydrology, Stream Channels, Water Quality and Riparian Reserves can best be described in a range of variability. This range has been established through time to represent the natural changes the various elements experience during a wide variety of outside influences. Flood, drought, fire, wind, snow, ice, and land movement all play a natural role in determining the changes to these elements. The following bullets are an attempt to discuss the Hydrology; Stream Channel, Water Quality and Riparian portion of this condition.

- Range of flow, discharge, which allow for a variety of species within riparian areas.
- Maintenance of wet areas and hyporheic zones, no net loss.
- Maintenance of flows within historic range, no artificial peaks that exceed range.
- Maintenance of channel conditions that represent natural range.
- Reduction of stream energies through channel complexity (adding structure into channel, riparian areas.)
- Recovery and maintenance of historic water temperatures found within the system (encourage riparian development and complexity)
- Broad range of diversity associated with the riverine systems
- Accumulation of woody material on the site.

Direct and Indirect Effects - Hydrology

Alternative 1 (No Action)

If Alternative 1 were implemented the consequence would be that stands through time would not have a sufficient live crown ratio (percent of the tree with limbs) to grow at full potential (Lowell person communication 2006). Over time these stands would experience reduced growth rates due to competition. Transpiration rates would decrease due to loss of canopy and crown diameters. This could lead to a potential for increases in summer flows due to a decline in stands' ability to utilize available water. There is a high likelihood of reduced tree health. In addition, the ability of tree crowns to intercept and hold snow decreases resulting in greater risk for tree damage (breakage) through the accumulation of snow loads. Infiltration rates could be affected by the loss of tree canopies and the drip that occurs from snow interception. Latent heat would remove the snow and not allow for the water to infiltrate in the same manner or at the same rate that would occur within a healthy canopy. (Reduced canopies are more exposed to latent heat transfer and rapid snow loss. This reduces the contact time the water stored in the snow has with the soil.) (Harr 1981).

Alternative 2

Alternative 2 thins 1549 acres of young, managed stands and builds 1.0 mile of new temporary spur roads and reconstructs about 2.2 miles of existing non-system spur roads. These roads are not rocked and require dry-weather haul.

Existing main haul routes (63.18 miles) out of the area are well rocked and suitable for wet weather haul.

Thirty-seven miles of reconstruction and 36 miles of road maintenance would be needed along 73 miles of road (including both main haul routes and tributary roads) being used for hauling activities with this project. Reconstruction would reestablish drainage and improve the condition of the road system while reducing the vegetation and interception associated with these roads. Approximately thirty-six 18 to 24 inch ditch relief culverts would be replaced, five new culverts would be placed, and two drain dips would be installed along the haul route. When connected to the natural drainage network, roads lead to quicker delivery of runoff to stream networks. This could potentially lead to lower low flows (and higher peak flows) as a result of some water bypassing the normal routing (drainage) pathways. (Pike and Scherer, 2003) Landings associated with these reconstructed roads would add an additional 56 acres (estimated 0.2 acres per landing) of openings.

Stand treatment consists of 1176 acres of thinning to 50 percent canopy, and 373 acres of thinning to 60 percent canopy. Four hundred acres of riparian treatment occur with this alternative. Primary shade zones would not be thinned. A no-harvest buffer of at least 50 feet would be placed along all perennial streams to maintain the primary shade zones. Thinning would occur in secondary shade zones where shade canopy closured would be maintained at 50% or greater as per the sufficiency analysis requirements.

Consequences to hydrology result from reduced competition for light, water, and nutrients in the thinned stands and increased snow accumulation on the thinned acres, roads and landings. A

short term (5-10 years) increase in discharge during the wet and the dry periods would occur from two mechanisms for the thinned stands. Increased snow accumulation (wet period) would create small increases in peak flows (Jones, and Grant; 2001), and reduced canopy (dry periods) would reduce transpiration rates which would account for small increases in summer flows. It is not anticipated that either of these changes would create detrimental effects (not sure they would be even measurable). (Pike and Scherer 2003).

Capturing water and routing it down a different path could occur from the use of ground-based yarding equipment. Units 1, 5, 6, 7, 9, 10, 12, 14, 16, 17, 21, 22, 23, 25, 29, 32, 33, 35, 36, 37, 38, 41, 42, 43, 44, 47, 48, and 52 all contain ground-based systems (totaling 307 acres in both uplands and Riparian Reserves).

Thinning with ground-based equipment in Riparian Reserves places the equipment in closer proximity to drainage networks so there is a greater risk of routing water out of its historic flow routes. To minimize this risk a buffer would be established along all streams and utilization of designated skid roads and stream crossings would be required. This has effectively worked in past thinning sales reducing the risk of re-routing water to an acceptable level. Ground-based systems tend to have a higher risk of encountering ground water and bringing it to the surface than skyline or helicopter yarding systems. Utilizing ground-based yarding systems on all or part of the above mentioned harvest units could result in the creation of additional wet areas. This effect would be minimized through the utilization of Best Management Practices that designate skid trails and season of operations found within the timber sale contract.

Alternative 3

Implementation of Alternative 3 is similar to Alternative 2 in road reconstruction, and haul routes. The difference between Alternatives 2 and 3 is that all units logged with helicopter and one skyline are dropped in Alternative 3. This reduces the acres treated to 1412. The 137 acre difference in acres treated, of which 120 is yarded with helicopter, accounts for little, if any difference in the in the effects to hydrology.

Cumulative Effects: Hydrology

Analysis Area: The planning sub-drainage was the area of consideration for cumulative effects..

Traditionally, projects involving timber harvest on the Willamette National Forest are analyzed for their cumulative impact on the quantity and timing of peak flows and water yields, using an accounting methodology known as Aggregate Recovery Percentage or ARP. The ARP model compares the amount of an analysis area within the transient snow zone that is recovered against a threshold value (Midpoint) that was calibrated for the area during development of the Forest Plan. The Midpoint values were developed based on the soil, geology, vegetation, climate, and stream channel condition, in each planning sub-drainage and were intended to represent a minimum safe level of vegetative recovery in the planning sub-drainage to prevent significant alteration of peak flow regimes as a result of management activities. Recovery generally occurs when stand diameters

average 8”dbh and crown closures exceed 70%. The transient snow zone is generally considered to include those areas of the forest between the elevations of 1,200 and 4,900 feet respectively (Note: for the Middle Santiam thin area the entire area is considered as transient snow zone).

As a result of current vegetative conditions and the land ownership pattern found within the area, Headwaters Middle Santiam planning subdrainage Aggregate Recovery Percent (ARP) is 19% below the Forest Plan midpoint level. This low mid-point value can be partially attributed to the checkerboard ownership which makes up a large part of this subdrainage in which alternate sections of private land are counted as unrecovered (whether they are or not) using the ARP methodology. Donaca subdrainage, on the other hand, is 15% above the Forest Plan midpoint level. This is due the amount of wilderness acres in Donaca planning subdrainage which count as fully recovered lands.

The low mid-point ARP levels trigger an intensive analysis of all the streams and wet areas within the project. This analysis determined that streams adjacent to proposed thinning activities were recovering and resistant to minor changes in hydrology provided prescribed buffers and riparian prescriptions were adhered to. Those that were not recovering or were felt to be at risk were fully protected with full-leave buffers.

In conclusion, after reviewing stream channels and their ability to respond to increases in peak flows, it was not anticipated that the changes in hydrology would have a detrimental impact on downstream beneficial users. Flow changes anticipated are well within the variation of normal flows and should not generate a condition that the channel has not responded to through time. Short-term changes may be evident in the time of the peak and the duration of flow throughout the year due to changes in transpiration rates and routing of flows. These changes, however, are short lived (3-5 years) until such time that the stand closes canopy and utilizes the available water from the site.

Direct and Indirect Effects – Stream Channels

Alternative 1 (No Action)

Alternative 1 would maintain the stream channels in their current conditions. Changes to stream channels occur with the changes in hydrology, vegetation and physical changes. These elements change naturally and artificially through disturbance.

With No Action, it is anticipated that a low risk of artificial disturbance mechanisms, road crossings, pipe installations, etc., would occur. Indirect affects could occur if riparian stands decline to a point of increasing the wood load into the stream and creating accelerated bank erosion. These channels do utilize the available wood and create small wetlands associated with the channels. A very low risk from increased wood is anticipated.

Alternative 2

Alternative 2 would yard 303 acres using ground-based equipment. During this activity a moderate risk of capturing water and creating additional channels exists. Ground-based yarding would require seven stream crossings to allow access to various locations in the units. The direct

effect of these crossings involves short-term sediment input into stream channels and disturbance to channel banks. Units 1, 5, 6, 7, 9, 10, 12, 14, 16, 17, 21, 22, 23, 25, 29, 32, 33, 35, 36, 37, 38, 41, 42, 43, 44, 47, 48, and 52 would utilize ground-based systems to log all or portions of these units (totaling 303 acres). Each of these units has its own complexities and would for the most part be yarded away from stream courses/ channels. This being said it is important to note that the design of the units has taken into consideration the stream locations and yarding requirements to reduce and or eliminate any disturbance to the channel's banks. Vegetation would be maintained to protect the stability of the channel banks. The seven stream crossings occur on class IV channels that flow during storm events and are very small, less than 5-foot wide channels, but contain a portion of their channel that are perennially wet. These wet locations have a shallow water table associated with them but do not always have surface water present. Design criteria utilized for these crossings would reduce disturbance to insure that the areas do not bring the water to the surface. Examples of these design criteria include: placement of woody material, pipes, or other materials to cross, and removing the material upon completion of the activity. It is expected that utilizing these practices would result in a short-term flush of sediment once flows reach sufficient capacity to mobilize material. This flush would be the bare material that is not removed from the channel and is expected to fall out within 200 feet of the crossing due to its particle size.

Under this alternative a loss of intermediate wood would occur due to the removal of material from the secondary shade zones in Riparian Reserves. This wood is utilized in the regulation of flows and creation of sediment storage areas within the channel. Loss would create a 10 to 30 year period that wood would not be recruited into the channel through the natural thinning of the stand. Channel response to this loss of wood varies depending upon the specific site, however in general it is anticipated that additional energy would be available and channel storage would be reduced. Areas of deposition currently would transition to transport reaches due to the increase in energy. Increases in energy would work channel banks and create channel cross-sections capable of handling higher flows.

In considering the above, a low risk of downstream effects exists due to the design critera prescribed for each of these units. This is due to the prescriptions requiring primary shade zones to be left intact and secondary shade zone being maintained at 50% canopy closure. All trees contributing to channel bank stability would be left. Stream channels should remain within their natural range of variability and the proposed project is not anticipated to have any long-term detrimental effects as a result of the action.

Effects of sediment generated from the seven stream crossings would be short-lived as the sediment would be flushed out of the channel after the first storm event that provides sufficient flow. Loss of wood structure for the intermediate term would be offset through the creation of larger wood in the long term. Due to the dynamic nature of channel morphology this action is not anticipated to create measurable differences in the channel conditions.

Alternative 3

Implementation of Alternative 3 would result in similar effects to Alternative 2. The difference between the alternatives is that in Alternative 3 fewer acres are treated in both upland and riparian areas. 358 acres would be treated in the riparian zone under this alternative. No detrimental effects are anticipated due to the design and objectives for these units.

Cumulative Effects: Steam channels

Analysis Area: The planning sub-drainage was the area of consideration for cumulative effects.

Cumulative effects are those effects which independently do not pose a risk to water quality yet, when added together may have some measurable effect on water quality. Looking at the watershed condition types for streams found within the project area, determines what management prescriptions should be followed. (Page E-10 to E-17; LRMP) "This criterion is intended to address the potential for changes in peak flows during rain-on-snow events, and the associate potential change in the stability of the stream banks and streambed." (LRMP pg. E-6). The Watershed condition types are type 5 and 6 channels (LRMP; pg. E-10-12). Under types 5 and 6 recommended ARP levels are to be at or above midpoint levels. Upon reviewing these criteria and the selected streams involved in this project it is anticipated that cumulative effects would occur on some of the channels that have been heavily influenced by debris torrents and earthflows from the 1996 flood era. These channels are still adjusting to an increased sediment load from these events.

These anticipated cumulative effects would not be adverse due to the incremental nature of the change, and the current conditions of the stream channels. Previous disturbance has set the channels to a point within their natural range of variability which is resistant, or hardened. This creates a channel capacity that appears to be capable of responding to the cumulative effect of increased small peak flows even though the area is below midpoint level. This judgment is due to the condition of the channels and the timing of the recovery associated with the past episodic event, 1996 flood. It is anticipated that due to the recovery rates of the channels affected and the current stand conditions, a window of low risk probability of adverse impacts to the stream channels exists at this time. This time interval is also considering the management of private land and the condition of their stands at this time. It is anticipated that this window would diminish, until the next episodic event occurs, as the channels recover.

Direct and Indirect Effects – Water Quality

Alternative 1

Water quality is closely tied to the hydrology and channel bank stability of the steams found within this area. Under this alternative very minor changes are expected to hydrology and stream channels as a result of No Action, so it is anticipated that little, if any, effect would occur to water quality.

Alternatives 2 and 3

Effects to water quality could occur with increases in inputs such as contaminants from petroleum products, sediment or solar radiation as the result of the timber sale. All of these could have an adverse effect of the quality of water within the project area.

To reduce and minimize these effects, design criteria such as timber sale contract provisions, design of unit boundaries and retention of no-harvest buffers on the primary shade zone would be utilized to provide for the maintenance of water quality.

Treatment of vegetation within riparian areas has been designed to comply with "Sufficiency Analysis for Stream Temperature - Evaluation of the adequacy of the Northwest Forest Plan Riparian Reserves to achieve and maintain stream temperature water quality standards" (USDA Forest Service and USDI BLM, 2005) process. The Sufficiency Analysis provides current scientific guidance for management of riparian vegetation to provide effective stream shade, including appropriate methods of managing young stands for riparian objectives other than shade, such as production of large wood for future recruitment. Aquatic Conservation Strategy (ACS) objectives surrounding water quality, temperature, are met through the use of the analysis to aid in establishing needed buffers.

No-harvest buffers of at least 50 feet were placed along perennial streams. In addition, intermittent and ephemeral channels were protected through the maintenance of trees contributing to channel bank stability. As per the Sufficiency Analysis these buffers protect the "primary shade zone" with the secondary shade zones on selected streams being maintained at least 50 percent canopy closure as per the nomographs listed in the sufficiency analysis.

Localized water quality effects would occur during the replacement of the culverts and the stream crossings after the first flow and for a limited length downstream. Mobilized materials are anticipated to fall out prior to reaching a confluence with a higher order stream due to the size of the material mobilized, usually within 200 feet of the crossing due to particle size.

Chemical changes to water quality could result from loading of channels with slash or ash entering channel as the result of fuel treatment. Design criteria reduce the possibility of either of these by establishing full leave buffers and restricting burning activities adjacent to channel areas. Best management practices and contract requirements further protect the water quality by placing a limitation on the time period actions could occur. In addition, design criteria limits grapple piling within 50 feet of perennial streams.

In conclusion, it is therefore anticipated that minimal if any downstream effects to water quality would occur as a result of the proposed activity. Stream temperatures would be maintained and improved upon as a result of thinning in the secondary shade zone to encourage growth and thereby improving the shade cast from the standing trees. This, through time, would intercept solar radiation and have the potential to reduce the solar radiation reaching the stream. Sediment would only have a short-term, localized effect on water quality as a result of the stream crossings.

Cumulative Effects - Water Quality

Analysis Area: The planning sub-drainage was the area of consideration for cumulative effects.

Cumulative effects to water quality would be similar to those discussed in the hydrology section above. The effect of all the activities that would occur under this proposal is tempered by the timing of the action in relation to the recovery of the stands and the required no-harvest stream buffers. Water quality impacts are expected to be minimal with due to no-harvest riparian buffers along the primary shade zones of perennial stream, and channel bank stability maintained through protection of rooting zones along intermittent and ephemeral streams. Provided the Best Management Practices (BMP's) prescribed in this report are met, it is not anticipated that adverse cumulative effects to water quality would occur as a result of this project. Tools used to ensure the protection of water quality include the Sufficiency Analysis, BMP's, Timber Sale contract provisions pertinent to water and the design criteria incorporated into this project.

Post sale opportunity projects could create a cumulative effect. These actions include, new stream structures (culverts), and restoring a roadbed by removing culverts and providing natural drainage. Water Quality effects can best be described in the short-term and the long-term. Short term, during the first flushing flow in the fall, additional sediment would be available as a result of stream crossing and road work. This sediment would be fine grained and pulse through the channel and settle out within close proximity to the crossing. Background levels of sediment typically moving at this time of year would mask any risk this additional sediment poses. It is therefore anticipated that no adverse cumulative effects to downstream beneficial users would occur as a result of these actions.

Direct and Indirect Effects – Riparian Reserves

Alternative 1 (No Action)

These reserves will through time develop the characteristics; structure, openings, down wood naturally. Modeling (Tom Lowell, 2007) shows that the stand will lag 4 inches in diameter at 70 years out while acquiring the same height. This is not anticipated to have an effect on the long-term (200 + years) objective for these areas.

Alternatives 2 and 3

Management within a portion of the Riparian Reserves is being proposed to accomplish a multitude of resource benefits. These reserves would through time develop the characteristics; structure, openings, down wood naturally, however development of these characteristics could be expedited with selective management. Direct and indirect effects to the Riparian Reserves are a compilation of the hydrology, stream channel, water quality, aquatic components and are discussed under these headings above and terrestrial wildlife components and are discussed within the wildlife section of this document.

Identification of riparian areas where benefits from management at this time would improve the long-term objectives for the Riparian Reserves were incorporated into the action alternatives. Design criteria developed for proposed harvest units, by the interdisciplinary team, directed the

management action and the protection needed to accomplish resource goals. Not all areas warranted management at this time due to the area developing the needed characteristics naturally so 850 acres are not entered at this time.

It is expected that management of the Riparian Reserves in this manner would protect and enhance the aquatic and wildlife dependent species present, and the Aquatic Conservation Strategy (ACS) objectives at the 5th field, landscape level. This expectation is the result of looking at the 5th field level and the project level and implementing conservation biology thought processes.

Cumulative Effects - Riparian Reserves

Analysis Area: The 5th field watershed was the area of consideration for cumulative effects.

Cumulative effects to Riparian for all alternatives are similar, except for the independent discussion found for each of the component parts of the riparian reserve see, fisheries and silvicultural effects sections of this document. The overall 5th field scale is so large a landscape and so diverse in structure and species diversity that it tends to dilute cumulative effects. The location and size of the project on the landscape will have a positive effect in the short term and the long term within the fifth field by providing addition diversity of structure and species.

Conclusions – Hydrology, Stream Channels, Water Quality and Riparian Reserves

In looking at the direct and indirect effect for hydrology, stream channel, water quality and Riparian Reserves, it is not anticipated that any of the effects would be detrimental or create significant downstream effects. The critical elements in the maintenance of hydrology, stream channels, water quality and Riparian Reserves in the planning area are the existing riparian areas. Provided these riparian areas are maintained in a healthy state, the stream systems would be anticipated to obtain their desired future condition. Future management activities are considered in the long-term objectives for riparian areas of perennial and intermittent streams. Long term riparian objectives are considered along with other resource goals and objectives agreed to by the interdisciplinary team. Stream-side management prescriptions are designed to maintain Aquatic Conservation Strategy Objectives (ACSO), as defined in the amended Forest Plan to meet these long term objectives.

Best Management Practices (BMP's) are utilized in the development of mitigation and compliance to ACSO's. These BMP's can be found in "General Water Quality Best Management Practices" Pacific Northwest Region, November, 1988.

Utilizing BMP's for this project specifically address direction and guidance in the protection of water quality. Middle Santiam Thin project objectives and mitigation for water quality are outlined in Table 13 Design Criteria Common to All Alternatives

Floodplains occur within the areas located in the planning area. No activities would occur within flood plains due to the maintenance of Riparian Reserves and buffer restrictions. Wet areas would be dealt with on an individual basis under the stand specific recommendations and wetland areas less than 1/4 acre would be treated as special habitat areas (FW-211).

The action alternatives proposed in the Middle Santiam Thin project meets Federal and State water quality objectives. These objectives are met through the implementation of BMP's. Riparian Reserves have been established 150 to 172 feet on either side of the intermittent and perennial non-fish-bearing streams, and 300-344 feet on either side of the fish-bearing or domestic water supply streams as per the interim direction in the Northwest Forest Plan. No-harvest buffers are found within these Riparian Reserves which help protect the waters of the State of Oregon. These reserves are adequate to maintain and restore water quality necessary to support healthy riparian, aquatic and wetland ecosystems and meet the ACS Objectives at the site and 5th field watershed level and are consistent with the State of Oregon's approved sufficiency analysis.

Consistency with Direction and Regulations – Hydrology, Stream Channels, Water Quality and Riparian Reserves

The following list shows the various Directions and regulations that were utilized in the development of the prescriptions for this proposal. In all action alternatives unit layout and design considered and applied the intent of the direction and regulation. All of the units were reviewed on the ground and recommendations and effects considered. All actions within the alternatives are anticipated to be consistent with this direction in regards to water quality, hydrology, stream channels and riparian protection. Thought processes are disclosed under the regulatory framework in section 2 of this report.

Table 35 - Consistency with Direction and Regulations for Hydrology, Stream Channels and Water Quality

Regulation	Hydrology	Stream Channels	Water Quality
Willamette National Forest Land and Resource Management Plan Watershed requirements.	Yes	Yes	Yes
Aquatic Conservation Strategy Objectives	Yes	Yes	Yes
NW Forest Plan	Yes	Yes	Yes
Clean Water Act	Yes	Yes	Yes
Dept. of Environmental Quality Sufficiency Analysis for Stream Temperature 303d listing Water Quality Management Plan.	Yes	Yes	Yes
Best Management Practices	Yes	Yes	Yes
Executive Orders 11988 and 11990	Yes	Yes	Yes

Fisheries

Introduction- Fisheries

There are six streams within the project area that provide habitat for fish. The species present in the project area include; rainbow trout, cutthroat trout, brook trout, dace, shiner and sculpins. There are approximately 1.5 miles of habitat in the lower end of the project area that was probably historically utilized by ESA listed, threatened Upper Willamette River Winter Steelhead (UWS) and possibly Upper Willamette River Spring Chinook (UWC). The current distribution of UWS does not include the project area as they are more than 30 miles downstream, and the nearest documented UWC is approximately 18 miles down stream. These UWC are hatchery produced (ODFW stock # 23) salmon from the South Santiam Hatchery. Given the extreme distances of current populations of UWC and UWS and the finding of no effect to these populations no ESA consultation was required in association with this project. For a more thorough description of fisheries resource refer to the Fisheries Report in Appendix G. Figure18 shows the current distribution in the project area.

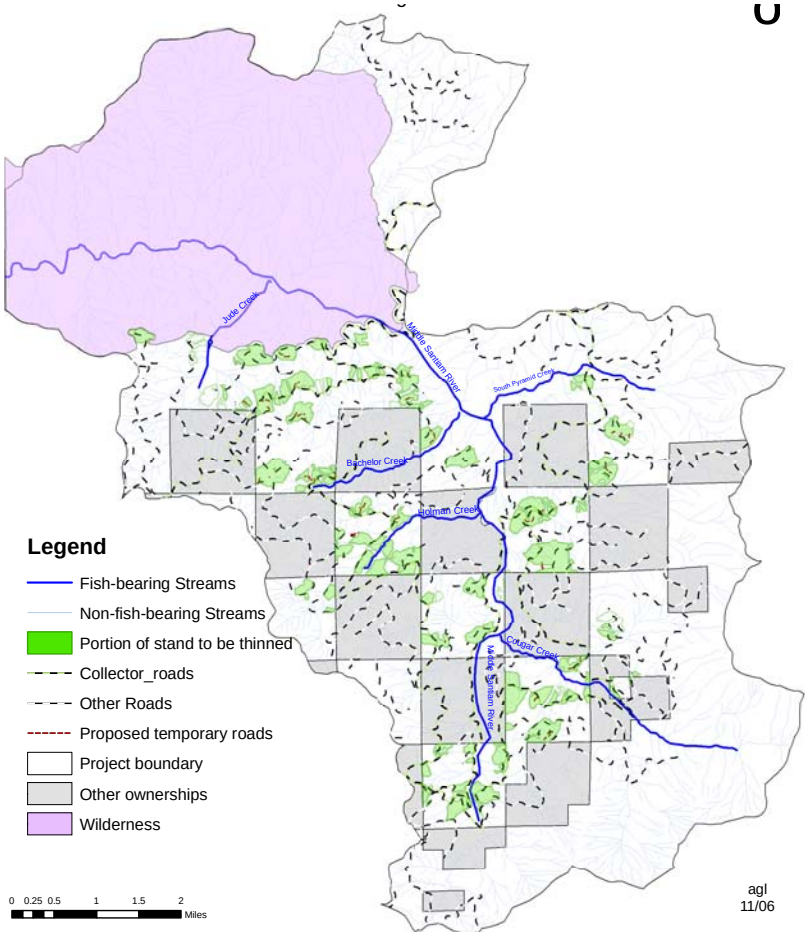


Figure 18 - Fish-bearing Streams

This project has five primary elements that were included in this review: upland and riparian reserve timber harvest, log yarding systems, road work, landings and fuel treatment. These are displayed, by alternative, in Table 36.

Table 36 -Comparison of Alternatives by Activity - Fisheries

Primary Project Elements	Unit of Meas.	Alt.1	Alt. 2	Alt. 3
Timber Harvest				
Upland Thinning	Acres	0	1149	1119
Riparian Reserve Thinning	Acres	0	400	293
Estimated Timber Volume	MBF	0	15490	14120
Log Yarding Systems				
Ground	Acres	0	303	307
Skyline	Acres	0	1126	1105
Helicopter	Acres	0	120	0
Road Work				
Haul Road Maintenance	Miles	0	73.6	73.6
Reconstruction	Miles	0	31.3	31.3
Road Closures	Miles	0	6.45	5.75
Temp. Road Construction	Miles	0	1.0	1
Temp. Road Reopening	Miles	0	2.2	2.2
Landings				
Helicopter Landings	Number of	0	7	0
Landings (all)	Number of	0	287	280
Fuels Treatments				
Grapple Pile and burn in units*	Acres	0	141	141
Grapple Pile along roads	Acres	0	66	66
Yard Tops Attached	Acres	0	236	267
Helicopter Landings Burn	Number of	0	7	0

Analysis Methods- Fisheries

The following were used to analyze effects of project activities on the fisheries resource:

- Region 6 Level II Steam Inventory surveys provided information on three of the six fish-bearing streams in the project area where these surveys have been completed. Data from these surveys included: pool frequency, pool quality, surface fines, woody material quantity, and fish species composition and distribution.
- The Middle Santiam Watershed Analysis was reviewed to gain an understanding of the larger-scale historical background condition of the fisheries resource; to identify concerns about existing natural watershed processes and to consider watershed recommendations.
- Existing data from the Willamette National Forest Geographic Information System (GIS) database was queried to provide values for road density, acres historically treated, Riparian Reserve condition, and historical and current fish distribution.

- Interdisciplinary Team (IDT) input from the hydrologist, soil scientist, wildlife biologist, silviculturist, botanist, fuels planners, logging system planners, and engineers was reviewed.
- Streams within the project area were sampled to confirm existing fish distribution records, identify changes in distribution, and identify fish species composition for each currently occupied creek. Sampling techniques included visual observations, angling, and electrofishing. In addition, the creeks were qualitatively sampled for macroinvertibrate populations and riparian condition was evaluated in units adjacent to fish-bearing streams during stream walks.
- Opportunities for restoration and habitat enhancement were identified where needed.
- Fish distribution and project elements with any risk to fish or other aquatic species were identified and this information was shared with the IDT.
- Critical habitat, Essential Fish Habitat and ESA fish distribution maps from NMFS were reviewed.

Current Conditions- Fisheries

1. Fish Habitat Complexity- The components of habitat complexity that were evaluated in this analysis include woody debris levels, recruitment and retention of woody debris, aquatic physical characters like pool and riffle habitat, and general channel condition. Current fish habitat complexity in the project area is probably within the natural range of variability for this watershed. Low levels of woody debris occur. The available pool habitat is not at an optimal level, and the character of the stream channel is generally in a recovering condition. At some points there is likely to have been very complex habitat for fish in this watershed historically, while at other points in time, after significant events, it is probable that there have been very low levels of complex habitat available for fish. Although a high level of complex habitat was not observed in the streams adjacent to harvest units during field surveys, it is still reasonable to believe that while there is decreased habitat complexity currently, we are entering the area during a period of time that the system is in a recovery stage. The level of habitat complexity observed in the system at this time is probably on the low end of the range of natural variability for this system. This area was significantly affected by the storm events of 1996, and also has had impacts from prior management activities.

2. Water Quality for Fish- Stream temperature, turbidity, stream peak and base flows, and chemical contamination were analyzed for the project area. Stream temperatures in the Middle Santiam River in the project area currently do not meet the criteria established by the Oregon Department of Environmental Quality (DEQ) for salmonid rearing during the summer season (17.8 ^{o}C). Natural sediment loads are high for the Middle Santiam due to the number and size of the earth flows in the watershed. During low storm activity in the wet months the turbidity levels are generally below 5 NTU's and during summer season typically less than 1 NTU. Turbidity levels seasonally exceed 500 NTU's during big storm events at the peak of the

hydrograph. This high turbidity level can last from 2 – 24 hours in duration and is very dependent upon the flow regimes that scour the toes of the earth flows. Water quality is therefore expected to vary as a result of these sediments through the wet periods of the year. At this time there is evidence that peak flows have changed to the extent that fish have gained or lost habitat. Some channels have been modified through peak flows occurring during extreme hydrologic events similar to the 1996 event. There are currently no sources of chemical contamination in the project area.

3. Fish Biological Parameters- There are six fish-bearing streams within the project area that have the potential to be affected by this project: **the Middle Santiam River, Jude Creek, Bachelor Creek, Holman Creek, Cougar Creek, and South Pyramid Creek** (see figure 18). All of these streams are documented to be utilized by cutthroat trout. Field surveys have confirmed that Holman Creek also contains brook trout. Region 6 Level II surveys of the Middle Santiam River (1995-1996) and South Pyramid (file note South Pyramid Stream inventory file Bucholtz, 1997) have documented the presence of rainbow trout, dace, shiner and sculpin in addition to cutthroat trout. The Willamette National Forest FEIS reports the presence of brook trout in the Middle Santiam River.

These local populations are resident fish and have naturally reproduced. The origins of the brook trout are unknown, and during field surveys for this project they were only observed in Holman creek.

The **Middle Santiam River** appears to have the most diverse fish assemblage of the six creeks. This 5th order stream is the river to which all others drain in this watershed. Cutthroat trout are the dominant species in the Middle Santiam and its tributaries in the project area. There are few rainbow trout in the Middle Santiam River in the project area, while there are higher proportions of them as you proceed down stream from the project area. Cutthroat trout were observed consistently in the Middle Santiam during field surveys in the summer of 2006, and sculpins were observed occasionally. No brook trout were observed. Macroinvertibrate populations appear normal in density and diversity as compared to other streams in this watershed. Stone flies (*Plecoptera*), may flies (*Ephemeroptera*), and caddis flies (*Tricpotera*), especially case making caddis, were consistently observed to be the dominant invertebrates present. Aquatic snails (*Gastropoda)* were observed, probably *Juga spp*., as well as crayfish (*Decopoda*), most likely *Pacificus spp*.. No fresh water clams or mussels (*Bivalvia*) were observed. No specific sampling was conducted for fresh water clams or mussels as it is not indicated for this project area.

Jude Creek is documented to have a natural barrier just up from the confluence with the Middle Santiam River. It is likely that the mouth and the area just upstream from the mouth of this creek is utilized by fish as refugia during high water events in the Middle Santiam.

Bachelor Creek is in the GIS database as a fish-bearing stream. No fish were observed during creek walks in the summer of 2005 or 2006. No snorkeling was done in Bachelor Creek. The habitat appears to be capable of supporting a population of fish and there were abundant macroinvertibrates. The lack of observed fish could be attributed to the timing of the surveys and locations at which the creek was surveyed. Only portions of the creek that were adjacent to project harvest units were surveyed. Just upstream from the confluence of the Middle Santiam River, the channel of Bachelor Creek is steep (>10%) and dynamic. It is likely that it is currently a barrier. It also appears to be very dynamic and this could be a transient condition. After field surveys and review of GIS data it is likely there are cutthroat trout in this creek. The habitat present appears to be suitable for fish.

Sampling in **Holman Creek** in the summer of 2005 resulted in identifying the presence of brook trout. This is the first evidence of this species in this creek or any tributary to the Middle Santiam. Their presence seems to be isolated to Holman Creek. Two brook trout were captured during electrofishing at the crossing of road 2045. They were approximately 6 and 8.5 inches total length. More were observed during creek walks and it is likely they are reproductively successful in this creek. There is an area up stream of the 2045 road crossing that has very good pools as a result of the influence of past beaver activity. Unlike most of the other sections of creeks in the project area, that are adjacent to proposed harvest units, there seems to be accumulations of woody debris in Holman Creek. This wood appears to be currently influencing the creek and providing some limited complexity of habitat for fish. It also appears to be decomposing at a rate greater than the rate of new wood input. The macroinvertibrate population in Holman Creek appears healthy with representation of the same dominant species as reported for the Middle Santiam River.

Cougar Creek was surveyed in the summer of 2006. This creek appears to support a very healthy population of cutthroat trout. Sampling in this creek resulted in the most fish capture per unit of angling effort in the project area as compared to the other creeks with adjacent harvest units. There were multiple age classes represented with sizes ranging from 2 to 8 inches. The macroinvertibrates observed in this creek were the same in species composition and abundance as reported above. There were areas observed on Cougar Creek that provide for very good cutthroat spawning habitat, and in general the habitat complexity of this creek is better than what was observed in the others in the project area. The creek in the area adjacent to proposed harvest units is deficient in large woody debris (LWD), and the habitat complexity could be more developed than what was observed during the planning stage.

South Pyramid Creek was surveyed according to the R6 Level II protocol in 1996. The survey showed multitudes of natural barriers, chutes and falls. The only species present in the stream adjacent to a proposed unit is probably cutthroat trout. None were observed during sampling, but prior surveys have reported their presence.

Table 37 - Fish species and distribution within the project area

Stream	rainbow	cutthroat	brook	dace sp. ukn.	sculpin sp. unk.	shiner sp. unk
Middle Santiam River	X	X	X	X	X	X
South Pyramid Creek	X	X		X	X	
Holman Creek		X	X			
Bachelor Creek		X				
Cougar Creek		X				
Jude Creek		X				

Desired Future Condition- Fisheries (Preferred Salmonid Habitat Conditions)

- *Water temperatures*: The desired condition is cooler summer water temperatures that satisfy, or are lower than the state established standards. The criterion established by the Oregon Department of Environmental Quality (DEQ) for salmonid rearing during the summer season is 17.8 ^{o}C.
- *Large wood*: Diameter and length of woody pieces may vary according to the stream width and gradient; pieces larger than 25 inches in diameter are generally preferred. Large wood in the stream would provide a variety of habitat and nutrient characteristics. In low gradient streams, an average of 20 pieces/1,000 lineal feet is preferred. The size of wood should provide stable, diverse stream habitats during high flows. LWM should be longer than the stream width, with assorted diameters including pieces larger than 25 inches. A similar quantity and size of wood should be available for recruitment in the future. On steeper stream channels approximately 50% of the channel length should be directly influenced by large woody material (LWM). This means half the length of any given reach of stream should be in a pool or sediment bar upstream of LWM, or in a plunge pool and associated gravel deposit downstream of a LWM accumulation, as well as the stream area occupied by LWM.
- *Pools*: A primary pool every five to seven channel widths in streams with less than a 2% gradient and every three to five channel widths in streams with a 2 to 8% gradient provides rearing habitat during summer low flows. Pool volume should not be reduced by excessive deposition of fine sediments or bedload.
- *Substrate*: A well sorted variety of gravels, cobbles, and boulders, with less than 20% of spawning gravels in fines (<1.0mm), and less than 25% embeddedness of cobbles in riffle areas provide salmonid and invertebrate spawning and rearing habitat. Less than 25% of substrate should be comprised of fine sediment, (<1.0mm), and less than 25% of riffle areas should be embedded by fine sediments.
- *Floodplains:* Stable, vegetated floodplains provide areas of slow water and refuge habitat during high flow events.

- *Streambanks and streambed:* 90% of the lower streambanks should be stabilized by LWM, vegetation, or bedrock. Stream channel down-cutting should not reduce floodplain functioning or significantly alter floodplain vegetation.
- *Food source:* Year-round input of leaf, needle, and insect material from a variety of species provides a variety of food sources for salmonids and invertebrates.
- *Water quality* that remains 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.
- *Water flows* sufficient to create and sustain riparian aquatic and wetland habitats and to retain patterns of sediment, nutrient, and wood routing.

Direct and Indirect Effects- Fisheries

Scale of Analysis- The site-scale analysis typically focused on the effects to the nearest stream channel. Effects to fish are the accumulated effects to the nearest fish-bearing stream reach. Cumulative effects to fish species occur at the analysis area scale, which includes two HUC6 subwatersheds Headwaters Middle Santiam River (170900060102) and Donaca Creek (170900060103). Additionally, the effects to UWC and the potential effects to fish population interactions between the two subwatersheds were evaluated at the HUC 5 Middle Santiam River watershed scale.

Alternative 1 - (No Action)

1. Fish Habitat Complexity **–** Implementation of Alternative 1, No Action, would maintain fish habitat complexity in its current conditions and on its current trajectory. The current deficient state of LWD, pool quality and quantity, and general stream condition would remain. Over time nature would take its course and LWD recruitment levels would return to higher levels in the watershed. This point in time would be delayed from the natural progression because these are densely vegetated, formerly managed stands with reduced growth rates. In the interim, fish habitat complexity in the stream areas adjacent to proposed harvest units would continue to have underdeveloped fish habitat. Changes in habitat complexity could occur with natural changes in hydrology, LWD levels, vegetation and other physical changes. These elements could change naturally and artificially through disturbance. Indirect affects could occur if riparian stand health declines to a point of increasing the wood load into the stream and creating accelerated bank erosion. Additionally if the stagnated growth rate reduces the recruitment rate of LWD to the channel, deficiencies could continue to be present and the result is a decline in habitat complexity for fish. Under this alternative there would be no habitat enhancement for fish in the project area.

2. Water Quality for Fish- Implementation of Alternative 1, No Action, would maintain water quality in its current conditions as described previously.

Stream Temperature – The implementation of this alternative would have little effect on the current trajectory of changes in stream temperature in the short term. Alternately there would be an

effect in the longer run. By taking no action in the Riparian Reserves the riparian trees would grow slower. Taller trees can provide more shade for streams. More shade contributes to the reduction in the potential for solar influences that tend to increase stream temperatures. In the no action alternative a period of time would occur where the riparian trees would not meet their full growth potential because of increased competition. This period would contribute to the delayed recovery of temperature reduction in the project area. If the trees are not thinned, there would be no benefit from reduced competition, and none of the trees would have the opportunity to grow taller, faster and provide for more shade to the streams quicker.

Turbidity - In the Middle Santiam River and its tributaries in the project area, the current turbidity levels during episodic storms exceeds the levels where reduction in fish use is observed. This could be causing a reduction in the population size and vigor for the resident fish at multiple life stages. The implementation of the no action alternative would not change this condition.

Peak and Base Flows – The implementation of the no action alternative would result in the continuation of the current condition.

Chemical Contamination – The implementation of the no action alternative would have no effect on chemical contamination in the project area.

Fish Biological Parameters- Implementation of Alternative 1, No Action, would maintain the fish biological parameters in their current condition and on its current trajectory as described in the current conditions section of this document.

Alternative 2 & 3 - (Action Alternatives)

Alternative 2 proposes to thin 1549 acres, while Alternative 3 proposes to thin 1412 acres. There are 11 units where harvest is proposed adjacent to the primary shade zone along fish bearing streams. Appendix A of the EA has maps showing all harvest units, including streams and proposed harvest boundaries. There is essentially no difference in the effects of Alternatives 2 and 3 on the fisheries resource. There are 110 acres that would be harvested by helicopter in Alternative 2. This would have insignificant and discountable effects to the fisheries resource. The discussion that follows is applicable for both action alternatives.

Differences in the probability or magnitude of negative effect to the fishery resource between the action alternatives are minor, and are predominantly described together in the following assessment:

1. *Fish Habitat Complexity*- Implementation of Alternatives 2 or 3 could result in effects to the fishery resource in the project area. It is not likely that any effects would continue downstream outside of the project area. The effects from this project would still be within the natural range of variability for this system and should, in the long term, be more positive than negative in nature. During the planning phase of this project any potential concerns relating to the fisheries

resource were identified and the interdisciplinary team worked cooperatively to develop a project that would have beneficial effects to multiple resource objectives, including fisheries, in the project area. As stated above there are current deficiencies in the project area related to fish habitat complexity. One area of deficiency is LWD. Implementation of this alternative should result in enhanced size and consistency in recruitment of LWD into this system. Trees would be harvested in Riparian Reserves outside of the primary shade zone in these alternatives. There would be a no-entry buffer on all fish-bearing streams where units area directly adjacent to stream channels, and they would not be entered for commercial harvest. Table #30 shows the unit numbers and the associated no entry buffers for all units adjacent to fish bearing streams. Below is a detailed discussion of potential effects to the fisheries resource in the project area.

- *Woody Debris* – There are two primary delivery mechanisms for LWD into a system. Direct and indirect delivery occurs over temporal and spatial scales that range significantly. Indirect delivery occurs when wood is recruited to areas up stream and carried down stream through the system. In the project area, specifically for the tributary creeks of the Middle Santiam River, the delivery mechanism is a combination between direct and indirect recruitment.

Table 38 - Minimum harvest buffers by unit number

Unit Number	No Harvest Buffer Width
6, 10, 11, 37, 46	Minimum 100 feet
7, 13, 20	Minimum 150 feet
8, 29, 31	Minimum 172 feet

LWD enters streams through chronic and episodic processes (Bisson et al., 1987). Chronic sources include streamside tree mortality and bank undercutting (Murphy and Koski, 1989) which delivers LWD to streams at a slow but constant rate. Bank undercutting may not be a primary recruitment process in headwater stream channels due to channel/hillslope constraints (Nakamura and Swanson, 2003), and low levels of alluvial material in the banks (Halwas and Church, 2002). Episodic sources such as windthrow (e.g., Harmon et al., 1986; Lienkaemper and Swanson, 1987; May and Gresswell, 2003), wildfire (Agee, 1993), infrequent flooding, landslides/debris flows (Benda et al., 2002, 2003), and insect infestations or disease usually deliver a large number of LWD pieces, and occur infrequently. In this watershed one of the dominant delivery mechanisms is probably through debris and earth flow activity. Mass wasting and other delivery mechanisms can be observed along the Middle Santiam River and its tributaries. The harvest of wood from the near riparian area can interfere with this direct delivery of LWD. Additionally stands with stagnated growth rates, like the stands present in the proposed harvest units, can interrupt the natural process of diverse sizes of woody debris delivered to streams. This interruption occurs as there is a lapse in time when the stands progressively develop into late successional stands. This development is delayed because of competition between trees in stands that are very densely populated. These

alternatives propose to thin stands that are densely populated in riparian (outside of the primary shade zone) and upland areas.

A review of literature (Murphy and Kosyi, 1989; McDade et al., 1990; Robison and Beschta, 1990, and Van Sickle and Gregory, 1990) shows that in selecting the most conservative findings from this set of publications the zone containing all of the potential direct LWD recruitment extends from zero to 50m (0 to~165ft) from the stream channel, with an estimated 80% of the potential direct LWD recruitment occurring in a zone zero to 30m (0 to ~100ft). Alternatives 2 and 3 propose no commercial thinning in areas closer to the stream channel than 100 feet on fish bearing streams. There are 5 of the 11 (6, 10, 11, 37, and 46) units adjacent to fish bearing streams where the unit boundary is only 100 feet from the bank full mark of the stream. In these units it was identified that there is the need to thin in the riparian reserve up to 100 feet away from the creek. The stands are very dense and by thinning and having a small amount of risk in this 65 foot band, between 100 and 165 feet) the benefits out weigh the short term negative impacts. The riparian stands of trees in these 5 units are in need of release from competition from the other trees. By remaining out of the 100 foot zone the action under this alternative would not interrupt 80% of potential direct recruitment. It is important to note here that at this point in time there is probably no direct input of LWD from the stands in the area of 100-150 feet from the creek. This is because the trees that are present in these stands are at an immature stage. Most trees in these stands are approximately 30 – 60 years old and 60 to 80 feet tall. Crown development is being delayed, and the diameter growth is stagnating. The only way direct recruitment would occur in that zone is if trees fell and rolled down hill. While this is a potential direct recruitment route, it is unlikely in these stands as they are densely populated and could probably interfere with down hill movement by rolling. The thinning that would occur under these alternatives would remove sub dominant trees. If the sub dominant trees are not removed it is unlikely that they would end up contributing to the course woody material in the creek. This conclusion was reached after the potential for sub dominant trees in the area of 100 to 150 feet from the creek was evaluated in these stands. These subdominant trees would grow at a slower rate than the dominant trees. Some may never achieve the height necessary (>100 feet) to fall and land in the creek and contribute large woody debris that could result in a positive impact for fish. Since the trees that would be removed are subdominant they are likely to stay subdominant and would likely not succeed to grow to a height where their contribution would have an effect given their subdominant status and the effect of competition. The trees that would be left after thinning are dominant trees and they would have the opportunity to maximize their growth potential. This would result in a contribution of LWD to streams that would be effective in creating the type of complex fish habitat that is need for fish. By thinning units in the riparian zone this project could enhance future potential direct input of LWD into the creeks adjacent to units. Thinning of units outside

of the 165 foot range would have no impact on direct recruitment of LWD to the streams in the project area.

The other potential recruitment delivery mechanism for LWD is indirect recruitment. Reeves et al. (2003) found that 65% of the wood in a large fish bearing stream in the Coast range in Oregon originated from upslope sources, with only 35% originating from chronic recruitment processes near the primary stream channel. It is likely that the zone width for indirect recruitment to headwater streams is similar to that for direct recruitment, and this zone should extend into upper headwater areas that have the potential for mass failure and subsequent debris torrent delivery.

As described above, research has shown that at least 80% of the instream LWD recruited to the stream network, either through chronic or episodic processes, originated from a zone 0-100 feet from the channel. Most of this wood originates from trees even closer to the channel (0-70 feet). The 100 foot no entry buffer would therefore retain most of the future direct recruitment source of LWD to fish habitat. The felling and yarding of trees from 100 to 165 ft from fish bearing streams would remove some trees that may have eventually been recruited directly to the streams. In all units in the Riparian zone thinning would not go below 50% canopy closure. The remaining trees would typically provide a sufficient level of standing trees to supply the stream network over the next zero to several hundred years, given chronic-only supply processes, and near natural rate of delivery given episodic supply processes.

It is probable that the implementation of this project would directly result in a reduction in the amount of woody debris available to the stream network. The woody debris removed as a result of this project would be of low quality, while the trees that would be retained would have a higher opportunity to provide a higher quality contribution of LWD. The development of fish habitat complexity is a result of contributions of LWD, not low quality small woody debris. The magnitude of this negative effect of removing low quality small woody debris is minimized through the establishment of protection buffers along streams and unstable areas, and limiting riparian thinning to a post harvest level of not less than 50% canopy closure. This would allow the majority of potential LWD trees to be retained in the treated watersheds. There would likely be a short term negative effect, of insignificant magnitude, and in the long term a positive effect for woody debris recruitment and retention.

- *Pools/riffles* – These stream features may occur immediately adjacent to some project elements. This project was designed to explicitly protect existing habitat features from negative direct impact, primarily by buffering these features from project impacts. Pool frequency and quality may also be indirectly affected through changes in the watershed physical processes, primarily via changed stream flow, or by changes in the sediment or woody material transport/retention rates to the streams. Changes to peak and base flow, sediment, and woody material were analyzed previously in this report and in the

hydrologists report, and it was concluded that the effects associated with the implementation of the project would rarely result in a negative effect to any of these indicators (discountable probability) or if negative effects were realized, they would be non-measurable, undetectable or the effects would not be of the level where they could be meaningfully evaluated (insignificant magnitude).

Since changes in these channel-associated habitat indicators is dependent on changes to the physical processes that shape and develop these features, and it is not expected that there would be significant negative effects to these processes, it can be determined that pool frequency and quality would also be relatively unaffected (negative, insignificant magnitude).

- *General Stream Channel Condition* – Given the above discussion of physical processes and the expected effects from the implementation of this project it is expected that there is a very low risk of direct or indirect negative effects to general channel condition in relation to fisheries habitat quality and quantity and the fisheries resource.

2. Water Quality for Fish

- *Water Temperature and Turbidity*- The hydrology report for this project states that

"Effects to water quality could occur with increases in inputs as the result of the timber sale… These inputs could be as varied as contaminants from petroleum products, sediment or solar radiation. All of these could have an adverse effect of the quality of water within the project area.

To reduce and minimize these effects design criteria were utilized which provided for the maintenance of water quality. 50 foot or larger no cut buffer were place along perennial streams and all intermittent and ephemeral channels were protected through the maintenance of trees attributing to channel bank stability. Localized effects would occur during the replacement of the culverts and the stream crossings after the first flow and for a limited length downstream. Mobilized materials are anticipated to fall out prior to reaching a confluence with a higher order stream due to the size of the material mobilized. It is therefore anticipated that minimal if any downstream effects would occur as a result of the proposed activity." (Halemeier 2006)

Increases in temperature would have an effect on the fisheries resource. This project was designed to protect and retain the primary shade zone and minimize the potential for increases in stream temperature. The project proposes to treat areas adjacent to and outside of primary shade zones along fish bearing streams. Approximately 11% (Table 4.) of the length of fish bearing streams in the project area is proposed to be treated. These alternatives propose to retain the complete primary shade zone in harvest areas adjacent to fish bearing streams. With the remaining 89% of the length of fish bearing streams remaining intact the potential for an increase is minimized. Additional risk reduction would result from the 50 foot or greater no entry buffer on all perennial streams. For most of these nonfish-bearing streams the primary shade zone is within that 50 (horizontal) foot buffer. Some of the stands required a greater 75 or 100 foot buffer. For stands in this area, in this type of terrain (trees >60 to 100 ft and hill slopes <30%) the minimum primary shade zone

is 50 horizontal feet (USFS BLM Sept 2005 pg 23). During implementation 50 slope feet would be used as the measure and it is likely that a greater than 50 foot horizontal buffer would be reserved for no entry in units adjacent to non fish bearing perennial streams. According to the Implementation Strategies document, by retaining the primary shade zone during implementation for projects such as this, the risk of increasing water temperature is reduced to a discountable probability.

Table 39 - Stream length and treated length in project area (outside of primary shade zone)

Stream	Length (apx miles)	Length treated (apx miles)	% Length Treated
Cougar Creek	3.4	.38	11
Bachelor Creek	2.25	.5	22
Holman Creek	2.5	.88	35
Jude Creek	2.25	.13	6
Middle Santiam River	12	.75	6
South Pyramid Creek	2.5	.13	5
Total	**24.9**	**2.77**	**11**

- *Chemical Contamination* **-** Fuel powered equipment used in timber falling and yarding activities would be used within the riparian reserves at varying distances from stream channels. Contract requirements specify spill containment measures for all machinery and equipment used in timber harvest activities. A fuel spill kit is required of operators in case of accidental spill, to minimize adverse aquatic effects. Chainsaws use minimal amounts of gas and any spills would likely be very small. Heavy ground-based equipment used for falling and yarding are fueled on landings, but there is a possibility that hydraulic lines could break during falling or yarding operations and could result in a spill. The no-harvest buffers along stream channels are sufficient to minimize potential transport of spilled fuels and fluids during timber falling and ground-based harvest.

  Cable yarding equipment is operated from, and fueled at, landings which must be over 100 feet from a stream channel. Spills associated with loading equipment may occur but are also likely to be very small and would occur within the road prism. Fuel spills originating from helicopter yarding or helicopter fueling operations are very rare, and transmission into waterways rarer still. The likelihood of fuel or fluid transmission during yarding operation is a discountable risk to aquatic habitat.

  Past projects with riparian thinning elements have demonstrated there is a very low probability of spilling significant amounts of fuel or oil near enough to channels to be transported and present risk to aquatic organisms. Project contract requirements and design criteria are effective measures to contain potential fuel and fluid transmission into waterways, reducing the possibility of aquatic habitat contamination to a discountable risk.

- *Stream Peak and Base Flows*- There is a discussion of Aggregate Recovery Percent (ARP) levels and the changes to peak and base flows in the hydrologist report for this sale (Halemeier 2006). That report states;

  "In reviewing the stream channels and their ability to respond to increases in peak flows it is not anticipated that the changes in hydrology would have a detrimental impact on downstream beneficial users. Flow changes anticipated are well within the variation of normal flows and should not generate a condition that the channel has not responded to through time. Short term changes may be evident in the time of the peak and the duration of flow through out the year due to changes in transpiration rates and routing of flows yet these changes are short lived until such time that the stand closes canopy and utilizes the available water for the site."

  Through discussion with the hydrologist on the Interdisciplinary Team (IDT) planning team, it appears that the changes in flow that may occur would not be of a nature that would impact the fisheries resource. The quality and quantity of available fish habitat would not likely be changed as a result of flow, or hydrologic change with the implementation alternatives 2 or 3 for this project.

3. Fish Biological Parameters

Implementation of Alternatives 2 or 3 could result in effects to the biological parameters for the fishery resource in the project area. A direct effect on the biological parameter would be from direct mortality or stress of fish as a result of chemical contamination. Removal of any stream side deciduous trees or leafy vegetation is not proposed but the following serves as an example of an indirect effect that was evaluated. An indirect effect on the biological parameters could be from loss of food sources (macroinvertibrates) as a result of less leafy debris delivered to streams because of reduction in riparian deciduous trees. The macroinvertibrates serve as a primary food source for fish and their population size would be negatively affected through the removal of stream side leafy vegetation that contributes to their diet. It is highly unlikely that any direct or indirect effects would continue downstream outside of the project area. The effects from this project would still be within the natural range of variability for this system and should in the long term be more positive than negative in nature.

The assessment above describes the potential changes to the physical habitat for fish in the project area in detail. The description includes explanations and information from current scientific literature of the importance of certain habitat complexities to the fishery resource. Changes to the biological parameter for fish as a result of the implementation of alternatives 2 or 3 as proposed for this project could be direct or indirect effects and would not likely impact fish on a scale that would be measurable or significant. Any effects should be short term in duration and could affect all life stages. Effects to population size and density are not expected, and there is no expected effect on the food supply for fish in the project area.

Cumulative Effects - Fisheries

Analysis Area: The area that was used to evaluate cumulative effects for this project is the 5th field watersheds of the Middle Santiam River and the rationale for selecting that area is that there are two smaller 6th field sub watersheds in the proposed project area. By limiting the evaluation to those sub watersheds would remove the opportunity to evaluate the interactions of fish between those two watersheds. It is likely that there are interactions between the populations of those watersheds. Additionally, if the analysis was limited to the smaller sub watershed area it would exclude analysis of the nearest ESA listed fish and would not analyze the potential impact on that population. Past, present and future projects were reviewed and the effects of those projects relative to the fishery resource shows there is overlap in time and space with the potential for direct and indirect effects resulting from this action.

Historic clear cut harvest and subsequent broadcast burning down to the stream banks may still be having a residual effect on fish habitat conditions, since this management probably interrupted the supply of wood to the stream, removed stream cover, and increased sediment delivery to the channel. Since these effects persist over time to some degree, and space for this project, they may still be incrementally affecting the condition of the stream channel. There are commercial timber lands in adjacent sections to some units in the project area. These lands are harvested more intensely and riparian thinning occurs into the primary shade zone in some areas. These management practices would have an effect on stream temperatures.

In addition to effects from past logging practices there remains some indirect effects from roads and their management. Past road construction resulted in the presence of roads which have had limited maintenance. Poor maintenance results in the potential for increased sediment delivery to streams in the project area. Fish are indirectly affected by the presence and poor maintenance of roads because the increased sediment from them can contribute to increased turbidity which results in negative impacts for fish.

Brook trout have been introduced to the project area and as an invasive species have a direct effect on the native population of rainbow and cutthroat trout. They directly compete for food and habitat.

Recreational fishing is an additional cumulative effect in the project area. The influence of this activity is direct in effects and can over time result in changes in population size and structure.

There would be no other cumulative effects to fisheries from the implementation of this project for any of the alternatives.

Conclusions- Fisheries

When the discussion of direct, indirect, and cumulative effects are combined the determination of how the exiting condition would be affected in relation to the DFC follows;

Through the IDT process alternatives 2 and 3 of this project were designed with criteria to protect the fisheries resource and prevent potential adverse impacts upon it. By maintaining no entry buffers on all of the primary shade zones, identifying potential habitat enhancement opportunities, utilizing protective contract language, and utilizing Best Management Practices

during implementation it is highly unlikely that the implementations of alternatives 2 or 3 would have a long term negative impact on the fish populations in the project area. On the contrary, the implementation of alternatives 2 or 3 would likely have a long term positive impact on this resource. If alternative 1 is selected it could result in the continued interruption of delivery and recruitment of LWD into this watershed, and the delay of growth of trees in the riparian zone that are so important for the needed development of complex fish habitat in this area.

Streams in the analysis area have been impacted by past management and natural events. The LRMP protection measures are allowing these streams and their associated riparian areas to slowly recover over time towards the DFC. This project is designed to accelerating that recovery.

This project would accelerate the growth and improve the health of the treated stands of trees. Implementation of this project could result in some short-term negative effects to stream conditions, primarily through slight increases in the sediment delivery rates to streams, short term interruption of the woody debris recruitment and retention rates for the project area, and subsequent increased turbidity levels. This is a slight risk that would unlikely result in the downstream effect to fish bearing stream reaches and MIS resident fish would not be affected. It is unlikely that any effects would be measurable. Endangered Species Act-listed fish UWC and UWS would not be negatively affected, given the very distant proximity to the project activity. All alternatives would be no effect to ESA-listed fish species.

Table 40 - ESA and MIS Fish

Measurement Criteria for Fish		Alt. 1	Alt. 2	Alt. 3
Probability of measurable negative effects realized to occupied fish habitat	ESA-Listed Fish	zero	zero	zero
	MIS-Anadromous	zero	zero	zero
	MIS-Resident	very low	very low	very low
Magnitude of negative effects to fish habitat	ESA Listed Fish	zero	zero	zero
	MIS-Anadromous	zero	zero	zero
	MIS-Resident	very low	very low	very low

Consistency with Direction and Regulations – Fisheries

Treatment of the fisheries resource is consistent with direction and regulations outlined in the Regulatory Framework, Management Direction, and Guidance section outlined in the Fisheries Specialist Report in Appendix G.

Fire and Fuels

Disturbance Mechanisms

a) Fires- Fire records from 1971-2001 indicate that approximately 35 fires caused by lightning, humans and escaped debris burns were reported and suppressed within or immediately adjacent to the planning area boundary. The largest of these fires were the 1976 Harter Mountain fire which burned 90 acres and the 1979 Cougar Rock fire which burned 325 acres near the western boundary of the planning area. Another thirty fires burned 50 acres or less within the planning area. All other fire starts during the modern fire suppression era (1971-present) were contained to one-third of an acre in size or less. In summary, the Middle Santiam Thin area has typically experienced one fire every three years since 1971 (Sources: Willamette NF fire records and GIS). The following map shows the spatial arrangement of historical fires in the planning area.

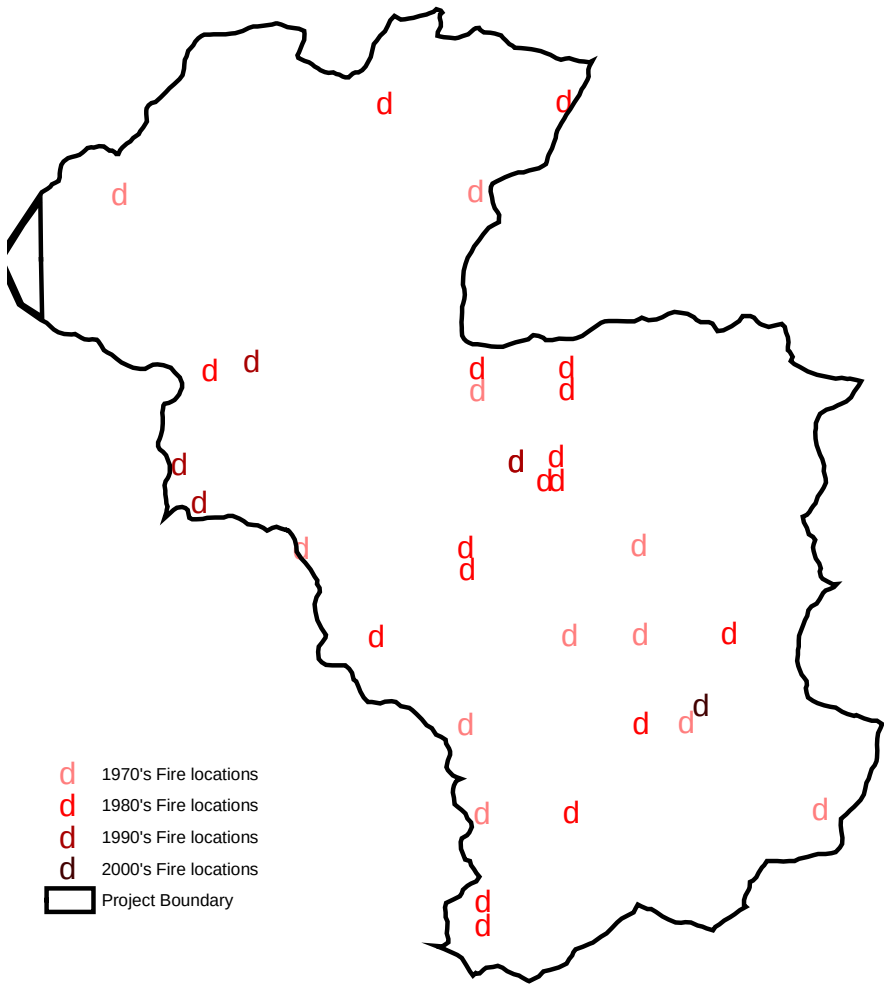


Figure 19 - Fire History

b) Timber Harvest- During the era of recorded fire history (1943-present), timber harvest has replaced fire as the dominant disturbance within the project area. Approximately 5500 acres of the project area were clearcut harvested and broadcast burned between the years 1951-1978, and the majority of stands that regenerated were pre-commercially thinned in later years. The thinned, second growth stands pose less of a threat in terms of fuels/fire danger potential. The forest understory is comprised primarily of vine maple, rhododendron, Oregon grape and beargrass (Sources: Willamette NF GIS and field observations).

Current Conditions- Fire/Fuels

Current fire/fuel conditions are classified by fire regime, condition class, fuel models, and fuel loading and are described below:

Natural Fire Regime

Fire Regime designations classify the frequency of fires on the landscape in the absence of modern human intervention. Mapping done through the Integrated Natural Fuels Management Strategy (INFMS) has designated lands within the Middle Santiam Thin project area as follows:

Table 41 - Fire Regimes in Project Area

Fire Regime	Fire Severity	Fire Return Interval	Percent of the Planning Area
3B	Mixed	50-100 years	5
3C	Mixed	100-200 years	75%
5A*	High	200-400 years	20%

*On the Willamette National Forest, fire regime 5Aoccurs mostly in the higher elevation forests.

The map below (figure 20) shows the distribution of these fire regimes within the project area

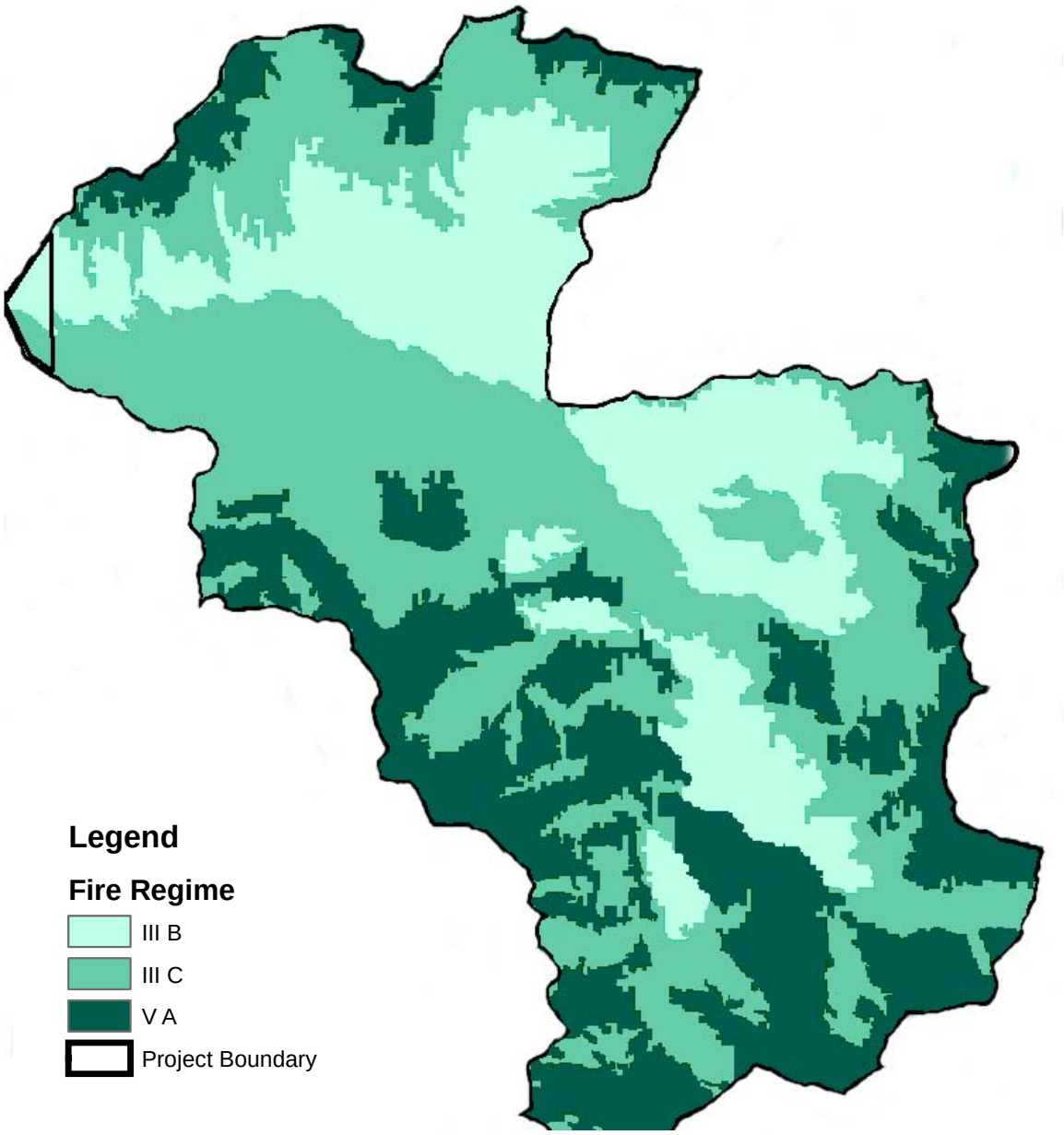


Figure 20 - Fire Regimes with Project Area

Condition Class

Condition Class describes the degree of departure from the natural fire regime as measured by variability in vegetation characteristics, fuel composition, fire frequency, fire severity, burn pattern and other associated disturbances.

- Class 1 - falls within the range of natural/historical variability of these characteristics.
- Class 2 - exhibits a moderate departure from the natural/historical variability while
- Class 3 - represents a high departure from the natural/historical variability.

Field observations during fuels inventories were used to determine Condition Classes for the proposed Middle Santiam Thin units. Approximately 80% of these units have been categorized as Condition Class 1 which is within the range of natural/historical variability. The remaining 20% exhibit moderate departure from the natural/historical variability and can be described as Condition Class 2.

Fuel Models

Field observations have identified three major Fire Behavior Prediction System Fuel Models in the planning area:

Table 42 - Fuel Models

Fuel Model	Characteristics	How Fire Spreads	Percent of Project Area
8	Closed conifer stands	Through litter and light fuels on the forest floor	35
5	Conifer stands	Primary carrier of fire is understory brush. Fires in this fuel model may generate high intensities and fast rates of spread under the right conditions. Crown fires may develop but are not as common as in Fuel Model 10	40
10	Closed conifer stands with significant component of dead and down fuels	Generally burn with greater intensity than fires in Fuel Model 8 and have and have a higher probability of developing into crown fires, which may lead to large fires with significant mortality when hot, dry and windy conditions persist.	25

While field observations are the most accurate method of determining fuel models described above, GIS fuels mapping done for the Willamette National Forest helps illustrate how fuels exist in a mosaic across a landscape. The following map (Figure 21) displays fuel model information based on landscape scale interpretation of stand and vegetation information.

Because landscape fuel mapping is done at a coarse scale, it is not as accurate as observations in the field. However, the following map does give an indication of how fuels models exist in a mosaic in the Middle Santiam Thin Project Area (Fuel modeling sources: GTR-INT-122, Willamette NF GIS and field observations).

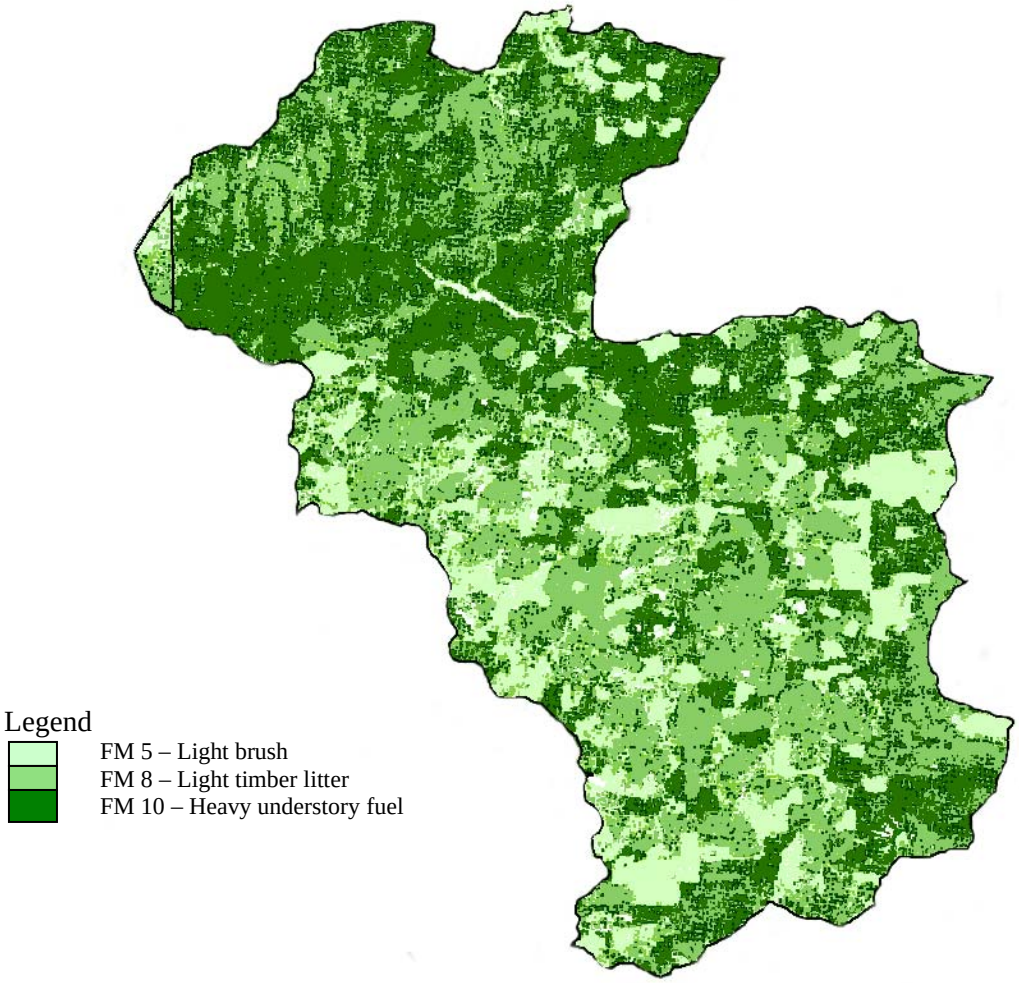


Figure 21 - Fuel Models

Fuel Loading: Random transects throughout the project area using digital photo series applications determined existing surface fuel loads.

Table 43 - Middle Santiam Surface Fuel Loading Estimates

Unit Number	0-3" Fuel Load+ (tons/acre)* Fine Fuels	>3" Fuel Load (tons/acre)	Total Fuel Load (tons/acre) Coarse Woody Fuels
25,26,27,28,30,33 34,36	2.1	18.2	20.3
3,4,5,6,7,8,9,10	2.3	10.6	12.9
2,37,38,39,43,46 47,48	2.4	8.7	11.1

Source: Field Surveys

\+ *Estimates were obtained using photo series/FMAPlus data and ocular estimates. In some cases, surface fuel loads from surveyed stands have been used to model nearby stands with similar characteristics.*

* *For the purpose of the Middle Santiam Thin analysis, 0-3" fuels may also be referred to as fine fuels and >3" fuels may be referred to as coarse woody fuels.*

It is well documented that coarse woody fuels have little influence on the spread and intensity of initiating surface fires. (Brown et al, 4) Fine fuels are required for fires to spread and gain the intensity needed to ignite heavier fuels. Harvest activities primarily generate fine fuels and create relatively small amounts of coarse woody fuels. In addition, treating coarse fuels on the landscape without treating fine fuels would not be considered further in this analysis. Coarse woody requirements for wildlife should be addressed in the wildlife biologist's analysis. Predictions for fine fuels generated as a result of harvest in the project area would be discussed in detail in the Environmental Consequences, Direct and Indirect Effects section.

Desired Future Condition- Fire/Fuels

As earlier noted, the Willamette National Forest plan Standards and Guidelines have established desired conditions for fine fuel loads on forest lands (7-11 tons/acre for 0-3" fuels). In addition, Fire Regime Condition Class (FRCC) assessment provides a framework for understanding the overall health of forested stands relative to their historical condition (refer to Fire/Fuels Specialist Report section VII, FRCC discussion in Appendix J). The desired future condition for treated stands in the planning area is Condition Class 1, which is defined by the following statement: within the range of natural/historical variability of vegetation characteristics, fuel composition, fire frequency, fire severity, and associated disturbances.

Direct and Indirect Affects- Fire/Fuels

Alternative 1 – (No Action)

Under Alternative 1, no fuels would be generated from harvest activity and forested stands would continue on a path of natural succession. However, modern fire suppression policies would continue to dictate fire exclusion from the project area. A lack of significant disturbance would mean that stands that were previously managed would continue growing in an overstocked condition. Slow growing and weakened trees would die and contribute to the fuel buildup on the forest floor. Condition Class 1 stands would progress towards Condition Classes 2 and 3. Overtime, the increasing fuel loads could be associated with greater fire intensity, severity and rates of spread. Fire occurrence on the landscape would continue only under uncontrolled wildland fire situations.

Alternatives 2 and 3

Timber harvest operations create fine fuels. These fuels are treated in order to reduce the majority of fine fuel loads to 7-11 tons per acre (the desired condition according to Willamette Plan Standards and Guidelines). Thinning of stands and the subsequent fuel reduction treatments will have the secondary benefit of lowering the risk of large wildfires in the project area.

Table 44 helps describe potential wildfire behavior in project area stands. The information in this table applies to all alternatives. Current fuel types in the planning area are Fuel Model 8, Fuel Model 5 mixed with Fuel Model 8 and Fuel Model 10. Post harvest fuel loadings in some of the stands are represented by fuel models 10 and 12.

Table 44 - Fire Behavior (late summer conditions)

Fuel Models*	Flame Length (ft.)	Rate of Spread (chains/hr)+	1 Hour Fire Size (acres)
8/5	2.9	7.4	2.8
10	4.2	5.0	1.4
12	7.2	9.6	4.9

Source: BEHAVE

* *Fuel Model 12 represents forests with moderate amounts of untreated slash on the ground. Fuel model 8/5 and 10 represent current fuel models. Under Alternatives 2 & 3, all stands would become fuel model 8/5 after proposed treatments are completed. See Table 42 for fuel model references.*

\+ *One chain = 66 feet*

The proposed commercial thinning in the Middle Santiam project area would open the stands, creating a forest canopy less susceptible to sustaining a crown fire. Ladder fuels would be reduced as harvest operations remove the vertical fuel continuity. Because heavily thinned stands would have fewer residual trees and more crown spacing, these stands would be less susceptible to crown fires than moderately thinned stands. The proposed treatments for both alternatives includes grapple piling, yarding trees with tops attached, roadside grapple piling clean-up, and pile burning.

The amount of harvest-related slash remaining in a unit depends primarily on the pre-existing surface fuel load and the number of trees to be harvested. In the Middle Santiam project area, stands that have been previously pre-commercial thinned would require harvest of fewer trees than stands that have never been thinned (assuming similar prescriptions). As a consequence, harvest generated slash would generally be heavier in previously unthinned units. In addition, previously unthinned stands in the project area generally have heavier pre-existing surface fuel loadings. This is true because there are more crowns to shed needles/twigs/branches, and because unthinned stands tend to have more dead and dying trees.

Both action alternatives require yarding tops/limbs on a number of units. Yarded material would be piled and burned at landings. Potential biomass utilization or firewood that is removed for home heating would reduce the amount of material burned at landings. Under both alternatives, roadside grapple piling cleanup would occur on all affected major and a few temporary roads. Upon completion, these fuel treatments would improve under Alternatives 2 and 3. Fire danger in acres left untreated would increase for up to 10 years until residual slash has sufficiently decomposed.

Alternative 2:

Alternative 2 is similar to Alternative 3 with regard to the treatments of skyline yarding of tops attached, grapple piling and roadside grapple piling cleanup. Alternative 2 differs from Alternative 3 in that approximately 120 acres are being helicopter logged. Similarly the residual slash (0-3" fuels) on all acres within the project area would be within or below the forest standards and guidelines. This treatment would effectively eliminate all uncharacteristic fire risk created by harvest-related logging slash, but at a slightly higher cost than Alternative 3 due to the use of a helicopter. Table 45 shows a summary of treatments for Alternative 2.

Table 45 - Alternative 2 Fuel Treatments by Individual Harvest Unit

Unit Number	Acres	Grapple Pile Acres	Roadside Grapple Pile Acres	Yarding Tops Acres	Number of Landings to Burn
1	11	0	1	9	4
2	20	0	2	20	6
3	24	0	1.5	0	6
4	14	0	0.5	0	2
5	52	0	2	0	9
6	59	0	3	0	10
7	13	0	0	0	5
8	17	0	1	0	4
9	21	0	1.25	0	6
10	40	30	0	0	6
11	22	0	2	0	3
12	48	0	0	0	7
13	7	0	0	0	0
14	98	33	0	0	11
15	81	0	6	0	17
16	7	0	0.5	0	1
17	34	0	1.5	0	6
18	27	0	1	0	6
19	43	0	0	0	13
20	18	0	1	0	4
21	11	2	1	0	3
22	59	0	2	0	4
22	33	0	1.5	0	5
24	30	0	3	30	8
25	51	0	2.5	0	11
26	58	0	3	46	6
27	24	0	2.25	24	7
28	29	0	1.5	23	7
29	28	0	2	0	6
30	31	0	0	8	4
31	22	0	0	0	0
32	20	9	0	11	3
33	13	7	0	6	3
34	23	0	2.25	23	4
35	45	21	0	24	7
36	10	0	0	0	3
37	15	3	1	12	6
38	49	0	0	0	10
41	38	0	0.5	0	6
42	16	14	0	0	2
43	3	0	0	0	2
44	36	0	0	0	4
46	76	0	5.5	0	14
47	28	0	2	0	6
48	58	22	1	0	6
49	49	0	4.5	0	12
52	38	0	6.25	0	5
Totals	**1549**	**141**	**66**	**236**	**280**

Alternative 3:

Under Alternative 3, skyline yarding of tops would occur on 236 acres, grapple & landing piling would occur on 141 acres and roadside grapple piling cleanup would be done on 66 acres of affected permanent and a few temporary roads. As a result of these treatments, residual fuel loadings in approximately 70% of the project area would be within standards and guidelines for 0-3" fuels. Fuel loadings in approximately 30% of the project area would be above forest standards and guidelines for several years.

Increased surface fuel loads affect fire behavior by temporarily increasing fire intensity and rate of spread. The increase in fuel loading is temporary because moderate to heavy precipitation in the western Cascades Mountains accelerates decomposition processes, especially for fine fuels. As a result, fire danger in an untreated stand would be highest 1-5 years after thinning and would decrease significantly thereafter. Studies done by Fahnestock and Dieterich have shown that Douglas fir slash decomposes to approximately 79% of its original volume after 5 years (Fahnestock, 1962). Field observations on the Willamette National Forest have indicated that Douglas fir and Western Hemlock slash decomposes to approximately 50% of its original volume after 10 years; observations have found that less than 10% of residual slash remains after 20 years. This indicates that all harvest units in the Middle Santiam Project Area would be within Willamette National Forest Standards and Guidelines for 0-3" fuels after 10 years. Because fire spread is primarily driven by 0-3" fuels, standards and guidelines for 0-3" fuels are used to determine when slash loadings are above acceptable levels.

The following table (Table 46) displays the fuels treatments by unit for Alternative 3.

Table 46 - Alternative 3 Fuel Treatments by Individual Harvest Unit

Unit Number	Acres	Grapple Pile Acres	Roadside Grapple Pile Acres	Yarding Tops Acres	Number of Landings to Burn
1	11	0	1	9	4
2	20	0	2	20	6
3	24	0	1.5	0	6
4	9	0	0.5	0	2
5	52	0	2	0	9
6	59	0	3	0	10
7	13	0	0	0	5
8	17	0	1	0	4
9	21	0	1.25	0	6
10	40	30	0	0	6
11	21	0	2	0	3
12	48	0	0	0	7
14	98	33	0	0	11
15	81	0	6	0	17
16	7	0	0.5	0	1
17	34	0	1.5	0	6
19	40	0	0	0	12
20	18	0	1	0	4
21	11	2	1	0	3
22	59	0	2	0	4
22	33	0	1.5	0	5
24	30	0	3	30	8
25	51	0	2.5	0	11
26	46	0	3	46	6
27	24	0	2.25	24	7
28	23	0	1.5	23	7
29	28	0	2	0	6
30	8	0	0	8	3
32	20	9	0	11	3
33	13	7	0	6	3
34	23	0	2.25	23	4
35	45	21	0	24	7
36	10	0	0	0	3
37	15	3	1	12	6
38	49	0	0	0	10
41	38	0	0.5	0	6
42	16	14	0	0	2
43	3	0	0	0	2
44	11	0	0	0	4
46	76	0	5.5	0	14
47	28	0	2	0	6
48	58	22	1	0	6
49	43	0	4.5	0	12
52	38	0	6.25	0	5
Totals	**1412**	**141**	**66**	**236**	**268**

As illustrated by Table 46, the fuels treatment for most units under Alternative 3 is grapple piling and piling/burning materials at roads/landings. The other treatments include yarding tops/limbs followed by excavator (grapple) cleanup of residual debris along major roads. This treatment is a cost effective approach to fuels cleanup that also creates fire breaks along project area roads. The amount of slash yarded to roads and landing areas through yarding tops/limbs would be approximately 2-3 tons per acre, depending on the unit being harvested. There is a small measure of risk until residual slash has decayed to levels within standards and guidelines, or up to 10 years, as noted previously. Units with proposed fuel treatments of yarding tops/limbs, burning piles and grapple piling along roadsides will be re-evaluated with post-harvest fuel loading surveys to determine if any additional fuel treatments would be required to meet fuel treatment objectives. Such treatment would consist of either grapple piling or hand piling of slash.

In summary, approximately 68% of the project area would be treated to levels within the Willamette National standards and guidelines for 0-3” fuel loading. The additional 32% of the area would remain slightly above standards and guidelines for 6-10 years while residual slash decomposes. Many of the units within the project area were already at or below standards and guides due to previous harvest activities, broadcast burning and YUM yarding & burning. The activity generated slash presented a small measure of risk.

Cumulative Effects- Fire/Fuels

Analysis Area**:** The analysis area for cumulative effects is the planning area.

Alternative 1

Under the no action alternative, stands would continue on the path of natural succession. Because of previous timber management practices of clearcutting, burning and yarding unmerchantable material in the planning area during the past, most stands in the project area are in relatively good condition. Approximately 35 fire starts have been recorded in or immediately adjacent to the 34,670 acre planning area during the era of modern fire suppression (1971-present). Approximately 38 % of these fires were contained at one-tenth of an acre or less. Two wildfires during the fire suppression era escaped initial attack and burned approximately 500 acres. During the pre-suppression era, natural fires in the project area would have burned at least 750 acres during the same number of years. This estimate in based upon a natural fire return interval of 200 years, although the actual return interval is probably closer to 150 years

(Source: INFMS Fire Regime Mapping). The cumulative effects of fire exclusion during the modern fire suppression era are well documented and have been observed in fire prone ecosystems throughout the American West (RMRS-GTR-42 vol. 5, pg.185-203). Due to the cumulative effects of fire suppression, the buildup of fuels in previously unthinned stands would become a more significant problem over the next 50 years. Increasing stand density and the accumulation of fuels would inevitably lead to a wildfire that is more difficult to control than a fire in a thinned stand. Condition class would continue to worsen until future treatments are accomplished or a stand destroying wildfire occurs. A severe, large wildfire may not occur in the project area for 50 years or more, but natural combinations of weather and fuel conditions would ensure that it would happen eventually.

Alternatives 2 and 3

As already noted, fire suppression practices during the past 50 years have caused the greatest cumulative effects with regard to fuels in the project area. Past timber management in the Middle Santiam planning area has been a secondary factor influencing cumulative effects on the forest fuel loadings. This has resulted in surface fuel loads and crown densities that are generally low-moderate in about 80% of the planned harvest area; these areas are represented mostly by fuel models 5 and 8. Surface and crown fuel loads in approximately 20% of the planned harvest area are generally heavy, and are mostly represented by a fuel model 10. Since 1949, approximately 5,500 acres in the Middle Santiam were sold as clearcuts creating a mosaic of stand ages. Ninety five percent of these stands were broadcast burned. The other 5% was YUM (yard unmerchantable material) yarded, piled and burned at the landings. This is the first commercial thinning that would occur in the planning area that had not been previously thinned within the Middle Santiam. Approximately three-fourths of forested stands in the planning area have never been managed. Approximately 16,000 acres are old growth or areas of special interest, 5,000 are

fire regenerated stands and the remaining 14,000 acres are a mix of Forest Service and private plantations, of which 5,500 acres are Forest Service. Surface and crown fuel densities in these stands are similar to unthinned stands within the planned Middle Santiam harvest areas. A wildfire in these stands has the potential to become larger and cause more tree mortality than a fire in a thinned stand. With proposed fuel treatments, areas that currently have low fuel loadings are expected to be within forest standards and guidelines after treatments are completed. From a fire danger perspective, this means that the post-treatment fire risk in these areas would be typical of other healthy stands found on the Willamette National Forest. Thinning would produce secondary benefit of long-term resistance to crown fire development and stand destroying fires in the project area. Main roads and spur roads within the project area where residual fuels have been thoroughly removed would serve as access points to firefighters and fuel breaks to reduce continuity of remaining slash. Condition class would improve and stabilize due to lower crown density and lighter fuel loads, especially as residual slash decomposes(Sources: GTR-INT-122, Willamette NF GIS timber sale data, and field observations.)

Air Quality

Current Conditions –Air Quality

The State of Oregon has been delegated authority for attainment standards set by the 1990 Clean Air Act and the 1977 Clean Air Act and its amendments. To do this, the state developed the Oregon Smoke Management Plan. The Forest Service has adopted this plan for the National Forest lands in Oregon.

The Oregon Smoke Management Plan establishes designated areas that are principal population centers and Class I airsheds, including wildernesses and other sensitive airsheds. One purpose of the Smoke Management Plan is to protect air quality in these high priority areas. The closest Class I airshed is Mt Jefferson Wilderness (10 miles respectively). The Middle Santiam Wilderness borders the northern project area units and the Menagarie is to the southwest (3 miles respectively). These are not considered a Class I airshed but are sensitive airsheds during the summer recreational months. Any burning of slash must be conducted according to the guidelines established by the Oregon Smoke Management Plan.

Direct and Indirect Effects– Air Quality

Alternative 1 – (No Action)

There would be no immediate impacts to air quality as a result of the No Action Alternative. However, the stands would continue to store biomass as they grow and postpone the release of smoke. Eventually a large fire would occur during the summer months when the fuels are the driest, resulting in a high consumption of fuels and large amounts of smoke. Smoke from such a wildfire could blanket one of the nearby wildernesses, town or impact a designated area (Albany, Sweet Home). This would amount to a significant, negative effect on air quality and visibility in the affected area. The most likely time for a large wildfire to occur is between July 1-September 15, coinciding with outdoor recreation activities and high public use of the wildernesses.

Alternatives 2 and 3

Air quality in the designated areas could be affected by fuel treatments that include pile burning. The following table (Table 43) illustrates the estimated totals of particulate matter (PM) 2.5 and 10 micron emissions according to treatment type.

Table 47 - Project Area Burning Emissions Estimates (tons)

Emission Type	Alternative 2 *	Alternative 3**	Wildfire +
PM 2.5	56	50	115
PM 10	63	59	136
PM Totals	119	109	251

* *Based on burning of approximately 726 acres of machine piles (landing and grapple piles within units and along roadsides).*

** *Based on burning 678 acres of machine piles (landing and grapple piles within units and along roadsides).*

\+ *Based on wildfire burning on approximately 1549 acres, late summer conditions.*

Prescribed pile burning would occur during fall and winter months according to limitations established by Oregon Smoke Management System forecaster. By adhering to the smoke management daily forecast, smoke impacts on sensitive areas should be negligible (Source: Oregon Smoke Management Emissions Estimates). If biomass utilization and/or firewood removal occurs, then smoke emissions would be reduced proportionately.

Cumulative Effects – Air Quality

Analysis Area- The analysis area for cumulative effects to air quality is the airshed.

Alternative 1 – (No Action)

The buildup of fuels represents a threat of the uncontrolled release of large amounts of emissions in the event of a wildfire. As noted earlier, fire exclusion has exacerbated the buildup of fuels in the project area and made a large wildfire more likely the longer forests go un-thinned. While there is no evidence to suggest that such a release of pollutants would be of any harm to general air quality, it is clear that such an event could have significant impact on air quality to sensitive areas. Table 47 gives an indication of the volume of common pollutants that would be released in the event of a wildfire.

Alternative 2 and 3

No long term, cumulative effects on air quality are anticipated due to burning associated with this project. All burning would be completed within two years of harvest, and would create far fewer emissions than a wildfire occurring in an area of equivalent size. In order to protect air quality, the Oregon Smoke Management instructions would be strictly adhered to. The Santiam River Zone Fire/Fuels (Sweet Home and Detroit RD) management strategy for prescribed burning is to avoid large, uncontrolled releases of smoke that are produced during large wildfires. By burning slash fuels in one timber sale area at a time, residual fuels are treated gradually and in a controlled manner. For this reason, emissions from prescribed burning are not greater than emissions caused by natural wildfires. The Santiam River Zone (Sweet Home and Detroit)

currently burns approximately 700 acres of logging slash per year. Fire history records for the districts from 1970-2001 indicate that wildfires burned 3611 acres on district lands or an average of 120 acres per year. Natural fire return intervals on most of the 490,000 acre Santiam River Zone are 100-200 years (INFMS mapping). If we assume (as the established fire regimes suggest) that all lands on the district burn at least once every 200 years, we can determine that the historical (pre-suppression era) average annual acres burned was 2450 acres (490,000 divided by 200- see FRCC Guidebook). In other words, natural wildfires that occurred prior to modern fire suppression era created a higher quantity of pollutants than are created by prescribed burning on the district today.

Monitoring- Air Quality

Monitoring of fuels treatments activities would include ocular and photo series assessments of treated areas for the purpose of evaluating the success of implemented fuels reduction plans. Monitoring activities would continue until fine fuel loads have been returned to background levels (7-11 tons/acre).

Special Habitats

Current Conditions – Special Habitats

Special habitats are non-forested areas including, meadows, ponds, caves, rock gardens, talus and cliffs. These sites are important reservoirs of biodiversity and provide habitat for a wide variety of plants, fungi, and animals, many of which are not found in forested areas. In fact, while special habitats cover only about 5% of the area in the Cascades Range, 85% of native flowering plants are found in these areas (Hickman 1976). In addition, special habitats provide habitat for many species currently on the Region 6 Sensitive Species List.

Approximately 47% of the mapped special habitats in the analysis area are adjacent to managed stands or roads (Middle Santiam Watershed Analysis 1996). Many of the units in Middle Santiam Thin contain special habitats as illustrated in the table below. Scattered rock openings, wetlands, and seasonal ponds are the most common special habitats in the area. These special habitats provide habitat for various plant communities and contribute to species diversity of the area, which is otherwise fairly uniform. The invasive weed, St. John's-wort is colonizing some of the rocky openings and Canada thistle is found in a number of wetlands.

Table 48 - Special Habitats found in and adjacent to harvest units

Unit No.	Special Habitats
1	Rock garden and cliffs along southern edge; rock garden along northwest edge: seep 300 feet northwest of remnant old-growth tree in north ½ of stand
2	Vine maple/talus along northeast edge
3	Rock outcrop in north half; swamp/pond along northern edge; vine maple/talus west of Road 2045
4	Seep in center of unit; rock outcrops on south and east sides
5	Rocky openings in western portion of stand
7	Beaver pond and large wet meadow on eastern edge
8	Seep ½ way between Road 2045 and Holman Creek
9	Wet meadow on eastern edge; rocky openings in western portion; talus to the northwest
10	Alder swamp in south east corner; seasonal pond northwest portion; linear wetlands south of Road 2045
11	Two seasonal ponds in western portion; alder swamp; large mesic meadow to north
12	Small seep and several *Phellinus weirii* pockets in southern portion
13	Rocky vine maple patches along western edge

Unit No.	Special Habitats
15	Rocky ridgeline northeast edge; alder swamp southeast portion; seep southeast portion; willow dominated wetland with ephemeral pond southeast portion
16	Alder swamp north of Road 2047
18	Beaver pond and meadow north edge of stand; small rock opening
19	Cliffs and vine maple/talus eastern edge and extending into center of stand
20	Large *Carex* wetland eastern edge; narrow wetland in stand interior; alder wetland in northwest corner; small seep and *Carex* wetland along southern boundary
21	Salix wetland divides north and south portions of stand
23	Alder wetland east side and forb-dominated wetlands in interior, east portion
24	Alder swale northern edge; wet meadow with seasonal pond south of spur 646
25	Three alder swales scattered throughout stand; small sedge meadow near Road 640
26	Two talus/vine maple patches just north of Road 2041
28	Pond west of stand; seasonal pond below road in wetland; additional Salix wetland below road
29	Multiple rock outcrops throughout stand
30	Vine maple/talus in southeast portion; wetlands below road along north edge
33	*Carex* wetland below road on northern edge
35	Wetland in northwest corner
38	*Phellinus weirii* pockets
41	Large mesic/wet meadow and seasonal pond in western portion
42	Large mesic meadow and a wet meadow and talus/vine maple along western edge
46	Multiple rock outcrops; cave
48	Wetland
49	Three wetlands
52	*Phellinus weirii* pocket, talus patch

Basis for evaluating effects – Special Habitats

Measurement criteria – Presence/absence; habitat quality

Scale of analysis, both direct/indirect effects and cumulative effects = Distribution within the watershed.

Direct and Indirect Effects – Special Habitats

Scale of analysis for indirect, direct and cumulative effects is the distribution within the watershed. Measurement criteria – presence/absence; habitat quality.

Alternative 1 – No Action

There would be minimal direct or indirect effects to special habitats under the No Action alternative. Trees in or surrounding the special habitats would continue to grow but at a slower pace than under the action alternatives do to the lack of thinning. Existing weed populations in special habitats would likely continue to spread, altering the plant composition of the site.

Alternatives 2 and 3

Special habitats are protected from physical disturbance in all action alternatives. No special habitats occur in proximity to planned temporary spur roads or landings. Buffers, when prescribed, should be sufficient to protect the microclimate and prevent invasive weed introduction. Buffers are not prescribed for rock outcrops, talus or other dry, rocky features because the prescription is for thinning and it is unlikely that opening up the canopy would significantly affect the plant community provided that the site is protected from physical disturbance, i.e. cable logging, skyline corridor. Many of the special habitats have invasive species in them and some control measure would be taken with the action alternatives.

Cumulative Effects- Special Habitats

Alternative 1 – No Action

Approximately 47% of the mapped special habitats in the Middle Santiam watershed are adjacent to roads or are in managed stands. Past management activities no doubt had an effect on special habitats, including changes to the microclimate and hydrology, soil compaction and introduction of invasive weeds.

Alternatives 2 and 3

Past timber harvest, road construction and associated activities on public and private lands have adversely affected special habitats by introducing invasive weeds and altering the microclimate. Given the protective measures of this action, additional cumulative effects are not anticipated.

Conclusions and rationale for conclusions- Special Habitats

Special habitats in the analysis area have been compromised by past management activities and the introduction of invasive weeds. Given the design criteria outlined in table 11 for special habitats and those for invasive plants, no further degradation would occur as a result of the proposed action.

Transportation System

Introduction- Transportation System

The proposed development for the Mid-Santiam Analysis Area would utilize but not expand the existing transportation system. Work would be required on the existing system roads either as reconstruction, pre-haul maintenance, during-haul maintenance or post-haul maintenance (see Table 51). Additionally, construction and opening of existing non-system roads would be required. The objective for the existing transportation system would be to maintain it to the level necessary to facilitate haul during the proposed season of use and comply with the current Road Management Objectives.

Documentation of the decision process and further notes are on file at the Sweet Home Ranger District (see also Transportation Report in Appendix L).

Current Condition- Transportation System

Most roads within the Mid-Santiam Planning area are share-cost agreement roads. These roads are in generally good condition due to ongoing share-cost agreement work. Needed road work normally involves only brushing, blading, ditch reconditioning, spot surfacing placement, culvert inlet and outlet cleaning, and occasional culvert replacements. However, a few settling issues have been reported. For example, on Road 2045 the road is settling with some cutbank failures and tension cracks along the road.

Primary access to the Mid-Santiam Planning area is provided by Roads 2041, 2045, 2047, and 2049. All primary access roads are aggregate surfaced. All other roads tributary to these major access roads are single lane gravel, pit-run, or native surfaced roads with turnouts which have been built and maintained primarily for timber harvest activities. These roads are either termed collector or local roads. Most local roads have been closed by some method for wildlife protection. All system roads designated for haul in the Mid-Santiam Planning area have been rocked previously to some degree with either crushed aggregate or pit-run material, with the possible exception of Road 2049643. The remaining quality and quantity of rock varies by road. The open road density for the planning area is currently at 3.2 square miles per mile. With the implementation of gate closures on Roads 2041 510 and 2041 520, berm closures on roads 2049 640 and 2049 643, and 2047 846, and decommissioning work on Roads 2041515, 2041519, and 2041520, the open road density for the planning area would decrease.

Over 60% of the roads used for haul also access private land holdings in the planning area and are within share cost agreement designations. An undetermined number of non-system roads exist, usually consisting of short spurs that accessed landing locations in previously logged areas. Rights of way or temporary easements would be necessary to provide access to Units 2, 3, and 10 within the planning area and would be obtained prior to harvest activities.

The Forest Service does not anticipate any future timber sale or public works projects to be conducted within the Mid-Santiam planning area that could result in adverse conditions to timber sale haul or other activities associated with this planning effort. However, it is anticipated that there would be timber cut and hauled from private lands within the planning area, although the locations and dates of these activities are not known.

Desired Future Condition- Transportation System

In Matrix-General Forest management allocations, most roads are share-cost and there is little latitude to adjust the system. Local roads can be storm-proofed where there are no active management projects. Mutually agreeable standards for storm-proofing shall be pursued on shared roads (USDA, 1996).

Over the long-term, Roads 2047747 and 2041 (to Road 2041646) are priorities for maintaining road access to the Middle Santiam Wilderness (USDA, 1996).

In the Late-Successional Reserves the following roads should be kept in a driveable condition for fire suppression, recreation access and other management activities: Roads 2047 and 2047 750 (USDA, 1996).

Table 49, below, depicts key forest roads within the Mid-Santiam planning area that are designated as Key Forest Roads according to the Willamette National Forest Roads Analysis (2003).

Table 49 - Key Forest Roads

Road Number	Key Forest Road	Objective Maintenance Level
2041 000	Yes	3 – Suitable for Passenger cars
2041 645	Yes	2 – High clearance vehicles
2041 646	Yes	2 – High clearance vehicles
2045 000	Yes	3 – Suitable for Passenger cars
2045 140	Yes	2 – High clearance vehicles
2045 240	Yes	2 – High clearance vehicles
2047 000	Yes	2 – High clearance vehicles
2047 840	Yes	2 – High clearance vehicles

These key forest roads “should be operated and maintained to standards consistent with its road maintenance objective. The public would be encouraged to use the system of Key Forest Roads for access into and through the Forest.” (USDA, 2003).

Key Forest Roads are perceived to be the minimum system of routes needed to meet anticipated forest management objectives and public access needs. Key Forest Roads are the roads most traveled to sites within the forest. They would provide the majority of forest visitor, administrative, commercial, research, and other travel needs. These roads would be identified as

the key roads to important destination points and provide a network of vital inter-forest connections (USDA, 2003).

Direct and Indirect Effects- Transportation System

The following measurement criteria were used to assess transportation system effects:

1. Miles of road to reconstruct.
2. Miles of road to perform pre-haul maintenance.
3. Road share-cost miles.
4. Cost of reconstruction.
5. Cost of pre-haul maintenance.
6. Miles of temporary spur road construction.
7. Miles of non-system spur road to be reopened.
8. Cost of temporary spur road construction and non-system road reopening

Alternative 1- No Action

Road conditions would remain unchanged. Road maintenance activities would occur according to established patterns of routine maintenance. No additional road maintenance, reconstruction, or construction would occur with this alternative.

Alternatives 2 and 3

The only difference between Alternative 2 and 3 is that Alternative 2 includes units utilizing helicopter logging harvest methods and Alternative 3 does not.

These Alternatives would require the same amount of temporary road work (see Tables 46 and 49 for costs). Both Alternatives would require substantial reconstruction and pre-haul maintenance work to be done (see Tables 46 and 48 for costs). Road decommissioning, storm-proofing and gate installation activities are similar in both alternatives (see Table 47 for work activities by road number).

Alternative 2

Four additional road segments would be utilized for haul that are not needed for Alternative 3. Three road segments involve pre-haul maintenance work. These are on Roads 2047720 (0.15 miles), 2047721 (0.40 miles), and 2047722 (0.15 miles). The fourth, Road 2041510 (0.07 miles) requires additional reconstruction. The cost for this additional work would be $600, $1,600, $600, and $5,000, respectively for a total of $7,800.

Road 2041 660, which is utilize for haul in Alternative 3, is not needed in Alternative 2, resulting in a reduction of 0.10 miles and $50,000 in reconstruction costs from Alternative 3.

Alternative 3

The four additional road segments needed for Alternative 2, at a cost of $7,800, are not required. As a result, 0.70 miles of pre-haul maintenance ($2,800) and 0.07 miles of

reconstruction ($5,000) that is utilized in Alternative 2 would not be used in Alternative 3. However, Road 2041660 (0.10 miles) would be utilized for haul, which is not needed for Alternative 2. The cost for reconstruction of this road is $50,000. These differences result in 0.70 miles less pre-haul maintenance and 0.03 greater miles of reconstruction required for Alternative 3 at respective cost differences of -$2,800 and +$45,000.

The differences between Alternatives 2 and 3 for pre-haul and reconstruction costs and haul miles are summarized in the following table.

Table 50 - Comparison of Road Work/Cost by Alternative

Type/Amount/Cost of Work	Alternative Two		Alternative Three	
	Miles	Cost	Miles	Cost
Reconstruction	37.01	$192,610	37.04	$237,610
Pre-haul Maintenance	36.17	$144,680	35.47	$141,880
Temporary Road Construction	1.0	$5,000	1.0	$5,000
Non-system Road Reopening	2.2	$11,078	2.2	$11,078
Totals	**76.38**	**$353,368**	**75.71**	**$395,568**

Table 51- Haul Road Status and Anticipated Level of Work Activities

Road Number	Haul Miles	Total Miles	Share Cost Miles	Recon-struction	Pre-haul Mtce	Surfacing	Mtce. Level	Material Source	Road Closures/Decommissiong/ Storm-Proofing
2041000	13.80	20.03	12.2	X		Agg. 1/	3	M-Line Pit M.P. 10.90	
2041510	2.00	2.00	0	X		Agg.	2		Gate
2041515		2.13**							Decommission last 0.7 miles of road
2041519		0.31							Decommission last 0.12 miles of road
2041520	2.80	2.80	2.04	X		Agg.	2		Decommission last 0.25 miles of road/ Add gate at beginning of road
2041559	0.30	0.30	0	X		Imp. 2/	1		
2041563	0.05	0.05	0	X		Imp.	1	Cayuse Pit	
2041625	1.26	1.77	1.26	X		Agg.	2		
2041640	0.30	1.67	0.90		X	Agg.	2		
2041645	1.20	1.48	1.16	X		Agg.	2		
2041646	0.60	0.60	0		X	Agg.	3		
2041 660	0.1	0.19	0	X		Imp.	1		
2045000	7.83	7.83	7.83	X		Agg.	2		
2045120 *	0.64	2.24	0.64	X		Agg.	2		
2045123 *	0.20	0.20	0.20	X		Agg.	-		
2045140	1.90	2.64	1.90	X		Agg.	2		
2045142	0.43	1.50	0.43	X		Agg.	2		
2045147	0.77	0.77	0.77	X		Agg.	1		

Road Number	Haul Miles	Total Miles	Share Cost Miles	Recon-struction	Pre-haul Mtce	Surfacing	Mtce. Level	Material Source	Road Closures/Decommissiong/ Storm-Proofing
2045149		0.17							Storm-proof
2045161	0.15	0.15	0		X	Agg.	1	Holman Pit	
2045170*	0.10	0.10	0.10	X		Agg.	-		
2045223	0.44	1.02	0	X		Imp.	2		
2045240	0.48	0.68	0		X	Agg.	2		
2045250	1.90	3.19	0.77	X		Agg.	2		
2047000	13.20	20.89	12.2		X	Agg.	2		
2047720	0.15	0.60	0.15		X	Imp.	2		
2047721	0.40	0.63	0		X	Agg.	1		
2047722	0.15	0.15	0		X	Agg.	1		
2047725	0.26	0.71	0	X		Imp.	1		
2047726	0.10	0.10	0		X	Imp.	1		
2047739	0.48	0.48	0		X	Agg.	1		
2047825	0.73	2.54	0.73	X		Agg.	2		
2047826	0.24	0.29	0.24		X	Imp.	1		
2047827	0.15	0.15	0		X	Agg.	-		
2047828	0.50	0.58	0.50		X	Imp.	2		
2047840	1.00	5.11	1.00		X	Agg.	2		
2047843	0.21	0.21	0		X	Imp.	1		
2047846	0.83	0.83	0		X	Agg.	1		Berm and storm proof
2047852	0.10	1.26	0		X	Agg.	2		
2049000	9.46	9.46	9.46		X	Agg.	2	Mid-Santiam Pit M.P. o.76	
2049550	0.80	1.16	0.80		X	Agg.	2		

Road Number	Haul Miles	Total Miles	Share Cost Miles	Recon-struction	Pre-haul Mtce	Surfacing	Mtce. Level	Material Source	Road Closures/Decommissiong/ Storm-Proofing
2049555	0.80	2.06	0.80		X	Agg.	2		
2049610	0.40	1.72	0.40	X		Agg.	2		
2049615	2.02	2.02	1.68		X	Agg.	2		
2049617	0.45	0.72	0		X	Imp.	1		
2049620	0.30	0.30	0		X	Imp.	1		
2049630	1.20	2.16	0.70		X	Agg.	2		
2049635	0.41	3.98	0.41		X	Agg.	2		
2049636	0.22	1.30	0.22		X	Agg.	2		
2049640	0.84	0.84	0.35		X	Agg.	2		Berm and storm proof
2049643	0.63	0.63	0		X	Nat. 3/	1		Berm and storm proof
Total	**73.28 Miles**	**144.67 Miles**	**59.84 Miles**	**20 Roads**	**28 Roads**				**6 Roads**

* *Requires R/W or Temporary Easement*

** *First 1.43 Miles is on Private Land*

*** *Material Source Access*

1/ Agg. – Aggregate, road surface is rocked.

2/ Imp. – Spot rock only on road surface.

3/ Nat. – Native surfaced road.

Mtce. - Maintenance

Table 52 - Estimated Road Reconstruction Costs

Road Number	Length of Reconstruction (Miles)	Estimated Cost	Anticipated Major Work Activity
2041000	13.80	$24,190	Brushing, ditch reconditioning, slough removal, culvert cleanout and replacement, spot surfacing, danger tree removal.
2041510	2.00	$13,225	Brushing, ditch reconditioning, slough removal, slump repair, culvert cleanout and replacement, spot surfacing.
2041520	2.80	$29,900	Remove blowdown, brushing, ditch reconditioning, slough removal, culvert cleanout and replacement, spot surfacing, repair hole in road.
2041559	0.30	$7,924	Brushing, clearing and grubbing, and spot surfacing.
2041563	0.05	$1,093	Brushing clearing and grubbing
2041625	1.26	$7,130	Brushing, ditch reconditioning, culvert cleanout and replacement, spot surfacing.
2041645	1.20	$10,465	Brushing, blowdown removal, ditch reconditioning, spot surfacing, culvert cleanout and replacement.
2041 660	0.10	$50,000	Culvert replacement
2045000	7.83	$43,896	Brushing, blowdown removal, ditch reconditioning, slough removal, culvert cleanout and replacement, spot surfacing.
2045120*	0.64	$5,100	Brushing, slough removal, culvert cleanout, spot surfacing
2045123*	0.20	$1,208	Brushing, spot Surfacing
2045140	1.90	$11,885	Brushing, ditch reconditioning, spot surfacing, culvert cleanout and replacement
2045142	0.43	$1,714	Brushing, ditch reconditioning, culvert cleanout and replacement
2045147	0.77	$18,573	Brushing, ditch reconditioning, repair washouts, spot surfacing, culvert cleanout and replacement, drain dip construction
2045170*	0.10	$575	Brushing , Clearing and Grubbing
2045223	0.44	$702	Brushing, clearing and grubbing
2045250	1.90	$4,479	Brushing, ditch reconditioning, spot surfacing.
2047725	0.26	$2,300	Brushing, borrow placement, culvert replacement.
2047825	0.73	$5,606	Brushing, ditch reconditioning, culvert clean/replace

Road Number	Length of Reconstruction (Miles)	Estimated Cost	Anticipated Major Work Activity
2049610	0.40	$2,645	Brushing, ditch reconditioning, culvert cleanout and replacement.
Total	**37.11**	**$242,610**	

* Need R/W or Temporary Easement

Table 53 - Temporary Road Construction Costs

Unit Number	Temporary Road Construction (Miles)	Reopen Non-system Roads (Miles)	Estimated Cost
3	0.03	0	$150
5	0.03	0	$150
8	0	0.12	$600
9	0.08	0.12	$1,000
10	0	0.34	$1,700
11	0	0.12	$600
12	0	0.13	$650
14	0	0.10	$528
15	0.21	0	$1,050
19	0.09	0.08	$850
22	0	0.09	$450
23	0	0.24	$1,200
25	0.09	0.28	$1,850
26	0	0.10	$500
28	0.06	0.05	$550
29	0	0.22	$1,100
34	0	0.16	$800
38	0.18	0	$900
41	0.05	0.06	$550
47	0.03	0	$150
48	0.06	0	$300
49	0.09	0	$450
Total	**1.00**	**2.21**	**$16,078**

Recreation

The following assessment of project effects on recreation opportunities is drawn from 15 years of managing recreation use in the Upper Middle Santiam watershed. Given the anticipated project effects on recreation facilities or opportunities, no recreation data specific to this project was collected to support this assessment beyond simple field visits to units.

Current Conditions – Recreation

The Middle Santiam project area is a lightly-used recreation area on the Sweet Home Ranger District that offers dispersed recreation opportunities to the public. These recreation opportunities include hiking, hunting, fishing, and undeveloped site (dispersed) camping. Other activities like mushroom harvesting, berry picking and driving forest roads for pleasure also occur in the project area, however the level of such use is minor.

Recreation use in the project area is constrained to the above activities primarily by a lack of developed recreation infrastructure, beyond access roads, and a high proportion of private land mixed with public land in the subwatersheds. Only two developed trails, #3382 and 3403, run through the project area. These trails provide trail access to the Middle Santiam Wilderness from the southeast and connect to the old Cascades Crest trail system from the east. Three managed trailheads are linked to these two trails. Two trailheads for trail #3382 (Chimney Peak Trail) would be affected by proposed thinning in units 28 and 36. The third trailhead for trail # 3403 (South Pyramid Creek Trail) is located at the end of road 2047-747 and north of proposed thinning unit 20. The trailhead for trail #3403 offers corrals and camp sites for horse riders. While both trails are managed for multiple uses, foot traffic is the dominant type of use on these trails.

Fishing within the analysis area occurs primarily in the Middle Santiam River, with most of this activity occurring within the Middle Santiam Wilderness and near the river crossing of trail #3382. Dispersed camping occurs throughout the planning area, typically on old harvest landings during the big game hunting seasons. Dispersed camping also occurs near the Middle Santiam River in the Middle Santiam Wilderness. Anglers, hunters and gatherers of huckleberries or mushrooms rely heavily on existing road systems to travel through the project area.

The project area possesses a high density of roads, though many of the local roads are on or lead to private timber lands. Over the last ten years, impressions during routine field patrols have noted an increase in the use of Class 1 off-highway vehicles (ATV’s or quads) on the District’s road systems. This density of roads may attract more OHV use within the project area over the next ten years. Currently most OHV use comes from local communities and occurs during fall hunting seasons. In general, ATV use on the District and within the project area is still low density, but is expected to increase over the next ten years in tandem with the expected growth in this activity.

Direct and Indirect Effects – Recreation

Alternative 1: No Action

Alternative 1 would not directly affect recreation visitors or opportunities in the project area, except through a lost revenue opportunity for maintaining roads, dispersed sites and recreation facilities. The effects of lost revenue are described below under indirect impacts.

Alternative 1 would not generate timber sale revenue that could be used for maintaining the forest road system at levels that recreation visitors have enjoyed over the last 20 years. Visitors to the project area may experience local road corridors narrowing from vegetation growth and downed trees under Alternative 1. Visitors may even find some local spurs becoming closed or impassable due to the District's reduced ability to fund the removal of downed trees or local roadside failures across these roads. In some cases, the natural closing of local roads would eliminate vehicle access to dispersed camp sites in the project area. Maintenance of main access roads to the three trailheads identified above and to the Middle Santiam Wilderness would not be affected by Alternative 1.

Alternative 1 would not generate timber sale revenue that also could be used for maintaining trailhead infrastructure or trail corridors within one-quarter mile of thinning units. Projected revenue from this timber sale could have contributed to maintaining up to ½ mile of trail repair and deferred trailhead maintenance for one or two years. For this project, recreation projects are ranked as lower priority work items on the list of potential post sale activities.

Alternatives 2 and 3:

Commercial thinning proposed under Alternatives 2 and 3 could have a minor influence on foreground views along the first 0.3 miles of trail # 2282 through unit 28. While both Alternatives would maintain a no-cut buffer along this trail, the change of stand density within thinned areas would be evident to hikers. Anticipated changes in the visual setting along this trial would likely disappear within the first five years after harvest.

Alternative 3 proposes to change the location of the trailhead at the end of Forest Road 2041 by reestablishing about 0.1 miles of obliterated road right-of-way for thinning unit 36. Currently, this right of way is used as a foot trail for accessing the Middle Santiam River and Wilderness. A 1996 landflow eliminated this obliterated section of Forest Road 2041. Vegetation within this right-of-way is currently sparse and less than 15 feet tall. Reestablishing this 5-600 foot road right of way would bring the trailhead and related motor vehicle traffic to the east side of a perennial stream and slightly closer to the Middle Santiam River. A new trailhead would need to be moved to either the landing site for unit 36 or to the gentle terrain in the debris flow area.

Both Alternatives 2 and 3 propose harvest operations and connected log truck traffic that would compete with recreation visitors for open road corridors. Visitors would find it necessary to avoid certain areas involved in active logging operations. The trailheads at the end of Forest Roads 2041 and 2041-646 would be closed for short periods while harvest operations occur. Hunters during the fall big game seasons may feel most affected by disturbance from logging operations within the project area. While those operations would be shut down during key hunting weekends, visitors on other hunt days would experience competition for

road corridors and disturbance from logging equipment or helicopters. Such logging disturbance and access constraints would be short in duration and likely to affect only one or two hunting seasons.

Alternatives 2 and 3 propose to close short sections of local roads with berms or gates in order to reduce road densities and the maintenance costs of keeping these roads open. The total miles of proposed road closures are less than six miles. Vehicle access to the project area would be slightly reduced by these closures. Closing road 2041-510 near its junction with road 2041 is likely to affect area visitors, particularly hunters, the greatest because of its length and opportunities for vehicle access to the edge of a large roadless area.

Alternatives 2 and 3 would generate timber revenues that could be used for road, trailhead, and trail maintenance. Road maintenance would improve vehicle travel along maintained local roads. Facility maintenance through timber revenues would reduce deferred maintenance needs at trailheads within the project area. Public access on major roads through the planning area would likely not change much under Alternatives 2 and 3. The extent of improved vehicle access on local roads offered by revenues from these alternatives would depend on how road access needs compare to other resource needs as a priority within the project area.

By extending road 2041 to the landing for unit 36, Alternative 3 would increase the potential for ATV traffic to access closed sections of road 2041 that are located beyond unit 36. Currently the existing trailhead location and creek crossing in the debris flow area act as deterrents for ATV riders. Alternative 3 would remove these deterrents, and by doing so could attract ATV traffic closer to the Middle Santiam River and Wilderness.

Cumulative Effects – Recreation

Analysis Area - The area analyzed for cumulative effects was the project area.

Alternative 1 – No Action

Recreation and road maintenance budgets have declined over the last ten years, due principally to a reduction revenues from the timber sale program. Consequently, the District has reduced the frequency of facility maintenance and thereby increased the amount of deferred maintenance. This budget trend has resulted in an incremental decline in the quality and quantity of facilities (roads, trails, trailheads) available to the visiting public. Alternative 1 would not change this trend of reduced timber sale revenue available for maintaining roads and trail systems.

Area visitors may find fewer open roads to travel in the project area and rougher road surfaces to travel over the next ten years. Hikers and wilderness visitors would likely experience a trend of rougher road conditions over the same period, but no net loss in their access to trailheads because limited road budgets would be targeted towards main routes like forest roads 2041 and 2047.

Over the next 10 years, the cumulative level of road access for visitors to the project area would depend on private timberlands operations and other Forest Service thinning projects in the planning area. Each of these operations has the potential to complete road maintenance work and improve overall access for area visitors.

Alternatives 2 and 3

For those local roads used by timber operations under Alternatives 2 and 3, visitors would experience incremental improvements in clearing limits and road surfaces after operations are complete. These improvements could be expected to last at least five years. Visitors would also have more vehicle access within the planning area through road maintenance efforts under these alternatives.

Conclusions and Rationale Supporting those Conclusions - Recreation

Alternatives 2 and 3 remain consistent with Forest Plan standards and guidelines for recreation resources. Effects from this project on recreation opportunities within the project area are expected to be minimal in time and space, considering the past history of timber harvest activities in the area, the level of recreation facilities affected, and the current level of recreation use. Road closures proposed under this project would create no significant changes to recreation use patterns within the watershed. The most notable change in recreation use patterns would be experienced by visitors during seasonal hunting seasons because of the closure of road 2041-510. Maintenance of transportation features offered by this project would benefit public access on local roads that are not receiving adequate maintenance.

Monitoring to Address Unknown Effects - Recreation

ATV use on closed sections of road 2041 beyond the road 2041-660 junction would be monitored.

Heritage Resources

Current Conditions- Heritage

The prehistory and history of the Middle Santiam sub basin and Middle Santiam River watershed have previously been summarized in the Cultural Resource Overview of the Willamette National Forest, Western Oregon (Minor 1987) and the Middle Santiam River Watershed Analysis Heritage Resource Report (Farque 1996). The following summarizes this information in sufficient detail to serve as a basic reference of ethnographic and historic background for this document.

Ethnographic evidence suggests that highly mobile groups indigenous to the western Cascade Mountains lived during the winter along low elevation streams, accessing the uplands during the summer and fall to hunt game and gather berries and other important plant resources. Extensive trail networks were important for traversing the Cascade Mountains, linking the Molala Indian bands with each other, surrounding tribes and important resource procurement and trade centers. A common activity at many of the sites is the manufacture and maintenance of lithic tools and biface reduction. The site distribution pattern within the Mid Santiam Timber Sale area suggests that past Indian groups were traveling along the ridgelines to access high elevation meadows, huckleberry fields, trading locales, and big game.

The 1931 Santiam National Forest map and the 1947 Willamette National Forest maps reveal the Silver Lake way trail that trends SW to NE across the southern third of the project area. This way trail connects two areas of archaeological site concentration indicating frequent, long term indigenous use: the Harter Mountain area (SW of the project area) and the Park (known today as Park Creek, East of the project area). This historic way trail is not recorded within any of the proposed Mid Santiam Thin units.

Direct and Indirect Effects - Heritage

The field survey for the Middle Santiam Thin Timber Sale located two new archaeological sites. In addition, previous surveys in the project area associated with salvage sale preparation located nine lithic scatter sites within the proposed project area boundary. These 11 sites are considered potentially eligible to the National Register of Historic Places (NRHP) and must be protected from project activities or evaluated to determine their eligibility to the NRHP.

Alternative 1 (No Action)

Implementation of the No Action Alternative would not directly nor indirectly affect heritage resources since there would be no change to the integrity of heritage resource sites.

All Action Alternatives

Implementation of Alternatives 2 or 3 would not directly nor indirectly affect heritage resources. All potentially eligible sites have been protected by redesigning timber sale unit boundaries, and/or restricting ancillary activities to protect the sites from Timber Harvest and associated project activities.

Cumulative Effects – Heritage

Analysis Area: The analysis area for cumulative effects was the project area.

All Alternatives

It is not anticipated that there would be cumulative effects to the potentially eligible heritage resources in the Middle Santiam Thin Project Area from any of the proposed activities.

Conclusions - Heritage

All eleven heritage sites have been evaluated as eligible or potentially eligible for inclusion to the National Register of Historic Places (NRHP) and would be strictly avoided during ground-disturbing activities. Log landings or other ground disturbing activities would not be permitted near the eligible or potentially eligible historic properties (for further information about Heritage Resources report in Appendix M)

Consistency with Direction and Regulations

Since project design has excluded all known heritage resources from potential impact, there would be no effect on heritage resources. Under the Programmatic agreement the Forest Heritage Specialist has project review authority, and certifies that the project complies with Section 106 of the National Historic Preservation Act. That certification of the project as "No Historic Properties Affected" was completed in March 2007.

Economics

Introduction - The viability of a timber sale proposal is predicated on having an economically efficient proposal that contractors would want to purchase. Sale design and thinning prescription implementation requirements all must be taken into consideration in determining the economic viability of a project. A below cost (deficit) sale or a package which generates no bidder interest is not desirable because it does not accomplish the desired silvicultural treatments to achieve habitat objectives and provides no wood or work for the community.

Direct and Indirect Effects - Economics

Alternative 1 (No Action) – This alternative would produce no returns to the treasury and no costs would be incurred for stand treatments. By not harvesting in this area, no timber volume would be offered for sale which could affect employment of local workers in the wood products industries.

Alternatives 2 and 3 - All proposed action alternatives for the Middle Santiam Thin EA show a positive return to the treasury (see Table 54 and economic worksheets in Appendix C). Short-term dollar costs and incomes have been used to provide relative economic values associated with each alternative. Values are not meant to be comprehensive because of the difficulty of assigning values to resource benefits. Timber values from a recent commercial thinning timber sale of comparable timber were used for this comparison. All acreage and costs used are estimates. Both action alternatives provide a positive return on investment.

See table 54 below for a comparison of the economics of the action alternatives and the harvest of unit 36.

Table 54 - Economic Summary

Evaluation Criteria	Alternative 2	Alternative 3
Net Present Value	$2,989,751	$3,021,144
Cost/Benefit Ratio	2.46	2.57
Logging Costs vs. Road Costs U-36	$82,000	$69,700

Alternative 2- This alternative harvests a total of 1549 acres of which 120 are proposed with helicopter yarding systems. This is an expensive yarding system and has become even more so with dramatic increases in fuel costs. For sales with small timber, such as these young stands, and many restrictions on when harvest can occur, using expensive yarding systems such as helicopters often make the sales less desirable to potential purchasers. If the sales are not harvested because the sales are not sold, then project objectives are not realized.

In Alternative 2, Unit 36 is proposed to be harvested with a helicopter to avoid reconstructing a road that washed out in the 1996 storm event. In Alternative 3 the road would be reconstructed and the unit would be logged using ground-based and skyline systems. Economically there is a tradeoff in costs between these two choices. The tradeoff in costs would be the cost of yarding with the helicopter vs. building the road crossing

and logging it conventionally. For Alternative 2 the cost of yarding this unit with a helicopter would be about $82,000.

Alternative 3- This alternative harvests a total of 1412 acres of which no harvest with helicopter yarding systems is proposed. See Table 54 for the economics of this alternative.

Unit 36- Background- this unit is accessed by the 2041 road and the 2041 660 spur road. The 2041 road currently ends at a washout from the 1996 storm event, then about half a mile past that point the road was taken out by the Middle Santiam slide when it became active in about 1980. Further down the 2041 road, the South Pyramid Bridge washed out in the 1996 storm event. In all about nine miles of the 2041 road is closed to vehicular traffic because of washouts, slides and a damaged bridge. This road and its associated spur roads access about 350 acres of managed stands that vary in age from 20 to 50 years. When these stands are ready for commercial thinning in the next ten years, the district would have to decide whether to access these stands with the 2041 road or by use of a helicopter. No decision would be made in this document regarding the reopening of the 2041 road past the washout point. That would be left to a future decision when the 350 acres of managed stands tributary to this section of road are available for commercial timber harvest.

Unit 36 – This project - In order to access the 2041 660 spur road, where the landings are located to log Unit 36 using conventional logging systems, it would be necessary to reconstruct the stream crossing on the 2041 road that washed out during the 1996 storm event. It was determined that the costs of a temporary stream crossing here were nearly as much as a permanent stream crossing, so a permanent crossing was selected for analysis purposes. After this crossing, access to the landings for this unit is a fairly simple process. This option was analyzed in Alternative 3. The costs associated with this option include a $50,000 road reconstruction project to access the landings plus the costs of logging the unit using skyline and ground-based yarding systems. The costs would be partially offset by the future potential use of the landing in Unit 36 for commercial thinning with helicopter for the 350 acres of units on the closed portion of the 2041 road system.

See table 54 above for a comparison of the economics of the action alternatives and the harvest of unit 36. (*Refer to Appendix C for more details concerning the Economic Analysis*).

Irreversible and Irretrievable Commitment of Resources

No irreversible and irretrievable commitment of resources beyond those previously identified in the Willamette Forest Plan, as amended are anticipated with this project. Utilization of Forest Plan standards and guidelines, mitigation/design criteria and Best Management Practices avoids or minimizes the potential for irreversible or irretrievable losses from proposed management actions.

As discussed in the Forest Plan, rock used to surface roads and landings would be an irreversible commitment of mineral resources. Road or landing aggregate, either crushed or pit run, that might be required for this sale could come from M Line Rock Source, located on FS Rd. 2041000 at mile post 10.87, Holman Rock Source located at T13S, R5E, Section 2, NW1/4, SW1/4, or Mid Santiam Rock Source located on FS Rd. 2049000 at mile post 0.75. M Line Pit is located along the south boundary of Unit 26; Holman Pit is located within Unit 41, and Mid Santiam Pit is located within Unit 46. Minor rock use, likely less than 100 cubic yards, could be obtained from existing small sources adjacent to Units 18 and 38. Minor clearing of less than one acre in total, could be associated with the development of any of these rock sources. Clearing could include managed stand trees in plantations or brush.

No new construction of permanent roads is planned. Temporary roads would be constructed, but would be obliterated following harvest operations. Landings would produce irretrievable changes in the natural appearance of the landscape. The visual effect of log landings would be somewhat reduced by mitigation and design criteria to reduce soil compaction and erosion (subsoiling and seeding for example) Little irreversible loss of soil should occur due to extensive mitigation associated with timber harvest such as ground-based yarding on slopes less than 35 percent, skyline and/or helicopter logging with partial or full suspension.

Compliance with Other Laws, Regulations, and Policies

This section describes how the action alternatives comply with applicable State and Federal laws, regulations and policies. It first lists the major applicable laws, gives a summary of the law and then tells how the project complies with the law.

National Forest Management Act (NFMA), 1976 (90 Stat. 2949; 16 U.S.C. 1609)

The National Forest Management Act reorganized, expanded and otherwise amended the Forest and Rangeland Renewable Resources Planning Act of 1974, which called for the management of renewable resources on national forest lands. The National Forest Management Act requires the Secretary of Agriculture to assess forest lands, develop a management program based on multiple-use, sustained-yield principles, and implement a resource management plan for each unit of the National Forest System. It is the primary statute governing the administration of national forests.

There are several important sections within the act, including Section 1 (purpose and principles), Section 19 (fish and wildlife resources), Section 23 (water and soil resources), and Section 27 (management requirements that relate to perspective project planning).

All alternatives were developed to be in full compliance with NFMA via compliance with the Willamette National Forest Land and Resource Management Plan 1990, as amended. Throughout the environmental analysis and various specialist reports in the Appendices, there are references to Forest Plan standards and guidelines and how those standards and guidelines were met in the various aspects of the alternative design.

National Environmental Policy Act of 1969 (NEPA), (42 U.S.C. §§ 4321-4347, January 1, 1970, as amended 1975 and 1994).

NEPA declares it a national policy to encourage productive and enjoyable harmony between man and the environment and promote efforts to better understand and prevent damage to ecological systems and natural resources important to the nation. Agencies are required to prepare a detailed environmental impact statement for any major federal action significantly affecting the environment. The Act also establishes the Council on Environmental Quality to review government policies and programs for conformity with NEPA.

This law essentially pertains to public participation, environmental analysis, documentation and appeals. NEPA establishes the format and content requirements of environmental analysis and documentation such as the Middle Santiam Thin analysis. The entire process of preparing an environmental assessment was undertaken to comply with NEPA requirements, as codified by 40 CFR 1501 and the Forest Service Handbook 1909.15, Chapter 40.

Endangered Species Act of 1973, (16 U.S.C. §§ 1531-1544, December 28, 1973, as amended 1976-1982, 1984 and 1988).

The Endangered Species Act provides broad protection for species of fish, wildlife and plants that are listed as threatened or endangered in the U.S. or elsewhere. Provisions are made for listing species, as well as for recovery plans and the designation of critical habitat for listed species. The Act outlines procedures for federal agencies to follow when taking actions that may jeopardize listed species, and contains exceptions and exemptions.

Field surveys and Biological Evaluations for all listed endangered, threatened, or sensitive species have been prepared to determine possible effects of any proposed activities in the Middle Santiam Thin project area. Consultation occurred with the US Fish and Wildlife Service regarding this project (see the Wildlife and Plant Biological Evaluations, and Fish Biological Assessment and the Biological Opinion from the US Fish and Wildlife Service in the Analysis File).

Clean Air Act (42 U.S.C. §§ 7401-7671q, July 14, 1955, as amended 1963, 1965-1967, 1969-1971, 1973, 1974, 1977, 1978, 1980-1983, 1988, 1990, 1991 and 1994-1996).

The primary objective of the Clean Air Act is to establish federal standards for air pollutants from stationary and mobile sources and to work with the states to regulate polluting emissions. The Act is designed to improve air quality in areas of the country which do not meet federal standards and to prevent significant deterioration in areas where air quality exceeds those standards.

This law authorizes the U.S. Environmental Protection Agency to establish National Ambient Air Quality Standards (NAAQS) to protect public health and the environment.

The Oregon Smoke Management Plan has delegated authority for implementing all regulations related to smoke emissions, including Clean Air Act and its amendments. The Northwest Oregon Fire Management Plan has established guidelines for implementing fire suppression, prescribed fire and fuels treatment operations. Fuel treatments proposed in this project are in compliance with the Willamette Forest Plan, the Oregon Smoke Management Plan and the Northwest Oregon Fire Management Plan helping to ensure compliance with the Clean Art Act.

Federal Water Pollution Control Act (Clean Water Act) (33 U.S.C. §§ 1251-1387, October 18, 1972, as amended 1973-1983, 1987, 1988, 1990-1992, 1994, 1995 and 1996).

The Federal Water Pollution Control Act, popularly known as the Clean Water Act, is a comprehensive statute aimed at restoring and maintaining the chemical, physical and biological

Under Section 303(d) of the Clean Water Act, the State has identified the Middle Santiam River as a water quality-limited water body due to elevated temperatures.

All action alternatives including associated mitigation/design criteria and Best Management Practices (BMPs) are consistent with current management direction for protecting water quality including Willamette Forest Plan Standards and Guidelines, Aquatic Conservation Strategy (ACS) Objectives (at the watershed analysis area) and the Federal Clean Water Act. Implementation of required BMPs would ensure protection of water quality and beneficial uses under all alternatives.

Retention of no-harvest buffers within the effective shade zone of the Middle Santiam River and it's tributaries would result in a negligible affect on stream temperatures in the 303 (d) listed Middle Santiam River in the short-term.

Federal Mine Safety and Health Act of 1977, Public Law 91-173, as amended by Public Law 95-164.

Development of rock pits would conform to the requirements of this act, which sets forth mandatory safety and health standards for each surface metal or non-metal mine. The purpose of the standards are to protect lives by preventing accidents and promoting health and safety.

Rock pit development is proposed in full compliance with this act.

Magnuson-Stevens Fishery Conservation and Management Act, 1976 (MSA):

This act directs that "Each Federal agency shall consult with the Secretary with respect to any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken, by such agency that may adversely affect any essential fish habitat identified under this Act."

Implementing regulations for this act (50CFR part 600), specifically §600.920(a) state that "Federal agencies must consult with National Marine Fisheries Service regarding any of their actions authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken that may adversely affect Essential Fish Habitat (EFH).

Chinook salmon are the only MSA fish species on the Willamette National Forest. Essential fish habitat has been delineated in the Willamette River Basin based on the process described in MSA §303(a) (7). Federal agencies are to minimize to the extent practicable adverse effects on such habitat caused by fishing, and identify other actions to encourage the conservation and enhancement of such habitat (MSA §303(a) (7)). All alternatives in the Middle Santiam Thin project are in compliance with this act. No Chinook salmon or any identified essential fish habitat would be impacted by this project.

Wild and Scenic Rivers Act (16 U.S.C. §§ 1271-1287, October 2, 1968, as amended 1972, 1974-1976, 1978-1980, 1984, 1986-1994 and 1996)

This Act establishes a National Wild and Scenic Rivers System for the protection of rivers with important scenic, recreational, fish and wildlife, and other values. Rivers are classified as wild, scenic or recreational. The Act designates specific rivers for inclusion in the System and prescribes the methods and standards by which additional rivers may be added. The Act contains procedures and limitations for control of lands in federally administered components of the System and for disposition of lands and minerals under federal ownership. Hunting and fishing are permitted in components of the System under applicable federal and state laws.

Alternatives for this project are designed to maintain the Outstandingly Remarkable Values of the Middle Santiam River which is eligible for inclusion into this program.

Wilderness Act (16 U.S.C. §§ 1131-1136, September 3, 1964, as amended 1978)

The Wilderness Act established the National Wilderness Preservation System. The Secretary of the Interior was directed to review every roadless area of 5,000 acres or more and every roadless island within the national wildlife refuge and national park systems for possible inclusion in the System. The Act also included some national forest lands in the System and directed the Secretary of Agriculture to recommend others. Over 100 million acres have been included in the National Wilderness Preservation System so far.

No project activities are proposed in either Wilderness or Inventoried Roadless Areas.

Executive Order 13186: Neotropical Migratory Birds

This E.O. requires the "environmental analysis of Federal actions, required by NEPA or other established environmental review processes, evaluate the effects of actions and agency plans on migratory birds, with emphasis on species of concern."

There are 85 bird species recognized as neotropical migrants on the Willamette National Forest. Thirty-five of these species found on the Willamette have been identified as species of concern (Sharp 1992). A Memorandum of Understanding was signed between the USFS and USFWS to complement the January 2001 Executive Order.

The Middle Santiam Thin Project Area contains populations of migratory land birds typical of the western Cascades. Current science applied to Forest Plan standards and guidelines governing management of this project area provide direction that ensures the long term maintenance of amount and distribution of suitable habitat for native residents and migratory land bird species.

National Historic Preservation Act of 1966, as amended

This Act requires Federal agencies to consult with American Indian Tribes, and various State and local groups before nonrenewable cultural resources, such as archaeological and historic structures, are damaged or destroyed. Section 106 of this Act requires Federal agencies to review the effects project proposals may have on the cultural resources in the Analysis Area.

The areas proposed for ground-disturbing activities have been surveyed and evaluated for the presence of inventoried cultural resources. Several areas containing these resources have been identified. The alternatives were either designed to avoid or exclude these areas from any management activities. (See Design Criteria and Mitigation Measure section and the Project Review for Heritage Resources form in Appendix M).

Executive Orders 11988 and 11990: Floodplains and Wetlands

Executive Order 11988 requires government agencies to take actions that reduce the risk of loss due to floods, to minimize the impact of floods on human health and welfare, and to restore and preserve the natural and beneficial values served by floodplains.

Executive Order 11990 requires government agencies to take actions that minimize the destruction, loss, or degradation of wetlands.

Floodplains occur within the planning area but no activities occur within flood plains due to no-harvest stream buffers on all perennial streams. Wet areas are protected on an individual basis under the stand-specific recommendations and wetland areas less than 1/4 acre are treated as special habitat areas (FW-211) and protected with appropriate buffers.

Executive Order 12898 - Environmental Justice in Minority Populations and Low Income Populations

Agencies are directed to address effects accruing in a disproportionate way to minority and low-income populations; the closest population or habitation to the project area is the City of Sweet Home, (population 8200) some thirty miles west of the project area. Sweet Home is within Linn County considered a non-metropolitan county located by its western boundary along Interstate 5 and ranging east along the Western Cascades. Linn County's per capita income ranked 25th out of 36 counties in the state in 1993. In 1999 percent of persons below poverty is 11.4% from the U.S. Census Bureau 1990 and 2000 data. The State of Oregon Employment Department for Sweet Home has an unemployment rate of 11.6 percent in 2002. Minority populations in Linn County are 6.8 percent which include Native Americans, Asians, African Americans, and Hispanic.

From Federal and State data this community contains low-income people and minority persons. Implementation of an alternative that provides the opportunity for employment may positively affect low-income families who are either unemployed or underemployed. No disproportionate impacts to the citizens of Sweet Home are anticipated upon the implementation of an alternative. All contracts offered by the Forest Service contain Equal Employment Opportunity requirements. Subsistence and cultural use levels are difficult to quantify and differential patterns of subsistence consumption are unknown at this time. However, the Forest provides access to firewood, Christmas trees, mushrooms and other consumables through a personal-use permit system. The proposed thinning has the potential to contribute to the supply of special forest products (SFP) available within the area, such as salal and beargrass.

Executive Order 13112 (Invasive Species)

This 1999 order requires Federal agencies whose actions may affect the status of invasive species to identify those actions and within budgetary limits, "(i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species… (iii) monitor invasive species populations… (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded;…(vi) promote public education on invasive species… and (3) not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species… unless, pursuant to guidelines that it has prescribed, the agency had determined and made public… that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions."

The action alternatives implement the direction from the Willamette Forest Plan and the Integrated Weeds Management EA. The action alternatives include mitigating which would limit the spread of invasive weeds. Mitigating measures include the cleaning of off road equipment between infested work sites, pre-treating

roads before road maintenance and reconstruction, re-vegetating all disturbed areas with native seed, and monitoring weed infestations following treatments.

Energy Requirement and Conservation Potential

There are no unusual energy requirements for implementing any of the alternatives. Alternatives which involve tree removal would create supplies of firewood as a by-product of the timber harvest. This product would contribute to the local supply of energy for home space heating.

Alternative Two proposes helicopter yarding of timber. Helicopter yarding is often considered to have high fuel requirements. Though helicopters may use more fuel per unit of time than other yarding equipment, they are more productive and do not need to be operated for as long as more convention yarding equipment for a given timber volume. Helicopter yarding also avoids the need to consume fuel for road construction. Analysis has shown that the energy used for helicopter use is not unusually excessive in comparison with other methods of accessing timber.

Prime Lands

The Secretary of Agriculture issued memorandum 1827 which is intended to protect prime farm lands and rangelands. The project area does not contain any prime farmlands or rangelands. Prime forestland is not applicable to lands within the National Forest System. National Forest System lands would be managed with consideration of the impacts on adjacent private lands. Prime forestlands on adjacent private lands would benefit indirectly from a decreased risk of impacts from wildfire. There would be no direct, indirect, or cumulative adverse effects to these resources and thus are in compliance with the Farmland Protection Act and Departmental Regulation 9500-3,“Land Use Policy”.

Forest Plan Consistency

Actions analyzed in the Middle Santiam Thin environmental assessment are consistent with the Forest Plan standards and guidelines that have been discussed and disclosed throughout this document. This project is consistent with the goals and management direction analyzed in the Willamette National Forest Land and resource Management Plan FEIS and Record of Decision as amended.

State Laws/Regulations

Oregon State Best Management Practices (BMPs) are employed to maintain water quality and are certified by the Environmental Protection Agency for meeting the Clean Water Act.

The Oregon Smoke Management Plan - The Oregon State Implementation Plan and the Oregon State Smoke Management Plan would be followed to maintain air quality. See Fire and Fuel prescription in Appendix J.

Consultation with the Oregon State Historic Preservation Officer (SHPO) will be completed concerning proposed activities prior to a decision being made on this project. SHPO has concurred with the finding that there are historic properties but the undertaking would have no effect on them as defined by 36 CFR 800.16(i). The Advisory Council on Historic Preservation (ACHP) has also been consulted about measures to

protect significant archeological sites from adverse effects (see the Project Review for Heritage Resources Form in Appendix M).

Sufficiency Analysis

Proposed harvest treatments within riparian areas have been designed to comply with the "Sufficiency Analysis" for stream temperature – Evaluation of the adequacy of the Northwest Forest Plan Riparian Reserves to achieve and maintain stream temperature water quality standards" (USDA and USDI, 2004). This document was prepared in collaboration with Oregon Department of Environmental Quality and United states Environmental protection Agency to provide documentation of Northwest Forest Plan compliance with the Clean Water Act with regard to state water quality standards for stream temperatures. As such, it redeems several of the Forest Service responsibilities identified in "Memorandum of Understanding between USDA Forest Service and Oregon Department of Environmental Quality to Meet State and Federal Water Quality Rules and Regulations" (USDA Forest Service and Oregon DEQ, May 2002). The Sufficiency Analysis provides current scientific guidance for management of riparian vegetation to provide effective stream shade, including appropriate methods of managing young stands for riparian objectives other than shade, such as production of large wood for future recruitment.

A sufficiency analysis was completed for this project since the Middle Santiam River is on the 303 (d) list for stream temperatures that exceed salmonid rearing requirements during part of the summer. All perennial were protected with a no-harvest buffer of at least 50 feet to ensure that these streams do not contribute to higher summer stream temperatures in the Middle Santiam River.

Oregon Smoke Management Plan

Oregon Department of Environmental Quality and the Oregon Department of Forestry are responsible for regulating all prescribed burning operations. The USDA Forest Service Region 6 has a Memorandum of Understanding with Oregon Department of Environmental Quality, Oregon Department of Forestry and the USDI Bureau of Land Management regarding limits on emissions, as well as reporting procedures. All burning will comply with the State of Oregon's Smoke Management Implementation Plan.

Consultation and Coordination

The Forest Service consulted the following individuals, Federal, State, and local agencies, tribes and non-Forest Service persons during the development of this environmental assessment:

Interdisciplinary Team (IDT) MEMBERS:

The following list identifies members of the IDT responsible for coordinating, conducting and contributing to the environmental analysis:

Table 55 - Interdisciplinary Team Members

Members Name	Position or Field	Education
Mike Rassbach	District Ranger	B.S. Forest Management
Paul Bennett	Engineering	B.A. Zoology M.S. Fisheries Science
K.C. Briggs	Fisheries Biologist	B.S. Fisheries Management
Nanci Curtis	Fire and Fuels Mgmt	A.S. Forestry Science Fuels Specialist
Tony Farque	Archaeologist	B.S. Anthropology A.A. Forestry
David Halemeier	Hydrologist	B.S. Resource Planning and Interpretation M.S. Natural Resources Watershed Management
Anita Leach	Planner	B.S. Forest Management
Ken Loree	Forestry Technician	Logging Systems Program, OSU Forest Engineering Institute
Tom Lowell	Timber Staff	B.S. Forest Resource Management Silviculture Institute Certification
Brian McGinley	Recreation Planner	B.S. Forestry M.F. Forest Management
Doug Shank	Geologist	B.S. Geology M.S. Geology
Alice Smith	Botanist	B.S. Botany/Plant Pathology M.S. Botany/Plant Ecology
Chuck Yeager	Engineer	Civil Engineering
Tiffany Young	Wildlife Biologist	B.S. Wildlife Biology and Fisheries Biology

Federal, State, and Local Agencies:

Formal consultation with the U.S. Fish and Wildlife Service, on this project, was completed and a Biological Opinion received September 2006. A “not likely to adversely affect” determination was made. (USDI, 2006).

Consultation with US Fish and Wildlife Service for fisheries was not required since no bull trout habitat exists in the planning area. In addition, consultation with NOAA Fisheries was not required because this undertaking would have no effect on ESA-listed anadromous fish species.

Under the Programmatic Agreement among the USDA, Forest Service Pacific Northwest (Region 6), The Advisory Council on Historic Preservation, and the Oregon State Historic Preservation Officer regarding Cultural Resource Management in the State of Oregon by the USDA Forest Service (2204) the Forest Heritage Specialist has project review authority, and certifies that the project complies with Section 106 of the National Historic Preservation Act. That certification of the project as "No Historic Properties Affected" was completed in March 2007.

Tribes:

Government-to-government consultation regarding this project was conducted with the Confederated Tribes of Grand Ronde Community on February 23, 2006 and with the Confederated Tribes of Siletz Indians on March 15, 2006. No comments were received regarding this project at either one of these meetings. In addition, during the scoping of issues and concerns, as part of the public participation process, letters were mailed to tribal governments in April 2006. No issues were raised regarding the proposed project as a result of that mailing.

A number of prehistoric sites were identified near the proposed units. Located sites have been protected from ground-disturbing harvest activities by removing them from harvest units or buffering them from mechanical disturbance. No impacts, as outlined in the American Indian Religious Freedom Act, are anticipated on any American Indian social, economic or subsistence rights.

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Sale Name : Holman	Unit Number 1	Reforestation Number 403	
General Stand Information			
Vegis Number	3002012	**Photo Number**	
Location	T13S, R5E, Sec. 24	**Subdrainage**	Middle Santiam
Plant Association	ABAM/RHMA3/XETE	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope		**Elevation**	
Aspect		**Stand Year of Origin**	1951
Average Stand Height		**Ave. Stand Diameter**	
Other Considerations			
Special Habitats	Rock garden and cliffs along southern edge; rock garden along northwest edge: seep 300 feet northwest of remnant old-growth tree in north ½ of stand		
Stand History	Clearcut 1948 and broadcast burned in 1949		
Alternative	**2**		**3**
Unit Size	11 acres		11 acres
Volume	220 CCF		220 CCF
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and		Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew.
Riparian Harvest Rx	No harvest in primary shade zones. Thin outside of primaryshade zones with same Rx as uplands.		No harvest in primary shade zones. Thin outside of primary shade zones with same Rx as uplands.
Wildlife Rx	Leave 5 trees per acre for snag and down wood habitat		Leave 5 trees per acre for snag and down wood habitat creation
Unit Layout and Marking			
Alternatives	**2**		**3**
Layout	Consult with archaeologist prior to unit layout and ground-		Consult with archaeologist prior to unit layout and ground-disturbing activities.
Riparian Rx	25 ' no-harvest buffer on western-most stream, 50' no-harvest buffer on remaining streams.		25 ' no-harvest buffer on western-most stream, 50' no-harvest buffer on remaining streams.
Soils	Unsuited rocky area along SE stand boundary - delete this area		Unsuited rocky area along SE stand boundary - delete this area from unit.
Special Habitats	50 ft. no harvest buffer on seep located 300 ft. NW of remnant old-growth tree in the north half of the stand.		50 ft. no harvest buffer on seep located 300 ft. NW of remnant old-growth tree in the north half of the stand.
Logging Operation			
Alternatives	**2**		**3**
Access Roads	Highway 20 to 2047then take 2045. Do not use unnumbered spur to the west of the unit to minimize potential spread of false brome population.		
Maintenance	Spot rock roads 2047 and 2045		Spot rock roads 2047 and 2045
Designated Skid Roads	Avoid placing skid roads though special habitats (see general information above for locations of special habitats).		Avoid placing skid roads though special habitats (see general information above for locations of special habitats).
Equipment Staging	Avoid staging equipment in special habitats (see general information above for locations of special habitats).		Avoid staging equipment in special habitats (see general information above for locations of special habitats).
Landings	Avoid placement of landings in special habitat areas (see general information above for locations of special habitats). There is an existing landing in the Riparian Reserve-do not		Avoid placement of landings in special habitat areas (see general information above for locations of special habitats). There is an existing landing in the Riparian Reserve-do not make it larger.
Falling	Directionally fall away from streams and special habitats (see description under general information above for locations)		Directionally fall away from streams and special habitats (see description under general information above for locations)
Skyline Corridors	Avoid placing skyline corridors through special habitats (see general information above for locations of special habitats).		Avoid placing skyline corridors through special habitats (see general information above for locations of special habitats).
Suspension Requirements	Partial suspension in skyline area. Ground in remainder of unit. Retain 40-60% of duff.		Partial suspension in skyline area. Ground in remainder of unit. Retain 40-60% of duff.
Yarding	Skyline - 9 acres Ground-based - 2 acres		Skyline - 9 acres Ground-based - 2 acres
Yard Tops	Yard tops attached in skyline area.		Yard tops attached in skyline area.
Hauling	Do not use unnumbered spur to the west of the unit to minimize potential spread of false brome population.		Do not use unnumbered spur to the west of the unit to minimize potential spread of false brome population.
Seasonal Restrictions	Seaonal restriction spotted owl nesting period March 1- July 15		Seaonal restriction spotted owl nesting period March 1- July 15.
Post Logging			
Alternatives	**2**		**3**
Botany	Seep in center of unit needs survey. Rock outcrops; lots of weeds in waste area along road		Seep in center of unit needs survey. Rock outcrops; lots of weeds in waste area along road
Fuels	Yard tops in skyline portion of unit, burn landings and piles, grapple pile ground-based and along road 2045		Yard tops in skyline portion of unit, burn landings and piles, grapple pile ground-based and along road 2045
Fisheries			
Heritage			
Hydrology			
Silviculture			
Soils	Subsoil to reduce existing compaction to try to get near S & G of 20%.		Subsoil to reduce existing compaction to try to get near S & G of 20%.
Transportation			
Wildlife	Create snags and down wood, no falling of down woody debris.		Create snags and down wood, no falling of down woody debris.
Monitoring			

Sale Name : Holman	Unit Number 2	Reforestation Number 105	
General Stand Information			
Vegis Number	3002056	**Photo Number**	
Location	T13S, R5E, Sec. 24	**Subdrainage**	Middle Santiam
Plant Association	ABAM/RHMA3-VAAL/COCA13	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope		**Elevation**	
Aspect		**Stand Year of Origin**	1951
Average Stand Height		**Ave. Stand Diameter**	
Other Considerations			
Special Habitats	Vine maple/talus along NE edge of stand.		
Stand History	Stand established 1951		
Stand Health			
Alternative	**2**		**3**
Unit Size	20 acres		20 acres
Volume	400 CCF		400 CCF
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA, Suggested DxD spacing = about 16 feet. Leave all cedars and pines. Cedars >10 inches can be used for spacing.		Thin to 50% Canopy Closure. 90 TPA, Suggested DxD spacing = about 16 feet. Leave all cedars and pines. Cedars >10 inches can be used for spacing.
Riparian Harvest Rx	No harvest in primary shade zones. Thin outside of primary shade zones with same Rx as uplands.		No harvest in primary shade zones. Thin outside of primary shade zones with same Rx as uplands.
Wildlife Rx	Leave 5 TPA for snag and down wood creation.		Leave 5 TPA for snag and down wood creation.
Unit Layout and Marking			
Alternatives	**2**		**3**
Layout	Western boundary is along property line. On southern boundary and northern portion of unit - go at least 50 feet or to break in slope.		Western boundary is along property line. On southern boundary and northern portion of unit - go at least 50 feet or to break in slope.
Logging Operation			
Alternatives	**2**		**3**
Access Roads	Need to use private spur road in northern-most unit. Need road use agreement		Need to use private spur road in northern-most unit. Need road use agreement.
Equipment Staging	Avoid equipment staging in special habitat along NE edge of stand.		Avoid equipment staging in special habitat along NE edge of stand.
Landings	Avoid placement of landings in special habitat along NE edge of stand. Note: two existing landings are in the Riparian Reserve		Avoid placement of landings in special habitat along NE edge of stand. Note: two existing landings are in the Riparian Reserve
Falling	Fall away from streams and special habitats located along NE edge of stand.		Fall away from streams and special habitats located along NE edge of stand.
Skyline Corridors	Avoid placing skyline corridors through special habitats located along NE edge of stand. Need mullusk surveys (pristoloma) on southern-most stream for yarding corridors.		Avoid placing skyline corridors through special habitats located along NE edge of stand. Need mullusk surveys (pristoloma) on southern-most stream for yarding corridors.
Suspension Requirements	Partial suspension with some areas of ground-lead near roads. Full suspension across streams at the three stream crossings. Retain 40-60% of duff.		Partial suspension with some areas of ground-lead near roads. Full suspension across streams at the three stream crossings. Retain 40-60% of duff.
Yarding	Skyline 20 acres.		Skyline 20 acres.
Yard Tops	Yard tops attached.		Yard tops attached.
Hauling			
Seasonal Restrictions	Spotted owls March 1 - July 15.		Spotted owls March 1 - July 15.
Post Logging			
Alternatives	**2**		**3**
Botany			
Fuels	Yard tops in skyline area.. Grapple pile along roadside and burn landings and piles.		Yard tops in skyline area. Grapple pile along roadside and burn landings and piles.
Fisheries			
Heritage			
Hydrology			
Silviculture			
Soils			
Transportation			
Wildlife	Create snags and down wood		Create snags and down wood
Monitoring			

Sale Name : Middle Santiam Thin		Unit Number 3	Reforestation Number 403
General Stand Information			
Vegis Number	3001706	**Photo Number**	1097-52
Location	T13S, R5E, Sec. 12	**Subdrainage**	Middle Santiam
Plant Association	TSHE/RHMA-MANE2	**Management Allocation(s)**	Matrix/Riparian Reserves
Average Slope	45%	**Elevation**	3400
Aspect	East	**Stand Year of Origin**	1950
Average Stand Height		**Ave. Stand Diameter**	
Other Considerations			
Special Habitats	Rock outcrop in north half; swamp/pond along northern edge; vine maple/talus west of Road 2045		
Stand History	Clearcut and burned.		
Stand Health			
Alternative	**2**		**3**
Unit Size	24 acres		24 acres
Volume	480 CCF		480 CCF
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew.		Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew.
Riparian Harvest Rx	No harvest in primary shade zones. Thin outside of primaryshade zones with same Rx as uplands.		No harvest in primary shade zones. Thin outside of primaryshade zones with same Rx as uplands.
Soils Rx	Band of rocky ground with debris chute scars below (east) of Rd. 2045. Thin though; little harvest will occur because there are few trees here. Small boulder patch along road.		Band of rocky ground with debris chute scars below (east) of Rd. 2045. Thin though; little harvest will occur because there are few trees here. Small boulder patch along road.
Wildlife Rx	Leave 5 TPA for snags and down wood.		Leave 5 TPA for snags and down wood.
Unit Layout and Marking			
Alternatives	**2**		**3**
Layout	Western boundary following property line.• Northern unit boundary on margin of earthflow. Recommend taking unit boundary to riparian buffer along northern stream. Pond and wet meadows – eastern portion.		Western boundary following property line.• Northern unit boundary on margin of earthflow. Recommend taking unit boundary to riparian buffer along northern stream. Pond and wet meadows – eastern portion.
Hydrology	25 foot buffer on stream in SE corner of unit.		25 foot buffer on stream in SE corner of unit.
Botany	LECY in wetland NE corner just outside of unit		LECY in wetland NE corner just outside of unit
Special Habitats	50 ft. no-harvest buffer on swamp/pond along northern edge of stand.		50 ft. no-harvest buffer on swamp/pond along northern edge of stand.
Logging Operation			
Alternatives	**2**		**3**
Access Roads	Neew ROW for un-numbered spur road off the 120 road. Need road use agreement.		Neew ROW for un-numbered spur road off the 120 road. Need road use agreement.
Construction	Construct 175 ft of temporary new loggers spur road. At conclusion of harvest activities berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.		Construct 175 ft of temporary new loggers spur road. At conclusion of harvest activities berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.
Maintenance	May need to redirect ditch relief runoff – two 18" pipes on road 2045 in NW corner of unit.		May need to redirect ditch relief runoff – two 18" pipes on road 2045 in NW corner of unit.
Equipment Staging	Do not stage equipment in special habitats described in general information section above.		Do not stage equipment in special habitats described in general information section above.
Landings	Avoid landings within special habitats described in general information section above.		Avoid landings within special habitats described in general information section above.
Falling	Directionally fall away from special habitats described in general information section above.		Directionally fall away from special habitats described in general information section above.
Skyline Corridors	Avoid placing skyline corridors through special habitats described in general information section above.		Avoid placing skyline corridors through special habitats described in general information section above.
Suspension Requirements	Partial, some area of ground along road 2045 223. Retain 50-70% of duff.		Partial, some area of ground along road 2045 223. Retain 50-70% of duff.
Yarding	24 acres skyline		24 acres skyline
Hauling			
Seasonal Restrictions	Seaonal restriction spotted owl nesting period March 1- July 15. Dry weather haul on native surface roads.		Seaonal restriction spotted owl nesting period March 1- July 15. Dry weather haul on native surface roads.
Post Logging			
Alternatives	**2**		**3**
Botany			
Fuels	Grapple pile along roadside. Burn landings and piles.		Grapple pile along roadside. Burn landings and piles.
Fisheries			
Heritage			
Hydrology			
Silviculture			
Soils			
Transportation			
Wildlife	Block the road into the southern half of the unit. Create snags and down wood.		Block the road into the southern half of the unit. Create snags and down wood.
Monitoring			

Sale Name : Middle Santiam Thin	Unit Number 4	Reforestation Number 404	
General Stand Information			
Vegis Number	3001611	**Photo Number**	
Location	T 13 S, R 5 E, Sec. 12	**Subdrainage**	Upper Middle Santiam
Plant Association	TSHE/RHMA-MANE2	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope		**Elevation**	
Aspect		**Stand Year of Origin**	1955
Average Stand Height		**Ave. Stand Diameter**	
Other Considerations			
Special Habitats	Seep in center of unit; rock outcrops on south and east sides		
Stand History	Clearcut and broadcast burned.		
Stand Health			
Alternative	**2**		**3**
Unit Size	14 acres		9 acres
Volume	280 CCF		180 CCR
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew.		Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew.
Riparian Harvest Rx	No harvest in primary shade zones. Thin outside of primaryshade zones with same Rx as uplands.		No harvest in primary shade zones. Thin outside of primary shade zones with same Rx as uplands.
Wildlife	Leave 5 TPA for snags and down wood		Leave 5 TPA for snags and down wood
Unit Layout and Marking			
Alternatives	**2**		**3**
Layout			
Hydrology	50 ft. no-havest buffer on perennial stream creek and wetland in unit.		50 ft. no-havest buffer on perennial stream creek and wetland in unit.
Botany			
Special Habitats	50 ft. no harvest buffer on seep in center of unit.		50 ft. no harvest buffer on seep in center of unit.
Logging Operation			
Alternatives	**2**		**3**
Access Roads			
Construction			
Reconstruction			
Maintenance			
Closures			
Equipment Staging	Avoid equipment staging in special habitats described in general information section above.		Avoid equipment staging in special habitats described in general information section above.
Landings	Avoid landings in special habitat areas described in general information above. Helicopter landing for this		Avoid landings in special habitat areas described in general information above.
Logging System	Skyline - 9 acres Helicopter - 5 acres.		Skyline - 9 acres
Falling	Directionally fall away from special habitats described in general information section above.		Directionally fall away from special habitats described in general information section above.
Skyline Corridors	Avoid skyline corridors through special habitats described in general information section above.		Avoid skyline corridors through special habitats described in general information section above.
Suspension Requirements	Partial. Retain 50-70% of duff.		Partial. Retain 50-70% of duff.
Yarding	Skyline 9 acres. Helicopter 5 acres.		Skyline 9 acres.
Hauling			
Seasonal Restrictions	Seaonal restriction spotted owl nesting period March 1-July 15. Dry weather haul on native surface roads.		Seaonal restriction spotted owl nesting period March 1-July 15. Dry weather haul on native surface roads.
Post Logging			
Alternatives	**2**		**3**
Botany			
Fuels	Roadside grapple pile. Burn landings and piles.		Roadside grapple pile. Burn landings and piles.
Fisheries			
Heritage			
Hydrology			
Silviculture			
Soils			
Transportation			
Wildlife	Create snags and downn wood.		Create snags and down wood.
Monitoring	Snag and down wood creation		Snag and down wood creation

Sale Name : Middle Santiam Thin	Unit Number 5	Reforestation Number 405 and 405a	
General Stand Information			
Vegis Number	3001584 and 3001524	**Photo Number**	
Location	T 13 S, R 5 E, Sec. 12	**Subdrainage**	Upper Middle Santiam
Plant Association	TSHE/RHMA-MANE2	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope		**Elevation**	
Aspect		**Stand Year of Origin**	3001584 = 1954; 3001524 = 1968
Average Stand Height		**Ave. Stand Diameter**	
Other Considerations			
Special Habitats	Rocky openings in western portion of stand.		
Stand History	Clearcut and broadcast burned.		
Stand Health			

Alternative	**2**	**3**
Unit Size	52 acres	52 acres
Volume	1040 CCF	1040 CCF
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew.	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew.
Riparian Harvest Rx	No harvest in primary shade zones. Thin outside of primaryshade zones with same Rx as uplands.	No harvest in primary shade zones. Thin outside of primaryshade zones with same Rx as uplands.
Wildlife Rx	Leave 5 TPA for snags and down wood	Leave 5 TPA for snags and down wood
Unit Layout and Marking		
Alternatives	**2**	**3**
Layout	Unsuited rocky area along SE boundary of stand - delete from unit.	Unsuited rocky area along SE boundary of stand - delete from unit.
Hydrology	Buffer on SW stream is 50 feet. Perennially wet stream in 405a portion of unit is 50 foot buffer.	Buffer on SW stream is 50 feet. Perennially wet stream in 405a portion of unit is 50 foot buffer.
Special Habitats		
Logging Operation		
Alternatives	**2**	**3**
Access Roads		
Construction	Construct 175 feet of new temporary logger spur construction. At conclusion of harvest activities berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.	Construct 175 feet of new temporary logger spur construction. At conclusion of harvest activities berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular
Designated skid roads	Avoid placement of skid roads through rocky openings (special habitats) in western portion of stand.	Avoid placement of skid roads through rocky openings (special habitats) in western portion of stand.
Equipment staging	Avoid equipment staging in rocky areas (special habitats) in western portion of stand.	Avoid equipment staging in rocky areas (special habitats) in western portion of stand.
Landings	No landings in Riparian Areas or rocky areas (special habitats) in western portion of stand. .	No landings in Riparian Areas or rocky areas (special habitats) in western portion of stand.
Logging System	Skyline - 48 acres Ground-based 4 acres.	Skyline - 48 acres Ground-based - 4 acres.
Falling	Directionally fall away from rocky openings in western portion of stand (special habitats)	Directionally fall away from rocky openings in western portion of stand (special habitats)
Skyline corridors	Avoid placement of skyline corridors through rocky openings in western portion of stand (special habitats).	Avoid placement of skyline corridors through rocky openings in western portion of stand (special habitats).
Suspension Requirements	Partial suspension except full suspension over wet areas. Retain 40-60% of duff.	Partial suspension except full suspension over wet areas. Retain 40-60% of duff.
Yarding	Leave remnant old growth. Ground-based logging equipment will be walked through skyline portion of unit. Locate skyline road east of wet area.	Leave remnant old growth. Ground-based logging equipment will be walked through skyline portion of unit. Locate skyline road east of wet area.
Hauling		
Seasonal Restrictions	On stream crossing Seaonal restriction spotted owl nesting period March 1- July 15 and stream crossing. Dry weather haul on native surface roads.	On stream crossing Seaonal restriction spotted owl nesting period March 1- July 15 and stream crossing. Dry weather haul on native surface roads.
Post Logging		
Alternatives	**2**	**3**
Botany	Rip and seed temporary logger's spur.	Rip and seed temporary logger's spur.
Fuels	Grapple pile along road 2045. Burn landings and piles.	Grapple pile along road 2045. Burn landings and piles.
Fisheries		
Heritage		
Hydrology		
Silviculture		
Soils	Subsoil to reduce existing compaction to try to get near S & G of 20%.	Subsoil to reduce existing compaction to try to get near S & G of 20%.
Transportation		
Wildlife	Snag and down wood creation	Snag and down wood creation
Monitoring		

Sale Name : Middle Santiam Thin Unit Number 6 Reforestation Number 406

General Stand Information			
Vegis Number	3001497	**Photo Number**	
Location	T 13 S, R 5 E, Sec. 2	**Subdrainage**	Upper Middle Santiam
Plant Association	ABAM/VAAL/COCA	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope		**Elevation**	
Aspect		**Stand Year of Origin**	1957
Average Stand Height		**Ave. Stand Diameter**	
Other Considerations			
Stand History	Clearcut and broadcast burned.		
Stand Health			

Alternative	**2**	**3**
Unit Size	59 acres	59 acres
Volume	1180 CCF	1180 CCF
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. DxD spacing = 16 feet. Leave all cedar, pine, hardwoods and yew.	Thin to 50% Canopy Closure. 90 TPA. DxD spacing = 16 feet. Leave all cedar, pine, hardwoods and yew.
Riparian Harvest Rx	No harvest in primary shade zones. Thin outside of primaryshade zones with same Rx as uplands.	No harvest in primary shade zones. Thin outside of primaryshade zones with same Rx as uplands.
Wildlife Rx	Leave 5 TPA for snags and down wood.	Leave 5 TPA for snags and down wood.

Unit Layout and Marking		
Alternatives	**2**	**3**
Layout		
Botany	100 ft. no-harvest buffer on one site of PEPA in northern portion of unit in Riparian, 100 ft. no-harvest buffer on multiple sites of LERI all along Riparian through center of unit	100 ft. no-harvest buffer on one site of PEPA in northern portion o unit in Riparian, 100 ft. no-harvest buffer on multiple sites of LERI all along Riparian through center of unit
Hydrology	50 foot buffer on wet seeps. 100 ft. buffer on Holman Ck.	50 foot buffer on wet seeps. 100 ft. buffer on Holman Ck.
Wildlife	Buffer main stream for pristoloma 10 meters. Yard away from stream. Should not be a stream crossing. Leave 2.1 TPA for snags and down wood	Buffer main stream for pristoloma 10 meters. Yard away from stream. Should not be a stream crossing. Leave 2.1 TPA for snags and down wood.

Logging Operation		
Alternatives		**3**
Access Roads	Do not use old road (hydro)	Do not use old road (hydro)
Construction		
Reconstruction	2045 will need to repair slip out (narrow spot in road)	
Maintenance		
Closures		
Landings	Skyline - 35 acres Ground-based - 24 acres. 1 ground-based crossing on class IV and 1 processor only crossing on class IV	Skyline - 35 acres Ground-based - 24 acres. 1 processor/forwarder crossing on class IV and 1 processor only crossing on class IV
Falling	Directionally fall away from seeps.	Directionally fall away from seeps.
Suspension Requirements	Partial, some ground lead. Retain 30-50% of duff.	Partial, some ground lead. Retain 30-50% of duff.
Yarding	The intention is to skid ground-based to eastern portion of unit and swing skyline outside of wet area. Swing landings are in riparian reserves.• Processor needs to cross intermittent stream, put logs in ditch to get machine over and then take out when done.	The intention is to skid ground-based to eastern portion of unit and swing skyline outside of wet area. Swing landings are in riparian reserves.• Processor needs to cross intermittent stream, put logs in ditch to get machine over and then take out when done
Yard tops	To ensure tops don't get left at swing landing, the purchaser needs to commit to whether they will utilize material when they yard it. Make sure TSO works with them. If they pull it to the swing landing, they need to take it all the way out. If they are going to deck it, it should be 172 feet from the stream.	To ensure tops don't get left at swing landing, the purchaser needs to commit to whether they will utilize material when they yard it. Make sure TSO works with them. If they pull it to the swing landing, they need to take it all the way out. If they are going to deck it, it should be 172 feet from the stream.
Hauling		
Seasonal Restrictions	Seaonal restriction spotted owl nesting period March 1- July 15.	Seaonal restriction spotted owl nesting period March 1- July 15.

Post Logging		
Alternatives	**2**	**3**
Botany	Weed treatment	Weed treatment
Fuels	Grapple pile along roadside. Burn landings and piles.	Grapple pile along roadside. Burn landings and piles.
Fisheries	Collect KV money to girdle and fall selected trees in area between 100 and 150 feet of stream to stimulate growth and vigor or remaining trees. Retain at least 65% canopy closure here.	Collect KV money to girdle and fall selected trees in area between 100 and 150 feet of stream to stimulate growth and vigor or remaining trees. Retain at least 65% canopy closure here.
Heritage		
Hydrology	Plants cedars in wet areas and stream crossings	Plants cedars in wet areas and stream crossings
Silviculture		
Soils	Subsoil to reduce existing compaction to try to get near S & G of 20%.	Subsoil to reduce existing compaction to try to get near S & G of 20%.
Transportation		
Wildlife	Create snags and down wood	Create snags and down wood
Monitoring		

Sale Name : Middle Santiam Thin Unit Number 7 Reforestation Number 407

General Stand Information			
Vegis Number	3001606	**Photo Number**	
Location	T 13 S, R 5 E, Sec. 10	**Subdrainage**	Upper Middle Santiam
Plant Association	ABAM/RHMA3/XETE	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope		**Elevation**	
Aspect		**Stand Year of Origin**	1957
Average Stand Height		**Ave. Stand Diameter**	
Other Considerations			
Special Habitats	Beaver pond and large wet meadow on eastern edge of stand.		
Stand History	Clearcut and broadcast burned.		
Stand Health			

Alternative	**2**	**3**
Unit Size	13 acres	13 acres
Volume	260 CCF	260 CCF
Upland Harvest Rx	50% canopy closure. About 90 TPA north of Holman Creek Suggested D x D = about 16 ft. Leave 70% canopy closure. About 130 TPA. Suggested DxD = about 12 ft. south of Holman Creek. Leave all cedar, pine, yew and hardwoods.	50% canopy closure. About 90 TPA north of Holman Creek Suggested D x D = about 16 ft. Leave 70% canopy closure. About 130 TPA. Suggested DxD = about 12 ft. south of Holman Creek. Leave all cedar, pine, yew and hardwoods.
Riparian Harvest Rx	No harvest in primary shade zone. Thin outside of primary shade zone with same Rx as upland Rx except south of Holman Creek where stand will be thinned to 70% canopy closure.	No harvest in primary shade zone. Thin outside of primary shade zone with same Rx as upland Rx except south of Holman Creek where stand will be thinned to 70% canopy closure.
Wildlife Rx	Leave 5 TPA for wildlife snags and down wood	Leave 5 TPA for wildlife snags and down wood

Unit Layout and Marking		
Alternatives	**2**	**3**
Marking	Creek with leave tree mark in the middle of this unit. Not buffered out. Leave trees contributing to stream bank stability and shade to be marked. Riparian mark trees about 10 x 10 spacing. Don't mark within 25 feet of streambank (ITM unit)	Creek with leave tree mark in the middle of this unit. Not buffered out. Leave trees contributing to stream bank stability and shade to be marked. Riparian mark trees about 10 x 10 spacing. Don't mark within 25 feet of streambank (ITM unit)
Layout	Some rocky areas a north end of unit.	Some rocky areas a north end of unit.
Botany		
Hydrology	150 no harvest buffer on Holman Creek. Northern-most stream- 25 foot buffer, no harvest-buffer on remaining perennial streams.	150 no harvest buffer on Holman Creek. Northern-most stream- 25 foot buffer, no harvest-buffer on remaining perennial streams.
Special Habitats	50 ft. no harvest buffer on beaver ponds and large wet meadow on eastern edge of stand.	50 ft. no harvest buffer on beaver ponds and large wet meadow on eastern edge of stand.

Logging Operation		
Alternatives	**2**	**3**
Access Roads		
Construction		
Reconstruction		
Maintenance		
Closures		
Equipment Staging	Avoid equipment staging in special habitats described in general information section above.	Avoid equipment staging in special habitats described in general information section above.
Landings	Avoid locating landings in special habitats described in general information section above.	Avoid locating landings in special habitats described in general information section above.
Logging Systems	Skyline - 13 acres	Skyline - 13 acres
Falling	Directionally fall away from special habitats described in general information section above.	Directionally fall away from special habitats described in general information section above.
Skyline Corridors	Avoid locating skyline corridors through special habitats described in general information section above.	Avoid locating skyline corridors through special habitats described in general information section above.
Suspension Requirements	Partial suspension. Retain 40-60% of duff.	Partial suspension. Retain 40-60% of duff.
Yarding		
Yard tops		
Hauling		
Seasonal Restrictions	Seaonal restriction spotted owl nesting period March 1- July 15. 1.	Seaonal restriction spotted owl nesting period March 1- July 15.

Post Logging		
Alternatives	**2**	**3**
Botany	Plant cedar	Plant cedar
Fuels	Burn landings.	Burn landings.
Fisheries		
Heritage		
Hydrology		
Silviculture		
Soils		
Transportation		
Wildlife	Create snags and down wood	Create snags and down wood
Monitoring		

Sale Name : Middle Santiam Thin	Unit Number 8	Reforestation Number 408	
General Stand Information			
Vegis Number	3001430	**Photo Number**	
Location	T 13 S, R 5 E, Section 2	**Subdrainage**	Upper Middle Santiam
Plant Association	ABAM/MANE2-GASH	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope		**Elevation**	
Aspect		**Stand Year of Origin**	1957
Average Stand Height		**Ave. Stand Diameter**	
Other Considerations			
Special Habitats	Seep half way between road 2045 and Holman Creek.		
Stand History	Clearcut and broadcast burned.		
Stand Health			
Alternative	**2**		**3**
Unit Size	17 acres		17 acres
Volume	340 CCF		340 CCF
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew.		Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew.
Riparian Harvest Rx	No harvest in primary shade zones. Thin outside of primaryshade zones with same Rx as uplands.		No harvest in primary shade zones. Thin outside of primaryshade zones with same Rx as uplands.
Wildlife Rx	Leave 5 trees per acre for snag and down wood habitat creation.		Leave 5 trees per acre for snag and down wood habitat creation.
Unit Layout and Marking			
Alternatives	**2**		**3**
Marking	Creek with leave tree mark in the middle of this unit. Not buffered out. Leave trees contributing to stream bank stability and shade. Riparian mark trees about 10 x 10		Creek with leave tree mark in the middle of this unit. Not buffered out. Leave trees contributing to stream bank stability and shade.
Layout			
Botany	100 ft. no-harvest buffer on PSRA above road. 172 ft. no harvest buffer on multiple sites of LERI by creek. buffer.		100 ft. no-harvest buffer on PSRA above road. 172 ft. no harvest buffer on multiple sites of LERI by creek. buffer.
Hydrology	172 ft. no-harvest buffer on Holman Creek. 50 ft. no-harvest buffers on remaining perennial streams		172 ft. no-harvest buffer on Holman Creek. 50 ft. no-harvest buffers on remaining perennial streams
Special Habitats	50 ft.no-havest buffer on seep location half way between road 2045 and Holman Creek.		50 ft.no-havest buffer on seep location half way between road 2045 and Holman Creek.
Logging Operation			
Alternatives	**2**		**3**
Access Roads			
Construction	Open 650 feet of existing temporary logger's spur. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.		Open 650 feet of existing temporary logger's spur. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.
Reconstruction			
Maintenance			
Closures			
Equipment Staging	Avoid equipment staging in special habitat described in general information section above.		Avoid equipment staging in special habitat described in general information section above.
Landings			
Logging Systems	Skyline - 17 acres		Skyline - 17 acres
Falling	Directionally fall away from special habitat described in general information section above.		Directionally fall away from special habitat described in general information section above.
Skyline Corridors	Avoid skyline corridors through special habitat described in general information section above.		Avoid skyline corridors through special habitat described in general information section above.
Suspension Requirements	Partial suspension, some ground along spur roads. Retain 60-80% of duff.		Partial suspension, some ground along spur roads. Retain 60-80% of duff.
Yarding			
Yard tops			
Hauling			

Seasonal Restrictions	Seaonal restriction spotted owl nesting period March 1-July 15. Dry weather haul on native surface roads.	Seaonal restriction spotted owl nesting period March 1-July 15. Dry weather haul on native surface roads.
Post Logging		
Alternatives	**2**	**3**
Botany	Rip and seed logger's spur.	Rip and seed logger's spur
Fuels	Roadside grapple pile. Burn landings and piles.	Roadside grapple pile. Burn landings and piles.
Fisheries	Collect KV money to girdle and fall selected trees in area between 100 and 150 feet of stream to stimulate growth and vigor or remaining trees. Retain at least 65% canopy closure here.	Collect KV money to girdle and fall selected trees in area between 100 and 150 feet of stream to stimulate growth and vigor or remaining trees. Retain at least 65% canopy closure here.
Heritage		
Fisheries	KV opportunity - between 100-172 foot within Riparian Reserve on Holman Creek can collect money to girdle or fall and leave trees to stimulate growth and vigor of leave trees. 65% canopy closure would be retained in this area.	KV opportunity - between 100-172 foot within Riparian Reserve on Holman Creek can collect money to girdle or fall and leave trees to stimulate growth and vigor of leave trees. 65% canopy closure would be retained in this area.
Silviculture		
Soils		
Transportation		
Wildlife	Create snags and down wood	Create snags and down wood
Monitoring		

Sale Name : Middle Santiam Thin Unit Number 9 Reforestation Number 409

General Stand Information			
Vegis Number	3001412	**Photo Number**	
Location	T 13 S, R 5 E, Section 2	**Subdrainage**	Upper Middle Santiam
Plant Association	TSHE/RHMA3-MANE2	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope		**Elevation**	
Aspect		**Stand Year of Origin**	1957
Average Stand Height		**Ave. Stand Diameter**	
Other Considerations	Invasive plants himalayan and evergreen blackberries are found in vicinity.		
Special Habitats	Wet meadow on eastern edge of stand; rocky openings in western portion; talus to northwest		
Stand History	Clearcut and broadcast burned.		
Stand Health			

Alternative	**2**	**3**
Unit Size	21 acres	21 acres
Volume	420 CCF	420 CCF
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew.	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew.
Riparian Harvest Rx	No harvest in primary shade zones. Thin outside of primaryshade zones with same Rx as uplands.	No harvest in primary shade zones. Thin outside of primaryshade zones with same Rx as uplands.
Wildlife Rx	Leave 5 TPA for wildlife snags and down wood.	Leave 5 TPA for wildlife snags and down wood.

Unit Layout and Marking		
Alternatives	**2**	**3**
Marking		
Layout	Stand has actively unstable earthflows to the south and west - delete from unit.	Stand has actively unstable earthflows to the south and west - delete from unit.
Botany	Leave 100 foot boundary on adjacent stand of old growth to protect PSRA. 7 PSRA along east and northeast edge of unit. Himalayan and evergreen blackberry along roads in or adjacent to unit.	Leave 100 foot boundary on adjacent stand of old growth to protect PSRA. 7 PSRA along east and northeast edge of unit. Himalayan and evergreen blackberry along roads in or adjacent to unit.
Hydrology		
Soils	Ensure actively unstable areas identified by soil scientist need to be deleted from the unit.	Ensure actively unstable areas identified by soil scientist need to be deleted from the unit.
Special Habitats	50 ft. no-harvest buffer on wet meadow on eastern edge of stand.	50 ft. no-harvest buffer on wet meadow on eastern edge of stand.

Logging Operation		
Alternatives	**2**	**3**
Access Roads		
Construction	400 feet of new temporary logger's spur road. Roll grade and alignment to control drainage. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.	400 feet of new temporary logger's spur road. Roll grade and alignment to control drainage. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.
Reconstruction	650 feet of existing temporary logger's spur road. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular	650 feet of existing temporary logger's spur road. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.
Maintenance	Severely restrict road maintenance. Will maintain sufficient width but the toe of the slide is at the road so no aggressive maintenance	Severely restrict road maintenance. Will maintain sufficient width but the toe of the slide is at the road so no aggressive maintenance
Closures		
Designated Skid Roads	Avoid placement of skid roads through special habitats described in general information section above.	Avoid placement of skid roads through special habitats described in general information section above.
Equipment Staging	Avoid equipment staging in special habitats described in general information section above.	Avoid equipment staging in special habitats described in general information section above.
Landings	Avoid placement of landings in special habitats described in general information section above.	Avoid placement of landings in special habitats described in general information section above.
Falling		
Skyline Corridors	Avoid placement of skyline corridors through special habitats described in general information section above.	Avoid placement of skyline corridors through special habitats described in general information section above.
Suspension Requirements	Partial suspension, some ground along spur road. Regain 50-70% of duff.	Partial suspension, some ground along spur road. Regain 50-70% of duff.
Yarding	Skyline - 18 acres Ground-based - 3 acres	Skyline - 18 acres Ground-based - 3 acres
Yard tops		
Hauling		
Seasonal Restrictions	Seaonal restriction spotted owl nesting period March 1- July 15. Dry weather haul on native surface roads.	Seaonal restriction spotted owl nesting period March 1- July 15. Dry weather haul on native surface roads.

Post Logging		
Alternatives	**2**	**3**
Botany		
Fuels	Grapple pile along roadside. Burn landings and piles.	Grapple pile along roadside. Burn landings and piles.
Fisheries		
Heritage		
Hydrology		
Silviculture		
Soils	Subsoil to reduce existing compaction to try to get near S & G of 20%.	Subsoil to reduce existing compaction to try to get near S & G of 20%.
Transportation		
Wildlife	Create snags and down wood	Create snags and down wood
Monitoring		

Sale Name : Middle Santiam Thin Unit Number 10 Reforestation Number 410

General Stand Information			
Vegis Number	3001335	**Photo Number**	
Location	T 13 S, R 5 E, Section 2	**Subdrainage**	Upper Middle Santiam
Plant Association	ABAM/MANE2	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope		**Elevation**	
Aspect		**Stand Year of Origin**	1956
Average Stand Height		**Ave. Stand Diameter**	
Other Considerations	Unit is heavily compacted currently.		
Special Habitats	Alder swamp in SE corner of stand; seasonal pond NW portion of stand; linear wetlands south of road 2045.		
Stand History	Clearcut and broadcast burned.		
Stand Health	Existing soil compaction in this unit exceeds Regional and Willamette standards of 20%.		

Alternative	**2**	**3**
Unit Size	40 acres	40 acres
Volume	800 CCF	800 CCF
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew.	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew.
Riparian Harvest Rx	No harvest in primary shade zones. Thin outside of primaryshade zones with same Rx as uplands.	No harvest in primary shade zones. Thin outside of primaryshade zones with same Rx as uplands.
Wildlife Rx	Leave 5 TPA for wildlife snags and down wood.	Leave 5 TPA for wildlife snags and down wood.
Unit Layout and Marking		
Alternatives	**2**	**3**
Marking		
Layout		
Botany	150 ft. no harvest buffer on multiple sites of LERI in creek.	150 ft. no harvest buffer on multiple sites of LERI in creek.
Hydrology	50 foot buffer on wet area.	50 foot buffer on wet area.
Fisheries	150-ft. no-harvest buffer on Bachelor Creek.	150-ft. no-harvest buffer on Bachelor Creek.
Soils		
Special Habbitats	50 ft. no harvest buffer on alder swamp in SE part of unit, seasonal wetlands in NW portion of unit, and linear wetlands south of road 2045.	50 ft. no harvest buffer on alder swamp in SE part of unit, seasonal wetlands in NW portion of unit, and linear wetlands south of road 2045.
Logging Operation		
Alternatives	**2**	**3**
Access Roads	Need about 100 feet of ROW	Need about 100 feet of ROW
Construction		
Reconstruction	Open 1800 feet of existing temporary roads. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.	Open 1800 feet of existing temporary roads. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.
Maintenance	Redirect drainage now running down roads off spur roads into channel.	Redirect drainage now running down roads off spur roads into channel.
Closures		
Designated Skid Roads	Use existing skid and haul roads as much as possible. Avoid placement of skid roads through special habitats described in general information section above.	Use existing skid and haul roads as much as possible. Avoid placement of skid roads through special habitats described in general information section above.
Equipment Staging	Avoid equipment staging in special habitats described in general information section above.	Avoid equipment staging in special habitats described in general information section above.
Landings	Avoid landing placement in special habitats described in general information section above.	Avoid landing placement in special habitats described in general information section above.
Falling	Directionally fall away from special habitats described in general information section above.	Directionally fall away from special habitats described in general information section above.
Skyline Corridors	Avoid skyline corridors through special habitats described in general information section above.	Avoid skyline corridors through special habitats described in general information section above.
Suspension Requirements	Partial suspension, some ground on benches. Retain 50-70% of duff.	Partial suspension, some ground on benches. Retain 50-70% of duff.
Yarding	Skyline - 10 acres Ground-based - 30 acres	Skyline - 10 acres Ground-based - 30 acres
Yard tops		
Hauling		
Seasonal Restrictions	Seaonal restriction spotted owl nesting period March 1-July 15. Dry weather haul on native surface roads.	Seaonal restriction spotted owl nesting period March 1-July 15. Dry weather haul on native surface roads.
Post Logging		

Alternatives	2	3
Botany	Collect yew seed. Collect KV for cedar planing by alder patch.	Collect yew seed. Collect KV for cedar planing by alder patch.
Fuels	Grapple pile ground-based portion of unit. Burn landings and piles.	Grapple pile ground-based portion of unit. Burn landings and piles.
Fisheries	Collect KV to selectively girdle and cut in the 100-150 feet next to Bachelor Creek to develop future structure for the stream (coord with WLand silv). Retain at least 65% canopy closure.	Collect KV to selectively girdle and cut in the 100-150 feet next to Bachelor Creek to develop future structure for the stream (coord with WLand silv). Retain at least 65% canopy closure.
Heritage		
Hydrology		
Silviculture	Underplant with cedar and yew.	Underplant with cedar and yew.
Soils	Subsoil to reduce existing compaction to try to get near S & G of 20%.	Subsoil to reduce existing compaction to try to get near S & G of 20%.
Transportation		
Wildlife	Create snags and down wood	Create snags and down wood
Monitoring		

Sale Name : Middle Santiam Thin	Unit Number 11	Reforestation Number 111	
General Stand Information			
Vegis Number	3001781	**Photo Number**	
Location	T 12 S, R 6 E, Sec. 18	**Subdrainage**	Upper Middle Santiam
Plant Association	TSHE/RHMA3/LIBO3	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope		**Elevation**	
Aspect		**Stand Year of Origin**	1957
Average Stand Height		**Ave. Stand Diameter**	
Other Considerations			
Special Habitats	Two seasonal ponds in western portion of stand; alder swamp; large mesic meadow to north.		
Stand History	Clearcut and broadcast burned		
Stand Health			
Alternative	**2**		**3**
Unit Size	22 acres		21 acres
Volume	440 CCF		420 CCF
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew.		Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew.
Riparian Harvest Rx	No harvest in primary shade zones. Thin outside of primaryshade zones with same Rx as uplands.		No harvest in primary shade zones. Thin outside of primaryshade zones with same Rx as uplands.
Wildlife Rx	Leave 5 trees per acre for snag and down wood habitat creation		Leave 5 trees per acre for snag and down wood habitat creation
Unit Layout and Marking			
Alternatives	**2**		**3**
Marking			
Layout	NW boundary adjacent to Tommy slide.		NW boundary adjacent to Tommy slide.
Botany			
Fisheries	100 ft. no-harvest buffer from edge of trees on Cougar Creek.		100 ft. no-harvest buffer from edge of trees on Cougar Creek.
Hydrology			
Soils			
Special Habitats	50 ft. no-harvest buffer on ponds in western portion of stand and alder swamp.		50 ft. no-harvest buffer on ponds in western portion of stand and alder swamp.
Fisheries	100 ft. no-harvest buffer on Cougar Creek.		100 ft. no-harvest buffer on Cougar Creek.
Logging Operation			
Alternatives	**2**		**3**
Access Roads			
Construction	Open 650' of existing logger's spur road. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.		Open 650' of existing logger's spur road. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.
Reconstruction			
Maintenance			
Closures			
Equipment Staging	Avoid staging equipment in special habitats described in general information section above.		Avoid staging equipment in special habitats described in general information section above.
Landings	Fly helicopter portion to landing in Unit 44. Avoid placement of landings in special habitat areas described in general		Avoid placement of landings in special habitat areas described in general information section above.
Falling	Directionally fall away from special habitats described in general information section above.		Directionally fall away from special habitats described in general information section above.
Skyline Corridors	Avoid placing skyline corridors through special habitats described in general information section above.		Avoid placing skyline corridors through special habitats described in general information section above.
Suspension Requirements	Partial suspension, some ground at SE boundary. Retain 40-60% of duff.		Partial suspension, some ground at SE boundary. Retain 40-60% of duff.
Yarding	Skyline yarding - 21 acres; Helicopter- 1 acre.		Skyline yarding - 21 acres
Yard tops			
Hauling			
Seasonal Restrictions	Seaonal restriction spotted owl nesting period March 1- July 15. Dry weather haul on native surface roads.		Seaonal restriction spotted owl nesting period March 1- July 15. Dry weather haul on native surface roads.
Post Logging			
Alternatives	**2**		**3**
Botany	Underplant cedar in wet areas. Evaluate if need to fall trees in these areas.		Underplant cedar in wet areas. Evaluate if need to fall trees in these areas.
Fuels	Grapple pile along road. Burn landings and piles.		Grapple pile along road. Burn landings and piles.
Fisheries	Girdle or fall and leave trees in area between primary shade zone and area 100 feet from Cougar Creek to stimulate growth and vigor. Retain at least 65% canopy closure.		Girdle or fall and leave trees in area between primary shade zone and area 100 feet from Cougar Creek to stimulate growth and vigor. Retain at least 65% canopy closure.
Heritage			
Hydrology			
Silviculture			
Soils			
Transportation			
Wildlife	Create snags and down wood		Create snags and down wood
Monitoring			

Sale Name : Middle Santiam Thin	Unit Number 12	Reforestation Number 702	
General Stand Information			
Vegis Number	3001315	**Photo Number**	
Location	T 12 S, R 6 E, Sec. 32	**Subdrainage**	Upper Middle Santiam
Plant Association	TSHE/MANE2	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope		**Elevation**	
Aspect		**Stand Year of Origin**	1965
Average Stand Height		**Ave. Stand Diameter**	
Other Considerations	Invasive plants himalayan and evergreen blackberries are found in vicinity.		
Special Habitats	Small seep and several Phellinus weirii pockets in southern part of stand.		
Stand History	Clearcut and broadcast burned		
Stand Health	Phyllinus pockts in stand.		
Alternative	**2**	**3**	
Unit Size	48 acres	48 acres	
Volume	960 CCF	960 CCF	
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about16 feet. Leave all cedar, pine, hardwoods	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about16 feet. Leave all cedar, pine,	
Riparian Harvest Rx	No harvest in primary shade zone. Thin outside of primary shade zone same as upland Rx except do not cut Phyllinus pockets or create openings in Riparian.	No harvest in primary shade zone. Thin outside of primary shade zone same as upland Rx except do not cut Phyllinus pockets or create openings in Riparian.	
Wildlife Rx	Leave 5 TPA for snags and down wood.	Leave 5 TPA for snags and down wood.	
Unit Layout and Marking			
Alternatives	**2**	**3**	
Marking			
Layout	Drop northern part of skinny piece on west of private land due to riparian and PSRA.	Drop northern part of skinny piece on west of private land due to riparian and PSRA.	
Botany	50 ft. no-harvest buffer on seeps. Invasive plant, false brome along roads in or adjacent to unit.	50 ft. no-harvest buffer on seeps. Invasive plant, false brome along roads in or adjacent to unit.	
Hydrology	50 ft. no-harvest buffer on streams and wet areas.	50 ft. no-harvest buffer on streams and wet areas.	
Soils			
Logging Operation			
Iternatives	**2**	**3**	
Access Roads			
Construction	Reopen 675 feet of existing temporary logger's spur. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.	Reopen 675 feet of existing temporary logger's spur. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.	
Reconstruction			
Maintenance			
Closures			
Designated Skid Roads	Avoid placement of skid roads in special habitats described in general information section above.	Avoid placement of skid roads in special habitats described in general information section above.	
Equipment Staging	Avoid equipment staging in special habitats described in general information section above.	Avoid equipment staging in special habitats described in general information section above.	
Landings	Avoid placement of landings in special habitats described in general information section above.	Avoid placement of landings in special habitats described in general information section above.	
Falling	Directionally fall away from private land and special habitat areas described in general information section above.	Directionally fall away from private land and special habitat areas described in general information section above.	
Skyline Corridors	Avoid placement of skyline corridors in special habitats described in general information section above.	Avoid placement of skyline corridors in special habitats described in general information section above.	
Suspension Requirements	Partial and ground. Retain 40-60% of duff.	Partial and ground. Retain 40-60% of duff.	
Yarding	Ground-based yarding - 11 acres; Skyline - 37 acres.	Ground-based yarding - 11 acres; Skyline - 37 acres.	
Yard tops			
Hauling			
Seasonal Restrictions	Spotted owls March 1 - July 15. Dry weather haul on native surface roads.	Spotted owls March 1 - July 15. Dry weather haul on native surface roads.	
Post Logging			
Alternatives	**2**	**3**	
Botany	Replant phyllinus pockets with cedar.		
Fuels	Burn landings.	Burn landings.	
Fisheries			
Heritage			
Hydrology			
Silviculture			
Soils			
Transportation			
Wildlife	Create snags and down wood.	Create snags and down wood.	
Monitoring			

Sale Name : Middle Santiam Thin	Unit Number 13	Reforestation Number 113 and 113a	
General Stand Information			
Vegis Number	3001580 and 3001568	**Photo Number**	
Location	T 13 S, R 5 E, Sec. 12 and T 13 S, R 6 E, Sec. 6	**Subdrainage**	Upper Middle Santiam
Plant Association	TSHE/MANE2 and TSHE/RHMA3-MANE2	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope		**Elevation**	
Aspect		**Stand Year of Origin**	1961 and 1962
Average Stand Height		**Ave. Stand Diameter**	
Other Considerations			
Special Habitats	Rocky vine maple patches along western edge of stand.		
Stand History	Clearcut and broadcast burned (113a not burned).		
Stand Health			
Alternative	**2**		**3**
Unit Size	7 acres		
Volume	140 CCF		
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods		
Riparian Harvest Rx	No harvest in primary shade zone. Thin outside of primary		
Wildlife Rx	Leave 5 TPA for snags and down wood.		
Unit Layout and Marking			
Alternatives	**2**		**3**
Marking			
Layout	Drop northern part of skinny piece on west of private land		
Botany	120 ft. no-harvest buffer on one site of NEOC. 120 ft. no-harvest buffer on three sites of PSRA.		
Hydrology	150' no-harvest buffer on Middle Santiam River.		
Fisheries			
Soils			
Logging Operation			
Iternatives	**2**		**3**
Access Roads			
Construction			
Reconstruction			
Maintenance			
Closures			
Equipment Staging	Avoid staging equipment in special habitat areas		
Landings	Avoid placement of landings in special habitats described		
Falling	Directionally fall away from special habitat areas described		
Suspension Requirements	Partial. Retain 50-70% of duff.		
Yarding	Helicopter - 7 acres.		
Yard tops			
Hauling			
Seasonal Restrictions	Spotted owls March 1 - July 15.		
Post Logging			
Alternatives	**2**		**3**
Botany			
Fuels	Not treatment		
Fisheries			
Heritage			
Hydrology			
Silviculture			
Soils			
Transportation			
Wildlife	Create snags and down wood		

Sale Name : Middle Santiam Thin	Unit Number 14	Reforestation Number 114 and 130	
General Stand Information			
Vegis Number	3001495 and 3001552	**Photo Number**	
Location	T 13 S, R 6 E, Sec. 6	**Subdrainage**	Upper Middle Santiam
Plant Association	TSHE/RHMA3/GASH and TSHE/RHMA3-MANE2	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope		**Elevation**	
Aspect		**Stand Year of Origin**	1955 and 1970
Average Stand Height		**Ave. Stand Diameter**	
Other Considerations			
Stand History	Clearcut and broadcast burned.		
Stand Health			
Alternative	**2**		**3**
Unit Size	98 acres		98 acres
Volume	1960 CCF		1960 CCF
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods		Thin to 50% canopy closure. 90 TPA. Suggested DxD spacing = about 16 ft Leave all cedar, pine, hardwoods
Riparian Harvest Rx	No harvest in primary shade zone. Thin Rx in secondary shade zone same as upland Rx.		No harvest in primary shade zone. Thin Rx in secondary shade zone same as upland Rx.
Wildlife	Leave 5 TPA for snags and down wood.		Leave 5 TPA for snags and down wood.
Unit Layout and Marking			
Alternatives	**2**		**3**
Marking			
Layout			
Botany			
Hydrology	50' no-harvest buffer on streams.		50' no-harvest buffer on streams.
Soils			
Logging Operation			
Iternatives	**2**		**3**
Access Roads			
Construction	Re-open 525 ft. of existing logger's spur road. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.		Re-open 525 ft. of existing logger's spur road. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.
Reconstruction			
Maintenance			
Closures			
Landings			
Falling			
Suspension Requirements	Partial and ground. Retain 30-50% of duff.		Partial and ground. Retain 30-50% of duff.
Yarding	Ground-based yarding 33 acres; skyline yarding 65 acres.		Ground-based yarding 33 acres; skyline yarding 65 acres.
Yard tops			
Hauling			
Seasonal Restrictions	Spotted owls - March 1 - July 15. Dry weather haul on native surface roads.		Spotted owls - March 1 - July 5. Dry weather haul on native surface roads.
Post Logging			
Alternatives	**2**		**3**
Botany			
Fuels	Grapple pile in ground-based portion of unit and burn landings and piles.		Grapple pile in ground-based portion of unit and burn landings and piles.
Fisheries			
Heritage			
Hydrology			
Silviculture			
Soils	Subsoil to reduce existing compaction to try to get near S & G of 20%.		Subsoil to reduce existing compaction to try to get near S & G of 20%.
Transportation			
Wildlife	Create snags and down wood.		Create snags and down wood.
Monitoring			

Sale Name : Middle Santiam Thin	Unit Number 15	Reforestation Number 115	
General Stand Information			
Vegis Number	3001410	**Photo Number**	
Location	T 13 S, R 6 E, Sec. 6	**Subdrainage**	Upper Middle Santiam
Plant Association	TSHE/MANE2-GASH	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope		**Elevation**	
Aspect		**Stand Year of Origin**	1958
Average Stand Height		**Ave. Stand Diameter**	
Other Considerations			
Special Habitats	Rocky ridgeline along NE edge of stand; alder swamp SE portion; seep SE portion; willow-dominated wetland with ephemeral pond SE portion.		
Stand History	Clearcut and broadcast burned.		
Stand Health			
Alternative	**2**	**3**	
Unit Size	81 acres	81 acres	
Volume	1620 CCF	1620 CCF	
Upland Harvest Rx	60% canopy closure. 110 TPA. Suggested DxD = about 14 ft. Include DTR's over 10% of thinned areas in upland.	60% canopy closure. 110 TPA. Suggested DxD = about 14 ft. Include DTR's over 10% of thinned areas in upland.	
Riparian Harvest Rx	No harvest in primary shade zone. Thin outside of shade zone withhsame Rx as uplands except no DTR's in Riparian Reserves.	No harvest in primary shade zone. Thin outside of shade zone withhsame Rx as uplands except no DTR's in Riparian Reserves.	
Wildlife Rx	Leave 5 TPA for snags and down wood	Leave 5 TPA for snags and down wood	
Unit Layout and Marking			
Alternatives	**2**	**3**	
Marking			
Layout			
Botany	100 ft. no-harvest buffer on three sites of PSMA and 100 ft. no-harvest buffer on nine sites of PSRA. Scotch broom, an invasive weed, population on landing in this unit.	100 ft. no-harvest buffer on three sites of PSMA and 100 ft. no-harvest buffer on nine sites of PSRA. Scotch broom, an invasive weed, population on landing in this unit.	
Hydrology	50' no-harvest buffer on streams and wet meadows.	50' no-harvest buffer on streams and wet meadows.	
Soils			
Special Habitats	50 ft. no-harvest buffer on alder swamp, seep, and wetland with ephemeral pond in SE portion of unit.	50 ft. no-harvest buffer on alder swamp, seep, and wetland with ephemeral pond in SE portion of unit.	
Logging Operation			
Iternatives	**2**	**3**	
Access Roads			
Construction	Construct 1125 ft.of new temporary logger's spur road. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.	Construct 1125 ft.of new temporary logger's spur road. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.	
Reconstruction			
Maintenance			
Closures			
Equipment and Equipment Staging	All road construction and logging equipment will be pressure washed prior to and after working in this unit. Avoid staging equipment in special habitat areas described in general information section above.	All road construction and logging equipment will be pressure washed prior to and after working in this unit. Avoid staging equipment in special habitat areas described in general information section above.	
Landings	Use filter cloth and at least six inches of rock on northern landing to prevent spread of weeds. Avoid landing placement in special habitats described in general information section above.	Use filter cloth and at least six inches of rock on northern landing to prevent spread of weeds. Avoid landing placement in special habitats described in general information section above.	
Falling	Directionally fall away from special habitats described in general information section above.	Directionally fall away from special habitats described in general information section above.	
Skyline Corridors	Avoid placement of skyline corridors in special habitats described in general information section above.	Avoid placement of skyline corridors in special habitats described in general information section above.	
Suspension Requirements	Partial. Retain 50-70% of duff.	Partial. Retain 50-70% of duff.	
Yarding	Skyline yarding 81 acres.	Skyline yarding 81 acres.	
Yard tops			
Hauling			
Seasonal Restrictions	Spotted owls March 1 - July 15. Dry weather haul on native surface roads.	Spotted owls March 1 - July 15. Dry weather haul on native surface roads.	
Other Requirements	Wash equipment to prevent weed spread.	Wash equipment to prevent weed spread.	
Post Logging			
Alternatives	**2**	**3**	
Botany			

Fuels	Grapple pile along road and burn landings and piles.	Grapple pile along road and burn landings and piles.
Fisheries		
Heritage		
Hydrology		
Silviculture	Plant openings (DTR's) with cedar	Plant openings (DTR's) with cedar.
Soils		
Transportation		
Wildlife	Create snags and down wood.	Create snags and down wood.
Monitoring		

Sale Name : Middle Santiam Thin	Unit Number 16	Reforestation Number 116	
General Stand Information			
Vegis Number	3001384	**Photo Number**	
Location	T 13 S, R 6 E, Sec. 6	**Subdrainage**	Upper Middle Santiam
Plant Association	TSHE/RHMA3/MANE2	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope		**Elevation**	
Aspect		**Stand Year of Origin**	1959
Average Stand Height		**Ave. Stand Diameter**	
Other Considerations	Large population of scotch broom (CYSC), an invasive plant, on landing. Also, himalaya and/or evergreen blackberryis		
Special Habitats	Alder swamp north of road 2047.		
Stand History	Clearcut and broadcast burned.		
Stand Health			
Alternative	**2**	**3**	
Unit Size	7 acres	7 acres	
Volume	140 CCF	140 CCF	
Upland Harvest Rx	Variable Density Thinning 60% canopy closure. About 110 TPA. Suggested DxD = about 14 ft. Leave 10% of area in DTR's in uplands. Leave all cedar, hardwood, pine and yew.	Variable Density Thinning 60% canopy closure. About 110 TPA. Suggested DXD = about 14 ft. Leave 10% of area thinned in uplands in DTR's. Leave all cedar, pine, hardwoods and yew.	
Riparian Harvest Rx	No harvest in primary shade zone. Thin outside primary shade zone same as upland Rx except no DTR's in Riparian Reserve.	No harvest in primary shade zone. Thin outside primary shade zone same as upland Rx except no DTR's in Riparian Reserve.	
Wildlife Rx	Leave 5 TPA for snags and down wood	Leave 5 TPA for snags and down wood	
Unit Layout and Marking			
Alternatives	**2**	**3**	
Marking			
Layout	Drop northern portion of unit. Area of active instability north of road 2049 - delete from unit.	Drop northern portion of unit. Area of active instability north of road 2049 - delete from unit.	
Botany	100 ft. no-harvest buffer on multiple sites of LERI in creek. 100 ft. no-harvest buffer on one site of PSMA and 2 sites of PSRA. Invasive plants, Himalaya and evergreen blackberry found along the roads in or adjacent to unit.	100 ft. no-harvest buffer on multiple sites of LERI in creek. 100 ft. no-harvest buffer on one site of PSMA and 2 sites of PSRA. Invasive plants, Himalaya and evergreen blackberry found along roads in or adjacent to unit.	
Hydrology	50' no-harvest buffer on stream.	50' no-harvest buffer on stream.	
Soils			
Special Habitats	50 ft. no-harvest buffer on alder swamp.	50 ft. no-harvest buffer on alder swamp.	
Logging Operation			
Alternatives	**2**	**3**	
Access Roads			
Construction			
Reconstruction			
Maintenance			
Closures			
Designated Skid Roads	Avoid placement of skid roads through special habitats described in general information section above.	Avoid placement of skid roads through special habitats described in general information section above.	
Equipment Staging	Avoid equipment staging in special habitats described in general information section above.	Avoid equipment staging in special habitats described in general information section above.	
Landings	Avoid placement of landings in special habitats described in general information section above.	Avoid placement of landings in special habitats described in general information section above.	
Falling	Directionally fall away from special habitat areas described in general information section above.	Directionally fall away from special habitat areas described in general information section above.	
Skyline Corridors	Avoid placement of skyline corridors through special habitats described in general information section above.	Avoid placement of skyline corridors through special habitats described in general information section above.	
Suspension Requirements	Partial. Retain 30-50% of duff.	Partial. Retain 30-50% of duff.	
Yarding	Ground-based yarding 2 acres; Skyline yarding 5 acres.	Ground-based yarding 2 acres; Skyline yarding 5 acres.	
Yard tops			
Hauling			
Seasonal Restrictions	Spotted owls March 1 - July 15.	Spotted owls March 1 - July 15.	
Post Logging			
Alternatives	**2**	**3**	
Botany			
Fuels	Grapple pile along roadside. Burn landings and piles.	Grapple pile along roadside. Burn landings and piles.	
Fisheries			
Heritage			
Hydrology			
Silviculture			
Soils	Subsoil to reduce existing compaction to try to get near S & G of 20%.	Subsoil to reduce existing compaction to try to get near S & G of 20%.	
Transportation			
Wildlife	Create snags and down wood	Create snags and down wood.	

Monitoring		

Sale Name : Middle Santiam Thin	Unit Number 17	Reforestation Number 507	
General Stand Information			
Vegis Number	3001675	**Photo Number**	
Location	T 13 S, R 5 E, Sec. 12	**Subdrainage**	Upper Middle Santiam
Plant Association	TSHE/RHMA3/MANE2	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope		**Elevation**	
Aspect		**Stand Year of Origin**	1974
Average Stand Height		**Ave. Stand Diameter**	
Other Considerations			
Stand History	Clearcut and broadcast burned.		
Stand Health	Very weedy unit.		
Alternative	**2**		**3**
Unit Size	34 acres		
Volume	680 CCF		
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine,		Thin to 50% canopy closure. 90 TPA. Suggested DxD spacing = about 16 ft Leave all cedar, pine, hardwoods
Riparian Harvest Rx	No harvest in primary shade zone. Thin Rx outside of primary shade zone same as upland Rx.		No harvest in primary shade zone. Thin Rx outside of primary shade zone same as upland Rx.
Wildlife Rx	Leave 5 TPA for snags and down wood.		Leave 5 TPA for snags and down wood.
Unit Layout and Marking			
Alternatives	**2**		**3**
Marking			
Layout			
Botany	100 ft. no-harvest buffer on multiple sites of LERI in creek and 100 ft. no-harvest buffer on four sites of PSRA.		100 ft. no-harvest buffer on multiple sites of LERI in creek and 100 ft. no-harvest buffer on four sites of PSRA.
Hydrology			
Soils			
Logging Operation			
Alternatives	**2**		**3**
Access Roads			
Construction			
Reconstruction			
Maintenance			
Closures			
Landings			
Falling			
Suspension Requirements	Partial, some ground along road. Retain 30-50% of duff.		Partial, some ground along road. Retain 30-50% of duff.
Yarding	Ground-based yarding 14 acres; Skyline yarding 20 acres		Ground-based yarding 14 acres; Skyline yarding 20 acres
Yard tops			
Hauling			
Seasonal Restrictions	Spotted owl March 1 - July 15.		Spotted owl March 1 - July 15.
Post Logging			
Alternatives	**2**		**3**
Botany			
Fuels	Grapple pile along road. Burn landings and piles.		Grapple pile along road. Burn landings and piles.
Fisheries			
Heritage			
Hydrology			
Silviculture			
Soils			
Transportation			
Wildlife	Create snags and down wood.		Create snags and down wood.
Monitoring			

Sale Name : Middle Santiam Thin	Unit Number 18	Reforestation Number 509	
General Stand Information			
Vegis Number	3001581	**Photo Number**	
Location	T 13 S, R 5 E, Sec. 12	**Subdrainage**	Upper Middle Santiam
Plant Association	TSHE/MANE2-GASH TSHE/RHMA3-GASH TSHE/GASH	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope		**Elevation**	
Aspect		**Stand Year of Origin**	1975
Average Stand Height		**Ave. Stand Diameter**	
Other Considerations	Invasive plants himalaya and/or evergreen blackberry found in vicinity.		
Special Habitats	Beaver pond and meadow north edge of stand; small rock opening.		
Stand History	Clearcut and broadcast burned.		
Stand Health	Very weedy unit.		
Alternative	**2**	**3**	
Unit Size	27 acres		
Volume	540 CCF		
Upland Harvest Rx	Thin to 60% Canopy Closure. 110 TPA. Suggested DxD spacing = about 14 feet. Leave all cedar, pine, hardwoods and yew.		
Riparian Harvest Rx	No harvest in primary shade zone. Thin outside of primary shade zone same as upland Rx.		
Wildlife Rx	Leave 5 TPA for snags and down wood.		
Unit Layout and Marking			
Alternatives	**2**	**3**	
Marking			
Layout	Drop part of unit by wetland to the north. Protect		
Botany	Invasive plants himalaya and/or evergreen blackberry found along roads in or adjacent to unit.		
Hydrology			
Soils			
Special Habitats	50 ft. no-harvest buffer on beaver pond and meadow on		
Logging Operation			
Alternatives	**2**	**3**	
Access Roads			
Construction			
Reconstruction			
Maintenance	Old rock pit along southern boundary may provide a few loads of pit run or riprap as needed.		
Closures			
Equipment Staging	Avoid equipment staging in special habitats described in the general information section above.		
Landings	Avoid placement of landings in special habitat areas described in general information section above.		
Falling	Directionally fall away from special habitats described in the general information section above.		
Skyline Corridors	Avoid placement of skyline corridors through special habitats described in the general information section above.		
Suspension Requirements	Partial, some ground along road. Retain 30-50% of duff.		
Yarding	Skyline - 27 acres.		
Yard tops			
Hauling			
Seasonal Restrictions	Spotted owls March 1 - July 15.		
Post Logging			
Alternatives	**2**	**3**	
Botany			
Fuels	Grapple pile along roadside. Burn landings and piles.		
Fisheries			
Heritage			
Hydrology			
Silviculture			
Soils			
Transportation			
Wildlife	Create snags and down wood.		
Monitoring			

Sale Name : Middle Santiam Thin	Unit Number 19	Reforestation Number 119	
General Stand Information			
Vegis Number	3001250	**Photo Number**	
Location	T 12 S, R 6 E, Sec. 32	**Subdrainage**	Upper Middle Santiam
Plant Association	TSHE/RHMA3/XETE TSHE/MANE2-GASH	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope		**Elevation**	
Aspect		**Stand Year of Origin**	1968
Average Stand Height		**Ave. Stand Diameter**	
Other Considerations	Invasive plants himalaya and/or evergreen blackberry found in vicinity. Also, false brome (BRSY) is found in the unit.		
Special Habitats	Cliffs and vine maple/talus along eastern edge and extending into center of stand.		
Stand History	Clearcut and broadcast burned.		
Stand Health	Very weedy unit.		
Alternative	**2**	**3**	
Unit Size	43 acres	40 acres	
Volume	860 CCF	800 CCF	
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine,	Thin to 50% canopy closure. 90 TPA. Suggested DxD spacing = about 16 ft Leave all cedar, pine, hardwoods	
Riparian Harvest Rx	No harvest in primary shade zone. Thin outside of primary shade zone same as upland Rx.	No harvest in primary shade zone. Thin outside of primary shade zone same as upland Rx.	
Wildlife Rx	Leave 5 TPA for snags and down wood	Leave 5 TPA for snags and down wood.	
Unit Layout and Marking			
Alternatives	**2**	**3**	
Marking			
Layout	Unsuited rocks and talus along eastern boundary - delete from unit.	Unsuited rocks and talus along eastern boundary - delete from unit.	
Botany	PEPA at one of proposed landing locations - drop landing. 100 ft. no-harvest buffer on false brome population in this unit. Invasive plants, Himalaya and evergreen blackberry are found along road in or adjacent	PEPA at one of proposed landing locations - drop landing. Invasive plant, false brome in this unit and Himalaya and evergreen blackberry found along road in or adjacent to unit.	
Hydrology	50' no-harvest buffer on all perennial streams; 25' no-harvest buffer on all intermittent streams	50' no-harvest buffer on all perennial streams; 25' no-harvest buffer on all intermittent streams	
Soils			
Weeds	100 ft. no-harvest buffer on BRSY and RULA	100 ft. no-harvest buffer on BRSY and RULA	
Logging Operation			
Alternatives	**2**	**3**	
Access Roads			
Construction	Reopen/construct 900 feet of temporary logger's spur road (500' of this is new). At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.	Reopen/construct 900 feet of temporary logger's spur road (500' of this is new). At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.	
Reconstruction			
Maintenance			
Closures			
Equipment Staging	Avoid equipment staging in special habitat areas described inn general information section above.	Avoid equipment staging in special habitat areas described inn general information section above.	
Landings	One landing location was dropped due to PEPA. Consult botanist prior to changing proposed landing locations. Helicopter landing in this unit. Avoid placement of landings in special habitats described in general information section above	One landing location was dropped due to PEPA. Consult botanist prior to changing proposed landing locations. Helicopter landing in this unit. Avoid placement of landings in special habitats described in general information section above	
Falling	Directionally fall away from special habitat areas described inn general information section above.	Directionally fall away from special habitat areas described inn general information section above.	
Skyline Corridors	Avoid placement of skyline corridors through special habitat areas described inn general information section above.	Avoid placement of skyline corridors through special habitat areas described inn general information section above.	
Suspension Requirements	Partial, some ground along road. Retain 30-50% of duff.	Partial, some ground along road. Retain 30-50% of duff.	
Yarding	Skyline - 40 acres Helicopter 3 acres. Helicpter yard NE corner where there is a weedy landing.	Skyline - 40 acres Helicopter 3 acres. Helicpter yard NE corner where there is a weedy landing.	
Hauling			
Seasonal Restrictions	Spotted owls March 1 - July 15. Dry weather haul on native surface roads.	Spotted owls March 1 - July 15. Dry weather haul on native surface roads.	
Post Logging			

Alternatives	2		3
Botany			
Fuels	Burn landings.		Burn landings.
Fisheries			
Heritage			
Hydrology			
Silviculture			
Soils			
Transportation			
Wildlife	Create snags and down wood.		Create snags and down wood.
Monitoring			

Sale Name : Middle Santiam Thin	Unit Number 20	Reforestation Number 120	
General Stand Information			
Vegis Number	3001153	**Photo Number**	
Location	T 12 S, R 6 E, Sec. 29 and 30	**Subdrainage**	Upper Middle Santiam
Plant Association	TSHE/RHMA3/MANE2	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope		**Elevation**	
Aspect		**Stand Year of Origin**	1971
Average Stand Height		**Ave. Stand Diameter**	
Other Considerations	Invasive plants himalaya and/or evergreen blackberry found in vicinity.		
Special Habitats	Large Carex wetland along eastern edge of stand; narrow wetland in stand interior; alder wetland in NW corner; small seep and Carex wetland along southern boundary.		
Stand History	Clearcut and broadcast burned.		
Stand Health			
Alternative	**2**	**3**	
Unit Size	18 acres	18 acres	
Volume	360 CCF	360 CCF	
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew.	Thin to 50% canopy closure. 90 TPA. Suggested DxD spacing = about 16 ft Leave all cedar, pine, hardwoods and yew.	
Riparian Harvest Rx	No harvest in primary shade zone. Thin outside of primary shade zone same as upland Rx.	No harvest in primary shade zone. Thin outside of primary shade zone same as upland Rx.	
Wildlife Rx	Leave 5 TPA for snags and down wood.	Leave 5 TPA for snags and down wood.	
Unit Layout and Marking			
Alternatives	**2**	**3**	
Marking			
Layout			
Botany	150' no-harvest buffer on two PSMA sites and one PSRA site. Invasive plants, Himalaya and evergreen blackberry found along roads in or adjacent to unit.	150' no-harvest buffer on two PSMA sites and one PSRA site. Invasive plants, Himalaya and evergreen blackberry found on roads in or adjacent to unit.	
Fisheries	150 ft. no-harvest buffer on South Pyramid Creek.	150 ft. no-harvest buffer on South Pyramid Creek.	
Hydrology	50' no-harvest buffer on all streams	50' no-harvest buffer on all streams	
Soils			
Special Habitats	50 ft. no-harvest buffer on all seeps and wetlands described in general information section above.	50 ft. no-harvest buffer on all seeps and wetlands described in general information section above.	
Logging Operation			
Alternatives	**2**	**3**	
Access Roads	Road to southern landing needs to be brushed	Road to southern landing needs to be brushed	
Construction			
Reconstruction			
Maintenance			
Closures			
Equipment Staging	Avoid equipment staging in special habitats described in general information section above.	Avoid equipment staging in special habitats described in general information section above.	
Landings	Avoid placement of landings in special habitats described in general information section above.	Avoid placement of landings in special habitats described in general information section above.	
Falling	Directionally fall away from special habitats described in general information section above.	Directionally fall away from special habitats described in general information section above.	
Skyline Corridors	Avoid placement of skyline corridors in special habitats described in general information section above.	Avoid placement of skyline corridors in special habitats described in general information section above.	
Suspension Requirements	Partial. Retain 20-40% of duff.	Partial. Retain 20-40% of duff.	
Yarding	Skyline - 18 acres	Skyline - 18 acres	
Yard tops			
Hauling			
Seasonal Restrictions	Spotted owl March 1 - July 15.	Spotted owl March 1 - July 15.	
Post Logging			
Alternatives	**2**	**3**	
Botany	Spray patch of blackberry prior to thinning	Spray patch of blackberry prior to thinning	
Fuels	Grapple pile along roadside. Burn landings and piles.	Grapple pile along roadside. Burn landings and piles.	
Fisheries			
Heritage			
Hydrology			
Silviculture			
Soils			
Transportation			
Wildlife	Create snags and down wood.	Create snags and down wood.	
Monitoring			

Sale Name : Middle Santiam Thin	Unit Number 21	Reforestation Number 503	
General Stand Information			
Vegis Number	3002008	**Photo Number**	
Location	T 13 S, R 5 E, Sec. 24	**Subdrainage**	Upper Middle Santiam
Plant Association	ABAM/ACCI/TITR	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope		**Elevation**	3300
Aspect	E to SE	**Stand Year of Origin**	1965
Average Stand Height		**Ave. Stand Diameter**	
Other Info.			
Special Habitats	Salix wetland divides north and south portions of stand.		
Stand History	Clearcut and broadcast burned.		
Stand Health			
Alternative	**2**	**3**	
Unit Size	11 acres	11 acres	
Volume	220 CCF	220 CCF	
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew.	Thin to 50% canopy closure. 90 TPA. Suggested DxD spacing = about 16 ft Leave all cedar, pine, hardwoods and yew.	
Wildlife Rx			
Heritage Rx			
Riparian Harvest Rx	No harvest in primary shade zone. In secondary shade zone harvest Rx is the same as upland Rx.	No harvest in primary shade zone. In secondary shade zone harvest Rx is the same as upland Rx.	
Wildlife Rx	Leave 5 TPA for snags and down wood.	Leave 5 TPA for snags and down wood.	
Unit Layout and Marking			
Alternatives	**2**	**3**	
Marking			
Layout			
Botany			
Hydrology			
Recreation			
Soils			
Special Habitats	50 ft. no-harvest buffer on wetland dividing north and south parts of unit.	50 ft. no-harvest buffer on wetland dividing north and south parts of unit.	
Weeds			
Fisheries			
Logging Operation			
Alternatives	**2**	**3**	
Access Roads			
Construction			
Reconstruction			
Maintenance			
Closures			
Designated Skid Roads			
Equipment Staging	Avoid equipment staging in special habitats described in general information section above.	Avoid equipment staging in special habitats described in general information section above.	
Landings	Avoid placement of landings in special habitats described in general information section above.	Avoid placement of landings in special habitats described in general information section above.	
Falling	Directionally fall away from special habitats described in general information section above.	Directionally fall away from special habitats described in general information section above.	
Skyline Corridors	Avoid placement of skyline corridors through special habitats described in general information section above.	Avoid placement of skyline corridors through special habitats described in general information section above.	
Suspension Requirements	Partial/ground depending on side slope. Retainn 30-50% of duff.	Partial/ground depending on side slope. Retainn 30-50% of duff.	
Yarding	Ground-based - 2 acres Skyline - 9 acres	Ground-based - 2 acres Skyline - 9 acres	
Yard tops/whole trees			
Hauling			
Seasonal Restrictions	Spotted owls March 1 - July 15.	Spotted owls March 1 - July 15.	
Post Logging			
Alternatives	**2**	**3**	
Botany			
Fuels	Grapple pile ground-based areas and along roadsides. Burn landings and piles.	Grapple pile ground-based areas and along roadsides. Burn landings and piles.	
Fisheries			
Heritage			
Hydrology			
Silviculture			
Soils	Subsoil to reduce existing compaction to try to get near S & G of 20%.	Subsoil to reduce existing compaction to try to get near S & G of 20%.	
Transportation			
Wildlife	Create snags and down wood.	Create snags and down wood.	
Monitoring			

Sale Name : Middle Santiam Thin	Unit Number 22	Reforestation Number M40, M40a and M40b	
General Stand Information			
Vegis Number	3001323, 3001326, and 300134	**Photo Number**	
Location	T 12 S, R 5 E, Sec. 34	**Subdrainage**	Donaca and Upper Middle Santiam
Plant Association	ABAM/VAAL/COCA	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope	25%	**Elevation**	3800
Aspect	SW-S-SE	**Stand Year of Origin**	1960, 1969 and 1969
Average Stand Height	65'	**Ave. Stand Diameter**	10"
Other Info.	Dominant trees are mostly Douglas-fir with some noble fir, western white pine, and western hemlock. Understory		
Stand History	Clearcut and broadcast burned.		
Stand Health	Existing compaction in this unit exceeds Regional and Willamette standards of 20%.		
Alternative	**2**		**3**
Unit Size	59 acres		59 acres
Volume	1180 CCF		1180 CCF
Upland Harvest Rx	Thin to 60% canopy closure,. About 110 TPA. Suggested DxD = about 14 ft. Leave openings in about 10% of upland area (DTR's). Leave all cedar, pine, hardwoods and yew.		Thin to 60% canopy closure. About 110 TPA. Suggested DxD = about 14 ft. Leave openings in about 10% of upland area (DTR's). Leave all cedar, pine, hardwoods and yew.
Heritage Rx			
Riparian Harvest Rx	No harvest in primary shade zone. In secondary shade zone harvest Rx is the same as upland Rx except no DTR's in Riparian Reserves.		No harvest in primary shade zone. In secondary shade zone harvest Rx is the same as upland Rx except no DTR's in Riparian Reserves.
Wildlife Rx	Leave 5 TPA for snags and down wood.		Leave 5 TPA for snags and down wood.
Unit Layout and Marking			
Alternatives	**2**		**3**
Marking			
Layout			
Botany			
Hydrology	Water not anticipated. If located during layout, place 50 ft. no-harvest buffer.		Water not anticipated. If located during layout, place 50 ft. no-harvest buffer.
Recreation			
Soils			
Special Habitats			
Weeds			
Fisheries			
Logging Operation			
Alternatives	**2**		**3**
Access Roads			Roads need to be brushed. Pit run rock available at pit within unit.
Construction	Open 475 ft. of existing temporary logger's spur road. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.		Open 475 ft. of existing temporary logger's spur road. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.
Reconstruction			
Maintenance			
Closures	Close spur roads after harvest activities.		Close spur roads after harvest activities.
Designated Skid Roads	Use existing skid roads as much as possible		Use existing skid roads as much as possible
Landings			
Falling			
Suspension Requirements	Ground/partial on steeper areas along northern boundary. Retain 40-60% of duff.		Ground/partial on steeper areas along northern boundary. Retain 40-60% of duff.
Yarding	Ground-based - 38 acres Skyline - 21 acres		Ground-based - 38 acres Skyline - 21 acres
Yard tops/whole trees			
Hauling			
Seasonal Restrictions	Spotted owls March 1 - July 15.		Spotted owls March 1 - July 15.
Wildlife			
Post Logging			
Alternatives	**2**		**3**
Botany			
Fuels	Grapple pile along roadside. Burn landings and piles.		Grapple pile along roadside. Burn landings and piles.
Fisheries			
Heritage			
Hydrology			
Silviculture			
Soils	Subsoil all existing skid roads without trees and landings. Maybe purchaser or KV. Seed with blue wild rye.		Subsoil all existing skid roads without trees. Maybe purchaser or KV. Seed with blue wild rye.
Transportation			
Wildlife	Create snags and down wood.		Create snags and down wood.
Monitoring			

Sale Name : Middle Santiam Thin	Unit Number 23	Reforestation Number M42	
General Stand Information			
Vegis Number	3001231	**Photo Number**	
Location	T 12 S, R 5 E, Sec. 27 and 34	**Subdrainage**	Donaca
Plant Association	ABAM/RHMA3-MANE2	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope	20%	**Elevation**	3400
Aspect	N to NE	**Stand Year of Origin**	1964
Average Stand Height	60'	**Ave. Stand Diameter**	8"
Other Info.	Dominant trees are mostly Douglas-fir with some western hemlock. Mountain hemlock and western redcedar in the		
Special Habitats	Alder wetland east side of stand and forb-dominated wetlands in interior, east portion.		
Stand History	Clearcut and broadcast burned.		
Stand Health			
Alternative	**2**		**3**
Unit Size	33 acres		33 acres
Volume	660 CCF		660 CCF
Upland Harvest Rx	Thin to 60% canopy closure. About 110 TPA. Suggested DxD = about 14 ft. Leave openings in about 10% of upland thinning (DTR's). Leave all cedar, pine, hardwoods and yew.		Thin to 60% canopy closure. About 110 TPA. Suggested DxD = about 14 ft. Leave openings in about 10% of upland thinning (DTR's). Leave all cedar, pine, hardwoods and yew.
Heritage Rx			
Riparian Harvest Rx	No harvest in primary shade zone. Outside of primary shade zone harvest Rx is the same as upland Rx except no DTR's in Riparian Reserves.		No harvest in primary shade zone. Outside of primary shade zone harvest Rx is the same as upland Rx except no DTR's in Riparian Reserves.
Wildlife Rx	Leave 5 TPA for snags and down wood.		Leave 5 TPA for snags and down wood.
Unit Layout and Marking			
Alternatives	**2**		**3**
Marking			
Layout	Actively unstable area along east stand boundary - (soils unit).		Actively unstable area along east stand boundary (soils unit)
Botany			
Hydrology	100 ft. no-harvest buffer on steam to the east. 50 ft. no harvest buffer on intermittent streams and wet area in SE.		100 ft. no-harvest buffer on steam to the east. 50 ft. no harvest buffer on intermittent streams and wet area in SE.
Recreation			
Soils			
Special Habitats	50 ft. no-harvest buffer on wetlands described in general information section above.		50 ft. no-harvest buffer on wetlands described in general information section above.
Weeds			
Fisheries			
Logging Operation			
Alternatives	**2**		**3**
Access Roads			
Construction	Reopen 1250 ft. of temporary loggers spur road. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.		Reopen 1250 ft. of temporary loggers spur road. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.
Reconstruction			
Maintenance			
Closures			
Designated Skid Roads	Avoid placement of skid roads through special habitats described in general information section above.		Avoid placement of skid roads through special habitats described in general information section above.
Equipment Staging	Avoid equipment staging in special habitats described in general information section above.		Avoid equipment staging in special habitats described in general information section above.
Landings	Avoid placement of landings in special habitats described in general information section above.		Avoid placement of landings in special habitats described in general information section above.
Falling	Directionally fall away from special habitats described in general information section above.		Directionally fall away from special habitats described in general information section above.
Skyline Corridors	Avoid placement of skyline corridors through special habitat areas described in general information section above.		Avoid placement of skyline corridors through special habitat areas described in general information section above.
Suspension Requirements	Partial, some ground along roads and part of area south of road 2041 640. Retain 40-60% of duff.		Partial, some ground along roads and part of area south of road 2041 640. Retain 40-60% of duff.
Yarding	Ground-based 7 acres Skyline - 26 acres		Ground-based 7 acres Skyline - 26 acres
Yard tops/whole trees			
Hauling			
Seasonal Restrictions	Spotted owls March 1 - July 15.		Spotted owls March 1 - July 15.
Wildlife			
Post Logging			
Alternatives	**2**		**3**
Botany			
Fuels	Grapple pile along roadside. Burn landings and piles.		Grapple pile along roadside. Burn landings and piles.
Fisheries			
Heritage			

Hydrology		
Silviculture		
Soils		
Transportation		
Wildlife	Create snags and down wood.	Create snags and down wood.
Monitoring		

Sale Name : Middle Santiam Thin	Unit Number 24	Reforestation Number M73	
General Stand Information			
Vegis Number	3001126	**Photo Number**	
Location	T 12 S, R 5 E, Sec. 26	**Subdrainage**	Donaca
Plant Association	TSHE/MANE2	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope	35%	**Elevation**	2600
Aspect	E to NE	**Stand Year of Origin**	1978
Average Stand Height	70'	**Ave. Stand Diameter**	11"
Other Info.	Dominant trees are mostly Douglas-fir. Mountain hemlock and western redcedar in the understory. Some big leaf		
Special Habitats	Alder swale northern edge; wet meadow with season pond south of spur 646.		
Stand History	Clearcut and broadcast burned.		
Stand Health			

Alternative	**2**	**3**
Unit Size	30 acres	30 acres
Volume	600 CCF	600 CCF
Upland Harvest Rx	Thin to 60% canopy closure. About 110 TPA. Suggested DxD = about 14 ft. Leave all cedar, pine, hardwoods and yew.	Thin to 60% canopy closure. About 110 TPA. Suggested DxD = about 14 ft. Leave all cedar, pine, hardwoods and yew.
Wildlife Rx		
Heritage Rx		
Riparian Harvest Rx	No harvest in primary shade zone. Outside of primary shade zone harvest Rx is the same as upland Rx.	No harvest in primary shade zone. Outside of primary shade zone harvest Rx is the same as upland Rx.
Wildlife Rx	Leave 5 TPA for snags and down wood.	Leave 5 TPA for snags and down wood.

Unit Layout and Marking		
Alternatives	**2**	**3**
Marking		
Layout		
Botany	100 ft. no-harvest buffer on two sites of PSRA and two sites of PSMA	100 ft. no-harvest buffer on two sites of PSRA and two sites of PSMA
Hydrology	50 ft. no-harvest buffers on wet areas.	50 ft. no-harvest buffers on wet areas.
Recreation		
Soils		
Special Habitats	50 ft. no-harvest buffer on wet meadow with seasonal pond south of road 646.	50 ft. no-harvest buffer on wet meadow with seasonal pond south of road 646.
Weeds		
Fisheries		

Logging Operation		
Alternatives	**2**	**3**
Access Roads	Road is in good condition	Road is in good condition.
Construction	Reopen existing temporary spur road to landing.	Reopen existing temporary spur road to landing.
Reconstruction		
Maintenance		
Closures	Close logger's spur road after harvest.	Close logger's spur road after harvest.
Equipment Staging	Avoid equipment staging in special habitats described in general information section above.	Avoid equipment staging in special habitats described in general information section above.
Landings	Avoid placement of landings in special habitats described in general information section above.	Avoid placement of landings in special habitats described in general information section above.
Falling	Directionally fall away from special habitats described in general information section above.	Directionally fall away from special habitats described in general information section above.
Skyline Corridors	Avoid skyline corridors through special habitats described in general information section above.	Avoid skyline corridors through special habitats described in general information section above.
Suspension Requirements	Partial, some ground along roads. Retain 40-60% of duff.	Partial, some ground along roads. Retain 40-60% of duff.
Yarding	Skyline - 30 acres	Skyline - 30 acres
Yard tops/whole trees	Yard tops attached	Yard tops attached
Hauling		
Seasonal Restrictions	Spotted owls March 1 - July 15.	Spotted owls March 1 - July 15.
Wildlife		

Post Logging		
Alternatives	**2**	**3**
Botany		
Fuels	Grapple pile along roadside, yard tops. Burn landings and piles.	Grapple pile along roadside, yard tops. Burn landings and piles.
Fisheries		
Heritage		
Hydrology		
Silviculture		
Soils		
Transportation		
Wildlife	Create snags and down wood.	Create snags and down wood.
Monitoring		

Sale Name : Middle Santiam Thin	Unit Number 25	Reforestation Number M25, M25a and M25b	
General Stand Information			
Vegis Number	3001197, 3001182, 3001222	**Photo Number**	
Location	T 12 S, R 5 E, Sec. 27 and 28	**Subdrainage**	Donaca
Plant Association	TSHE/MANE2	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope	35%	**Elevation**	3200
Aspect	NW to NE	**Stand Year of Origin**	1959, 1962, and 1962
Average Stand Height	85'	**Ave. Stand Diameter**	12"
Other Info.	Stand is predominantly Douglas-fir with some western redcedar and western hemlock.		
Special Habitats	Three alder swales scattered throughout stand; small sedge meadow near road 640.		
Stand History	Clearcut and broadcast burned.		
Stand Health			

Alternative	**2**	**3**
Unit Size	51 acres	51 acres
Volume	1020 CCF	1020 CCF
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew.	Thin to 50% canopy closure. 90 TPA. Suggested DxD spacing = about 16 ft Leave all cedar, pine, hardwoods and yew.
Botany Rx	50 ft. no-harvest buffer on landing with scotch broom population.	50 ft. no-harvest buffer on landing with scotch broom population.
Wildlife Rx		
Heritage Rx		
Riparian Harvest Rx	No harvest in primary shade zone. Outside primary shade zone harvest Rx is the same as upland Rx.	No harvest in primary shade zone. Outside primary shade zone harvest Rx is the same as upland Rx.
Wildlife Rx	Leave 5 TPA for snags and down wood.	Leave 5 TPA for snags and down wood.

Unit Layout and Marking		
Alternatives	**2**	**3**
Marking		
Layout	Drop second landing - don't cross 2nd creek. Yard what we can read from 2041 road.	Drop second landing - don't cross 2nd creek. Yard what we can read from 2041 road.
Botany	Invasive plant, Scotch broom population on landing.	Invasive plant, Scotch broom population on landing.
Fisheries		
Hydrology	75 foot buffer on streams if they are perennial. 50 ft no-harvest buffers if streams are perennial.	
Recreation		
Soils		
Special Habitats	Sedge meadows and alder swales. Big alder wet area need 50 foot no harvest buffer.	Sedge meadows and alder swales. Big alder wet area need 50 foot no harvest buffer.
Wildlife	Protect pristoloma habitat.	Protect pristoloma habitat.
Weeds	50-ft. no-harvest buffer around landing with large population of scotch broom.	50-ft. no-harvest buffer around landing with large population of scotch broom.

Logging Operation		
Alternatives	**1**	**3**
Access Roads	Check for road use agreements. Locate road at stream from 519 to landing. Drop second landing and yard what we can reach from 2041.	Check for road use agreements. Locate road at stream from 519 to landing. Drop second landing and yard what we can reach from 2041.
Construction	Reopen 1500 ft. of existing temporary logger's spur and construct 500 ft. of new temporary logger's spur road. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.	Reopen 1500 ft. of existing temporary logger's spur and construct 500 ft. of new temporary logger's spur road. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.
Reconstruction		
Maintenance		
Closures		
Designated Skid Roads	Avoid placement of designated skid roads through special habitats described in general information section above.	Avoid placement of designated skid roads through special habitats described in general information section above.
Equipment Staging	Avoid equipment staging in special habitats described in general information section above.	Avoid equipment staging in special habitats described in general information section above.
Landings	Avoid placement of landings in special habitats described in general information section above. Landing with large scotch broom population will not be used.	Avoid placement of landings in special habitats described in general information section above. Landing with large population of scotch broom will not be used.
Falling	Directionally fall away from special habitats described in general information section above.	Directionally fall away from special habitats described in general information section above.
Skyline Corridors	Avoid placement of skyline corridors through special habitats described in general information section above.	Avoid placement of skyline corridors through special habitats described in general information section above.

Suspension Requirements	Partial, some ground on flat ridges and small benches. Retain 40-60% of duff.	Partial, some ground on flat ridges and small benches. Retain 40-60% of duff.
Yarding	Ground-based - 5 acres Skyline - 46 acres	Ground-based - 5 acres Skyline - 46 acres
Yard tops/whole trees		
Hauling		
Seasonal Restrictions	Spotted owls March 1 - July 15. Dry weather haul on native surface roads.	Spotted owls March 1 - July 15. Dry weather haul on native surface roads.
Heritage Restrictions		
Wildlife	Do not open up upper portion of unit to ATV's with logging set up.	Do not open up upper portion of unit to ATV's with logging set up.
Post Logging		
Alternatives	**2**	**3**
Botany		
Fuels	Grapple pile along roadside. Burn landings and piles.	Grapple pile along roadside. Burn landings and piles.
Fisheries		
Heritage		
Hydrology		
Silviculture		
Soils		
Transportation		
Wildlife	Create snags and down wood.	Create snags and down wood.
Monitoring		

Sale Name : Middle Santiam Thin	Unit Number 26	Reforestation Number M26, M27a and M26c	
General Stand Information			
Vegis Number	3011146, 3011158, 3011151	**Photo Number**	
Location	T 12 S, R 5 E, Sec. 27	**Subdrainage**	Donaca
Plant Association	TSHE/MANE2	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope	45%	**Elevation**	2800
Aspect	N to NW	**Stand Year of Origin**	1965, 1962, and 1975
Average Stand Height	80'	**Ave. Stand Diameter**	12"
Other Info.	Stand is predominantly Douglas-fir with some western redcedar and western hemlock.		
Special Habitats	Two talus/vine maple patches just north of road 2041.		
Stand History	Clearcut and broadcast burned.		
Stand Health			
Alternative	**2**		**3**
Unit Size	58 acres		46 acres
Volume	1160 CCF		920 CCF
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet, except on earthflow leave 65% canopy closure. Leave all cedar, pine, hardwoods and yew.		Thin to 50% canopy closure. 90 TPA. Suggested DxD spacing = about 16 ft, except on earthflow leave 65% canopy closure. Leave all cedar, pine, hardwoods and yew.
Wildlife Rx	Leave 5 TPA for snags and down wood.		Leave 5 TPA for snags and down wood.
Heritage Rx			
Riparian Harvest Rx	No harvest in primary shade zone. Outside primary shade zone harvest Rx is the same as upland Rx.		No harvest in primary shade zone. Outside primary shade zone harvest Rx is the same as upland Rx.
Soils Rx	In M26a portion of this unit there are areas of old debris chutes in the unit. Thin this area to promote stability here.		In M26a portion of this unit there are areas of old debris chutes in the unit. Thin this area to promote stability here.
Unit Layout and Marking			
Alternatives	**2**		**3**
Marking			
Layout	East boundary of unit borders actively unstable earthflow.		East boundary of unit borders actively unstable earthflow.
Botany	100 ft. no-harvest buffer on one site of PSMA		100 ft. no-harvest buffer on one site of PSMA
Hydrology			
Recreation			
Soils	Thin on the unstable earthflow to encourage growth and vigor. This will increase evapotranspiration and help stabilize earthflow. Encourage release of cedar and retain 65% canopy closure. Trees should be evenly spaced across the unstable portion of unit.		Thin on the unstable earthflow to encourage growth and vigor. This will increase evapotranspiration and help stabilize earthflow. Encourage release of cedar and retain 65% canopy closure. Trees should be evenly spaced across the unstable portion of unit.
Special Habitats			
Weeds			
Fisheries			
Logging Operation			
Alternatives	**2**		**3**
Access Roads			
Construction	Reopen about 550 ft. of existing temporary logger's spur road. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.		Reopen about 550 ft. of existing temporary logger's spur road. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.
Reconstruction			
Maintenance			
Closures			
Equipment Staging	Avoid equipment staging in special habitat areas described in general information section above.		Avoid equipment staging in special habitat areas described in general information section above.
Landings	Helicopter landing at rock pit in Unit 26. Avoid placing landings in special habitat areas described in general information section above.		Helicopter landing at rock pit in Unit 26. Avoid placing landings in special habitat areas described in general information section above.
Falling	Directionally fall away from special habitat areas described in general information section above.		Directionally fall away from special habitat areas described in general information section above.
Skyline Corridors	Avoid placement of skyline corridors through special habitat areas described in general information section above.		Avoid placement of skyline corridors through special habitat areas described in general information section above.
Suspension Requirements	Ground on benches along road 2041 640. Otherwise partial suspension. Retain 50-70% of duff except in M26a portion of unit retain 60-80% duff.		Ground on benches along road 2041 640. Otherwise partial suspension. Retain 50-70% of duff except in M26a portion of unit retain 60-80% duff.
Yarding	Skyline - 46 acres Helicopter 12 acres.		Skyline - 24 acres.
Yard tops/whole trees	Yard tops attached.		Yard tops attached.
Hauling			

Seasonal Restrictions	Spotted owls March 1 - July 15. Dry weather haul on native surface roads.	Spotted owls March 1 - July 15. Dry weather haul on native surface roads.
Post Logging		
Alternatives	**2**	**3**
Botany		
Fuels	Grapple pile along roadside, yard tops. Burn landings and piles.	Grapple pile along roadside, yard tops. Burn landings and piles.
Fisheries		
Heritage		
Hydrology		
Silviculture		
Soils		
Transportation		
Wildlife	Create snags and down woody material	Create snags and down woody material
Monitoring		

Sale Name : Middle Santiam Thin	Unit Number 27	Reforestation Number M27 and M27a	
General Stand Information			
Vegis Number	3001134 and 3001130	**Photo Number**	
Location	T 12 S, R 5 E, Sec. 26	**Subdrainage**	Donaca
Plant Association	TSHE/RHMA3-MANE2	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope	30%	**Elevation**	2700
Aspect	N	**Stand Year of Origin**	1959 and 1965
Average Stand Height	75'	**Ave. Stand Diameter**	10"
Other Info.	Stand is predominantly Douglas-fir with some western redcedar and western hemlock. Invasive plants himalaya and/or evergreen blackberry found in vicinity. Debris chute track crosses unit. The unit itself is stable.		
Stand History	Clearcut and broadcast burned.		
Stand Health			

Alternative	**2**	**3**
Unit Size	24 acres	24 acres
Volume	480 CCF	480 CCF
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew.	Thin to 50% canopy closure. 90 TPA. Suggested DxD spacing = about 16 ft Leave all cedar, pine, hardwoods and yew.
Wildlife Rx	Leave 5 TPA for snags and down wood.	Leave 5 TPA for snags and down wood.
Heritage Rx		
Riparian Harvest Rx	No harvest in primary shade zone. In secondary shade zone harvest Rx is the same as upland Rx.	No harvest in primary shade zone. In secondary shade zone harvest Rx is the same as upland Rx.
Soils Rx	Place as much slash as possible in debris chute tracks for ravel and slough stabilization.	Place as much slash as possible in debris chute tracks for ravel and slough stabilization.

Unit Layout and Marking		
Alternatives	**2**	**3**
Marking		
Layout		
Botany	100 ft. no harvest buffer on two sites of PSRA. Invasive plants, Himalaya and evergreen blackberry found along roads in or adjacent to unit.	100 ft. no harvest buffer on two sites of PSRA. Invasive plants, Himalaya and evergreen blackberry found along roads in or adjacent to unit.
Hydrology	Almost the entire unit is within a Riparian Reserve. There is also an earthflow in this unit. Streams are moving around due to earthflow activity. Rx**:** Maintain 100 foot full leave buffers for stability. Streams change and may not be in the same location next year. Slide in this unit.	Almost the entire unit is within a Riparian Reserve. There is also an earthflow in this unit. Streams are moving around due to earthflow activity. Rx**:** Maintain 100 foot full leave buffers for stability. Streams change and may not be in the same location next year. Slide in this unit.
Recreation		
Soils		
Special Habitats		
Wildlife	Buffer streams for pristoloma.	Buffer streams for pristoloma.
Weeds		
Fisheries		

Logging Operation		
Alternatives	**2**	**3**
Access Roads		
Construction		
Reconstruction		
Maintenance		
Closures		
Landings	Landing needs to be 150 ft. away from stream.	Landing needs to be 150 ft. away from stream.
Falling		
Suspension Requirements	Partial, ground along road in M27a portion of unit.	Partial. Retain 60-80% of duff.
Yarding	Skyline - 24 acres	Skyline - 24 acres.
Yard tops/whole trees	Yard tops attached.	Yard tops attached.
Hauling		
Seasonal Restrictions	Spotted owls March 1 - July 15.	Spotted owls March 1 - July 15.
Heritage Restrictions		

Post Logging		
Alternatives	**2**	**3**
Botany		
Fuels	Grapple pile along roadside, yard tops. Burn landings and piles.	Grapple pile along roadside, yard tops. Burn landings and piles.
Fisheries		
Heritage		
Hydrology		
Silviculture		
Soils		
Transportation		
Wildlife	Create snags and down wood.	Create snags and down wood.
Monitoring		

Sale Name : Middle Santiam Thin	Unit Number 28	Reforestation Number M28	
General Stand Information			
Vegis Number	3001188	**Photo Number**	
Location	T 12 S, R 5 E, Sec. 25, 26 and 36	**Subdrainage**	Upper Middle Santiam
Plant Association	TSHE/RHMA3-MANE2	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope	30%	**Elevation**	2600
Aspect	NE	**Stand Year of Origin**	1959
Average Stand Height	90	**Ave. Stand Diameter**	12"
Other Info.	Stand is predominantly Douglas-fir with some western hemlock. False brome (BRSY), an invasive plant is found in the unit.		
Special Habitats	Pond west of stand; seasonal pone below road in wetland; additional Salix wetland below road.		
Stand History	Clearcut and broadcast burned.		
Stand Health	Unstable area just to the north of the helicopter ground - failed in 1964.		
Alternative	**2**	**3**	
Unit Size	29 acres	23 acres	
Volume	580 CCF	460 CCF	
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew.	Thin to 50% canopy closure. 90 TPA. Suggested DxD spacing = about 16 ft Leave all cedar, pine, hardwoods and yew.	
Wildlife Rx			
Heritage Rx			
Riparian Harvest Rx	No harvest in primary shade zone. Outside primary shade zone harvest Rx is the same as upland Rx.	No harvest in primary shade zone. Outside primary shade zone harvest Rx is the same as upland Rx.	
Soils Rx	Some of unit south of road 2041 645 has slight debris chute potential. Thin here to improve stability.	Some of unit south of road 2041 645 has slight debris chute potential. Thin here to improve stability.	
Wildlife Rx	Leave 5 TPA for snags and down wood.	Leave 5 TPA for snags and down wood.	
Unit Layout and Marking			
Alternatives	**2**	**3**	
Marking			
Layout	In downhill area, just layout what can fall to the road.	In downhill area, just layout what can fall to the road.	
Botany	100 ft. no-harvest buffer on one site of NEOC and 100 ft. no-harvest buffer on one site of PSRA next to the trail near the old growth. False brome in the slump in the western portion of the unit.	100 ft. no-harvest buffer on one site of NEOC and 100 ft. no-harvest buffer on one site of PSRA next to the trail near the old growth. False brome in the slump in the western portion of the unit.	
Hydrology	Slope break – channel is unstable – leave 100 foot buffer here. In the flat, thin down to 50 feet.	Slope break – channel is unstable – leave 100 foot buffer here. In the flat, thin down to 50 feet.	
Recreation	Chimney Peak trail – Do not log over trail or place yarding corridors across trail. End of road 646 is the trailhead. Protect trail or recondition after harvest.	Chimney Peak trail – Do not log over trail or place yarding corridors across trail. End of road 646 is the trailhead. Protect trail or recondition after harvest.	
Soils	Potentially unstable debris chute along west boundary - delete from unit.	Potentially unstable debris chute along west boundary - delete from unit.	
Special Habitats	50 ft. no-harvest buffers on ponds and wetlands described in general information section above.	50 ft. no-harvest buffers on ponds and wetlands described in general information section above.	
Weeds	False brome in the slump in the western portion of the unit.	False brome in the slump in the western portion of the unit.	
Fisheries			
Logging Operation			
Alternatives	**2**	**3**	
Access Roads			
Construction	Reopen 250 feet of existing temporary loggers spur and construct an additional 300 feet of temporary logger's spur road. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.	Reopen 250 feet of existing temporary loggers spur and construct an additional 300 feet of temporary logger's spur road. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.	
Reconstruction			
Maintenance			
Closures			
Equipment Staging	Avoid equipment staging in special habitat areas described in general information section above.	Avoid equipment staging in special habitat areas described in general information section above.	
Landings	Helicopter landing west of unit 24 on 2041 road. Avoid landing placement in special habitat areas described in	Avoid landing placement in special habitat areas described in general information section above.	
Falling	Directionally fall away from special habitat areas described in general information section above.	Directionally fall away from special habitat areas described in general information section above.	
Skyline Corridors	Avoid placement of skyline corridors through special habitat areas described in general information section above.	Avoid placement of skyline corridors through special habitat areas described in general information section above.	
Suspension Requirements	Partial, some ground along roads. Full suspension through wet areas. Retain 50-70% of duff.	Partial, some ground along roads. Full suspension through wet areas. Retain 50-70% of duff.	
Yarding	Skyline - 23 acres Helicopter - 6 acres.	Skyline - 23 acres	
Yard tops/whole trees	Yard tops attached in skyline area.	Yard tops attached in skyline area.	
Hauling			

Seasonal Restrictions	Spotted owls March 1 - July 15. Close Chimney Peak Trail and trailhead during harvest operations. Dry weather haul on native surface roads.	Spotted owls March 1 - July 15. Close Chimney Peak Trail and trailhead during harvest operations. Dry weather haul on native surface roads.
Heritage Restrictions		
Post Logging		
Alternatives	**2**	**3**
Botany		
Fuels	Grapple pile along roadside, yard tops in skyline area. Burn landings and piles.	Grapple pile along roadside, yard tops in skyline area. Burn landings and piles.
Fisheries		
Heritage		
Hydrology		
	Pull slash away from Chimney Peak Trail.	Pull slash away from Chimney Peak Trail.
Silviculture		
Soils		
Transportation		
Wildlife	Create snags and down wood.	Create snags and down wood.
Monitoring		

Sale Name : Middle Santiam Thin	Unit Number 29	Reforestation Number M29 and M29a	
General Stand Information			
Vegis Number	3001260	**Photo Number**	
Location	T 12 S, R 5 E, Sec. 36	**Subdrainage**	Upper Middle Santiam
Plant Association	TSHE/MANE2	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope	35%	**Elevation**	2600
Aspect	E	**Stand Year of Origin**	1964
Average Stand Height	80'	**Ave. Stand Diameter**	10" - 12"
Other Info.	Stand is predominately Douglas-fir with lessser amounts of western hemlock, western redcedar, and incense cedar.		
Special Habitats	Multiple rock outcrops throughout stand.		
Stand History	Clearcut and broadcast burned.		
Stand Health			
Alternative	**2**	**3**	
Unit Size	28 acres	28 acres	
Volume	560 CCF	560 CCF	
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew. This unit already has several natural openings.	Thin to 50% canopy closure. 90 TPA. Suggested DxD spacing = about 16 ft Leave all cedar, pine, hardwoods and yew. This unit already has several natural openings.	
Riparian Harvest Rx	No harvest in primary shade zone. Outside primary shade zone harvest Rx is the same as upland Rx. Do not cut cedar.	No harvest in primary shade zone. Outside primary shade zone harvest Rx is the same as upland Rx. Do not cut cedar.	
Wildlife Rx	Leave 5 TPA for snags and down wood.	Leave 5 TPA for snags and down wood.	
Unit Layout and Marking			
Alternatives	**2**	**3**	
Marking			
Layout			
Botany	100 ft. no-harvest buffer on four sites of PSRA along SE boundary, along old growth.	100 ft. no-harvest buffer on four sites of PSRA along SE boundary, along old growth.	
Hydrology	The Riparian Reserve on Bachelor Creek is 344 feet wide because it is a fish-bearing stream. There is an existing old growth leave strip that is 100-200 feet wide here so thinning could occur to the existing unit boundary because of this leave strip. Place a 100 foot buffer on the springs in the northern portion of the unit to maintain water temperatures.	The Riparian Reserve on Bachelor Creek is 344 feet wide because it is a fish-bearing stream. There is an existing old growth leave strip that is 100-200 feet wide here so thinning could occur to the existing unit boundary because of this leave strip. Place a 100 foot buffer on the springs in the northern portion of the unit to maintain water temperatures.	
Recreation			
Soils			
Special Habitats	100 ft. no-harvest buffer on springs.	100 ft no-havest buffer on springs	
Weeds			
Fisheries			
Logging Operation			
Alternatives	**2**	**3**	
Access Roads	There is a road drainage issue on the road in the NE corner of the private land. There are 3 to 4 water crossings on this road. Need a drainage structure (drain dip or new pipe) …rock. May be a good road to put drain dip in road if there is enough money available.	There is a road drainage issue on the road in the NE corner of the private land. There are 3 to 4 water crossings on this road. Need a drainage structure (drain dip or new pipe) …rock. May be a good road to put drain dip in road if there is enough money available.	
Construction	Reopen 1150 ft. of existing temporary logger's spur road. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.	Reopen 1150 ft. of existing temporary logger's spur road. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.	
Reconstruction			
Maintenance			
Closures			
Designated Skid Roads	Avoid placement of skid roads through special habitat areas described in general information section above.	Avoid placement of skid roads through special habitat areas described in general information section above.	
Equipment Staging	Avoid equipment staging in special habitat areas described in general information section above.	Avoid equipment staging in special habitat areas described in general information section above.	
Landings	Avoid placement of landings in special habitat areas described in general information section above.	Avoid placement of landings in special habitat areas described in general information section above.	
Falling	Directionally fall away from special habitat areas described in general information section above.	Directionally fall away from special habitat areas described in general information section above.	

Skyline Corridors	Avoid placement of skyline corridors through special habitat areas described in general information section above.	Avoid placement of skyline corridors through special habitat areas described in general information section above.
Suspension Requirements	Partial, some ground along roads. Retain 40-60% of duff.	Partial, some ground along roads. Retain 40-60% of duff.
Yarding	Ground-based - 8 acres Skyline - 20 acres.	Ground-based - 8 acres Skyline - 20 acres.
Yard tops/whole trees		
Hauling		
Seasonal Restrictions	Spotted owls March 1 - July 15.	Spotted owls March 1 - July 15.
Heritage Restrictions		
Post Logging		
Alternatives	**2**	**3**
Botany		
Fuels	Grapple pile along roadside. Burn landings and piles.	Grapple pile along roadside. Burn landings and piles.
Fisheries		
Heritage		
Hydrology		
Silviculture		
Soils	Subsoil to reduce existing compaction to try to get near S & G of 20%.	Subsoil to reduce existing compaction to try to get near S & G of 20%.
Transportation		
Wildlife	Create snags and down wood.	Create snags and down wood.
Monitoring		

Sale Name : Middle Santiam Thin	Unit Number 30	Reforestation Number M30 and M30a	
General Stand Information			
Vegis Number	3001180 and 3001173	**Photo Number**	
Location	T 12 S, R 5 E, Sec. 28	**Subdrainage**	Donaca
Plant Association	TSHE/MANE2	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope	20% - 55%	**Elevation**	2800
Aspect	NW to N	**Stand Year of Origin**	1964 and 1970
Average Stand Height	70' - 90'	**Ave. Stand Diameter**	10" - 13"
Other Info.	Stand is predominantly Douglas-fir with western hemlock and western redcedar. There is some red alder present as well. False brome (BRSY), an invasive plant is also found in the unit.		
Special Habitats	Vine maple/talus in southeast portion of stand; wetlands below road along north edge.		
Stand History	Clearcut and broadcast burned.		
Stand Health			
Alternative	**2**		**3**
Unit Size	31 acres		8 acres
Volume	620 CCF		160 CCF
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew. The unit has several natural openings already.		Thin to 50% canopy closure. 90 TPA. Suggested DxD spacing = about 16 ft Leave all cedar, pine, hardwoods and yew. The unit has several natural openings already.
Wildlife Rx			
Heritage Rx			
Riparian Harvest Rx	No harvest in primary shade zone. Outside primary shade zone harvest Rx is the same as upland Rx.		No harvest in primary shade zone. Outside primary shade zone harvest Rx is the same as upland Rx.
Wildlife Rx	Leave 5 TPA for snags and down wood.		Leave 5 TPA for snags and down wood.
Unit Layout and Marking			
Alternatives	**2**		**3**
Marking			
Layout	The edge of the buffer on the Middle Santiam River is the SE unit boundary.		The edge of the buffer on the Middle Santiam River is the SE unit boundary.
Botany	Invasive plant, false brome in unit.		Invasive plant, false brome in unit.
Hydrology	100 ft. no-harvest buffer on springs.		100 ft. no-harvest buffer on springs.
Recreation			
Soils	Actively unstable area along southwest boundary - delete from unit. Potentially highly unstable area in southeastern portion of stand - delete from unit.		Actively unstable area along southwest boundary - delete from unit. Potentially highly unstable area in southeastern portion of stand - delete from unit.
Special Habitats	50 ft. no-harvest buffer on wetlands below road along north edge of stand.		50 ft. no-harvest buffer on wetlands below road along north edge of stand.
Weeds	BRSY along road.		
Logging Operation			
Alternatives	**2**		**3**
Access Roads			
Construction	Access road heavily sidecast. Reopen then close with sidecase pullback. Use the road as a waste area.		Access road heavily sidecast. Reopen then close with sidecase pullback. Use the road as a waste area.
Reconstruction			
Maintenance			
Closures			
Equipment Staging	Avoid equipment staging in special habitats described in general information section above.		Avoid equipment staging in special habitats described in general information section above.
Landings	Avoid placement of landings in special habitats described in general information section above.		Avoid placement of landings in special habitats described in general information section above.
Falling	Directionally fall away from special habitats described in general information section above.		Directionally fall away from special habitats described in general information section above.
Skyline Corridors	Avoid placement of skyline corridors through special habitats described in general information section above.		Avoid placement of skyline corridors through special habitats described in general information section above.
Suspension Requirements	Partial. Retain 50-70% of duff. Do not tailhold in the wilderness.		Partial. Retain 50-70% of duff. Do not tailhold in the wilderness.
Yarding	Skyline - 8 acres Helicopter - 23 acres.		Skyline - 8 acres.
Yard tops/whole trees	Yard tops attached.		Yard tops attached.
Hauling			
Seasonal Restrictions	Spotted owls March 1 - July 15.		Spotted owls March 1 - July 15.
Post Logging			
Alternatives	**2**		**3**

Botany		
Fuels	Yard tops in skyline area. Burn landings.	Yard tops in skyline area. Burn landings.
Fisheries		
Heritage		
Hydrology		
Silviculture		
Soils		
Transportation		
Wildlife	Create snags and down wood.	Create snags and down wood.
Monitoring		

Sale Name : Middle Santiam Thin	Unit Number 31	Reforestation Number M50	
General Stand Information			
Vegis Number	3001061	**Photo Number**	
Location	T 12 S, R 5 E, Sec. 28	**Subdrainage**	Donaca
Plant Association	TSHE/MANE2, TSHE/GASH	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope		**Elevation**	2600
Aspect	NE	**Stand Year of Origin**	1967
Average Stand Height		**Ave. Stand Diameter**	
Other Info.			
Stand History	Clearcut and broadcast burned		
Stand Health			
Alternative	**2**		**3**
Unit Size	22 acres		
Volume	440 CCF		
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew.		
Wildlife Rx	Leave 5 TPA for snags and down wood.		
Riparian Harvest Rx	No harvest in primary shade zone. Outside primary shade zone harvest Rx is the same as upland Rx.		
Special Habitat Rx			
Unit Layout and Marking			
Alternatives	**2**		**3**
Marking			
Layout			
Botany	100 ft. no-harvest buffer on one site of PSMA.		
Fisheries			
Hydrology			
Recreation			
Soils			
Special Habitats			
Weeds			
Logging Operation			
Alternatives	**2**		**3**
Access Roads			
Construction			
Reconstruction			
Maintenance			
Closures			
Landings			
Falling			
Suspension Requirements	Partial. Retain 50-70% of duff.		
Yarding	Helicopter- 22 acres		
Yard tops/whole trees			
Hauling			
Seasonal Restrictions	Spotted owls March 1 - July 15.		
Post Logging			
Alternatives	**2**		**3**
Botany			
Fuels	No treatment.		
Fisheries			
Heritage			
Hydrology			
Silviculture			
Soils			
Transportation			
Wildlife	Create snags and down wood.		
Monitoring			

Sale Name : Middle Santiam Thin	Unit Number 32	Reforestation Number M32	
General Stand Information			
Vegis Number	3001043	**Photo Number**	997 - 87
Location	T 12 S, R 5 E, Sec. 29	**Subdrainage**	Donaca
Plant Association	ABAM/VAAL/COCA	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope	35%	**Elevation**	3600
Aspect	NE	**Stand Year of Origin**	1955
Average Stand Height	50' - 60'	**Ave. Stand Diameter**	10"
Other Info.	Stand is predominantly Douglas-fir with western hemlock, noble fir and western white pine. Some western redcedar in understory.		
Stand History	Clearcut and broadcast burned.		
Stand Health	Snow breakage in stand.		
Alternative	**2**		**3**
Unit Size	15 acres		15 acres
Volume	300 CCF		300 CCF
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew.		Thin to 50% canopy closure. 90 TPA. Suggested DxD spacing = about 16 ft Leave all cedar, pine, hardwoods and yew.
Riparian Harvest Rx	No harvest in primary shade zone. Outside primary shade zone harvest Rx is the same as upland Rx.		No harvest in primary shade zone. Outside primary shade zone harvest Rx is the same as upland Rx.
Wildlife Rx	Leave 5 TPA for snags and down wood.		Leave 5 TPA for snags and down wood.
Unit Layout and Marking			
Alternatives	**2**		**3**
Marking			
Layout			
Botany			
Hydrology			
Recreation	Wilderness boundary is 200 feet from the road. Locate unit boundary 175 ft. from road to ensure unit is out of wilderness.		Wilderness boundary is 200 feet from the road. Locate unit boundary 175 ft. from road to ensure unit is out of wilderness.
Soils			
Special Habitats			
Fisheries			
Logging Operation			
Alternatives	**2**		**3**
Access Roads			Decommimssion road as it enters unit adjacent to rest of wilderness boundary.
Construction			
Reconstruction			
Maintenance			
Closures	Close 2041 520 road with a gate at the junction with the 526 road.		Close 2041 520 road with a gate at the junction with the 526 road.
Landings			
Falling			
Suspension Requirements	Ground. Retain 40-60% of duff.		Ground. Retain 40-60% of duff.
Yarding	Ground-based yarding -9 acres Skyline - 11 acres.		Ground-based yarding - 9 acres Skyline - 11 acres.
Yard tops/whole trees	Yard tops attached in skyline area.		Yard tops attached in skyline area.
Hauling			
Seasonal Restrictions	Spotted owls March 1 - July 15.		Spotted owls March 1 - July 15.
Post Logging			
Alternatives	**2**		**3**
Botany			
Fuels	Yard tops in skyline area. Grapple pile in ground-based yarding area. Burn landings and piles.		Yard tops in skyline area. Grapple pile in ground-based yarding area. Burn landings and piles.
Fisheries			
Heritage			
Hydrology			
Silviculture			
Soils	Subsoil to reduce existing compaction to try to get near S & G of 20%.		Subsoil to reduce existing compaction to try to get near S & G of 20%.
Transportation			
Wildlife	Create snags and down wood.		Create snags and down wood.
Monitoring			

Sale Name : Middle Santiam Thin	Unit Number 33	Reforestation Number M51	
General Stand Information			
Vegis Number	3001059	**Photo Number**	
Location	T 12 S, R 5 E, Sec. 27	**Subdrainage**	Donaca
Plant Association	TSHE/MANE2	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope	35%	**Elevation**	2400
Aspect	NE	**Stand Year of Origin**	1965
Average Stand Height	60'	**Ave. Stand Diameter**	8-10"
Other Info.	Stand is predominantly Douglas-fir and western hemlock. Some western redcedar in the understory. Also bigleaf maple and red alder. Road drainage pipe caused failure into part of unit dominated by maple.		
Special Habitats	Carex wetland below road on northern edge of stand.		
Stand History	Clearcut and broadcast burned.		
Stand Health			
Alternative	**2**		**3**
Unit Size	13 acres		13 acres
Volume	260 CCF		260 CCF
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew.		Thin to 50% canopy closure. 90 TPA. Suggested DxD spacing = about 16 ft Leave all cedar, pine, hardwoods and yew.
Heritage Rx			
Riparian Harvest Rx	No harvest in primary shade zone. In secondary shade zone harvest Rx is the same as upland Rx.		No harvest in primary shade zone. In secondary shade zone harvest Rx is the same as upland Rx.
Special Habitat Rx			
Wildlife Rx	Leave 5 TPA for snags and down wood.		Leave 5 TPA for snags and down wood.
Unit Layout and Marking			
Alternatives	**2**		**3**
Marking			
Layout			
Botany	100 ft. no-harvest buffer on five sites of PSMA and six sites of PSRA along southern boudary adjacent to old growth.		100 ft. no-harvest buffer on five sites of PSMA and six sites of PSRA along southern boudary adjacent to old growth.
Hydrology			
Recreation	Verify wilderness boundary and pull unit boundary 25 feet away from wilderness boundary (no survey)		Verify wilderness boundary and pull unit boundary 25 feet away from wilderness boundary (no survey)
Soils	Unstable debris chute-prone ground along east boundary - delete from unit.		Unstable debris chute-prone ground along east boundary - delete from unit.
Special Habitats	50 ft. no-harvest buffer on wetland below road on northern edge.		50 ft. no-harvest buffer on wetland below road on northern edge.
Wildlife			
Fisheries			
Logging Operation			
Alternatives	**2**		**3**
Access Roads	Do not use proposed road along the souther unit boundary due to PSRA and PSMA.		Do not use proposed road along the souther unit boundary due to PSRA and PSMA.
Construction			
Reconstruction			
Maintenance			
Closures			
Designated Skid Roads	Avoid placement of skid roads through special habitat areas described in general information section above.		Avoid placement of skid roads through special habitat areas described in general information section above.
Equipment Staging	Avoid equipment staging in special habitat areas described in general information section above.		Avoid equipment staging in special habitat areas described in general information section above.
Landings	Avoid placement of landings in special habitat areas described in general information section above.		Avoid placement of landings in special habitat areas described in general information section above.
Falling	Directionally fall away from special habitat areas described in general information section above.		Directionally fall away from special habitat areas described in general information section above.
Skyline Corridors	Avoid placement of skyline corridors through special habitat areas described in general information section above.		Avoid placement of skyline corridors through special habitat areas described in general information section above.
Suspension Requirements	Partial and ground. Retain 40-60% of duff.		Partial and ground. Retain 40-60% of duff.
Yarding	Ground-based yarding - 7 acres Skyline - 6 acres. Can't use road because of botany buffers, get the rest – downhill log from the road below.		Ground-based yarding - 7 acres Skyline - 6 acres. Can't use road because of botany buffers, get the rest – downhill log from the road below.
Yard tops/whole trees	Yard tops attached in skyline area.		Yard tops attached in skyline area.
Hauling			
Seasonal Restrictions	Spotted owls March 1 - July 15.		Spotted owls March 1 - July 15.
Post Logging			
Alternatives	**2**		**3**
Botany			
Fuels	Grapple pile in ground-based yarding area. Yard tops in skyline area. Burn landings and piles.		Grapple pile in ground-based area. Yard tops in skyline area. Burn landings and piles.

Fisheries		
Heritage		
Hydrology		
Silviculture		
Soils	Subsoil to reduce existing compaction to try to get near S & G of 20%.	Subsoil to reduce existing compaction to try to get near S & G of 20%.
Transportation		
Wildlife	Create snags and down wood	Create snags and down wood
Monitoring		

Sale Name : Middle Santiam Thin	Unit Number 34	Reforestation Number M52, M52a and M52b	
General Stand Information			
Vegis Number	3001067, 3001082, 3001119	**Photo Number**	
Location	T 12 S, R 5 E, Sec. 27	**Subdrainage**	Donaca
Plant Association	TSHE/MANE2	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope	40%	**Elevation**	2500
Aspect	NW to NE	**Stand Year of Origin**	1964, 1966 and 1972
Average Stand Height	70'	**Ave. Stand Diameter**	10"
Other Info.	Stand is predominantly Douglas-fir with some western hemlock and western redcedar.		
Stand History	Clearcut and broadcast burned.		
Stand Health			
Alternative	**2**		**3**
Unit Size	23 acres		23 acres
Volume	460 CCF		460 CCF
Upland Harvest Rx	Thin to 60% canopy closure. About 110 TPA. Suggested DxD = about 14 ft. Leave openings in about 10% of upland thinning (DTR's). Leave all cedar, pine, hardwoods and yew.		Thin to 60% canopy closure. About 110 TPA. Suggested DxD = about 14 ft. Leave openings in about 10% of upland thinning (DTR's). Leave all cedar, pine, hardwoods and yew.
Wildlife Rx			
Heritage Rx			
Riparian Harvest Rx	No harvest in primary shade zone. In secondary shade zone harvest Rx is the same as upland Rx except no DTR's.		No harvest in primary shade zone. In secondary shade zone harvest Rx is the same as upland Rx except no DTR's.
Wildlife Rx	Leave 5 TPA for snags and down wood.		Leave 5 TPA for snags and down wood.
Unit Layout and Marking			
Alternatives	**2**		**3**
Marking			
Layout			
Botany	100 ft. no-harvest buffer on LECY in riparian area.		100 ft. no-harvest buffer on LECY in riparian area.
Hydrology	Perennial channel along the eastern unit boundary. On the southern boundary-below is unstable headwalls and debris torrent tracks, alder, wet areas. Need to locate southern boundary carefully – hard to find. Rx**:** No skid roads by intermittent seep. 52a – 50 foot buffer on wet area adjacent to jct. 2041 551. 52a -50 foot buffer on the wet area at the jct. 2041 551.		Perennial channel along the eastern unit boundary. On the southern boundary-below is unstable headwalls and debris torrent tracks, alder, wet areas. Need to locate southern boundary carefully – hard to find. Rx**:** No skid roads by intermittent seep. 52a – 50 foot buffer on wet area adjacent to jct. 2041 551. 52a -50 foot buffer on the wet area at the jct. 2041 551.
Recreation	Verify wilderness boundary and pull unit boundary 25 feet away from wilderness boundary (no survey)		Verify wilderness boundary and pull unit boundary 25 feet away from wilderness boundary (no survey)
Soils	Some instabiliy along southern unit boundary.		
Special Habitat	20' x 20' wet area 6" deep 50 ft. downhill from road flags. Locate.		20' x 20' wet area 6" deep 50 ft. downhill from road flags. Locate.
Logging Operation			
Alternatives	**2**		**3**
Access Roads			
Construction	Re-open 850 ft. of existing temporary loggers spur road. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.		Re-open 850 ft. of existing temporary loggers spur road. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.
Reconstruction			
Maintenance			
Closures			
Landings			
Falling			
Suspension Requirements	Partial, some ground along roads. Retain 50-70% of duff. No tailholds in wilderness.		Partial, some ground along roads. Retain 50-70% of duff. No tailholds in wilderness.
Yarding	Skyline - 23 acres		Skyline - 23 acres
Yard tops/whole trees	Yard tops attached.		Yard tops attached.
Hauling			
Seasonal Restrictions	Spotted owls March 1 - July 15. Dry weather haul on native surface roads.		Spotted owls March 1 - July 15. Dry weather haul on native surface roads.
Heritage Restrictions			
Post Logging			
Alternatives	**2**		**3**
Botany			
Fuels	Grapple pile along roadside. Yard tops. Burn landings and piles.		Grapple pile along roadside. Yard tops. Burn landings and piles.
Fisheries			
Heritage			
Hydrology			
Silviculture			
Soils			
Transportation			
Wildlife	Create snags and down wood.		Create snags and down wood.
Monitoring			

Sale Name : Middle Santiam Thin	Unit Number 35	Reforestation Number M53	
General Stand Information			
Vegis Number	3001083	**Photo Number**	
Location	T 12 S, R 5 E, Sec. 27 and 28	**Subdrainage**	Donaca
Plant Association	TSHE/MANE2	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope	35% overall but some slopes up to 70%	**Elevation**	2700
Aspect	NW to NE	**Stand Year of Origin**	1968
Average Stand Height	70'	**Ave. Stand Diameter**	10"
Other Info.	Stand is predominantly Douglas-fir with some western hemlock and western redcedar.		
Special Habitats	Wetland in northwest corner of stand.		
Stand History	Clearcut and broadcast burned.		
Stand Health			

Alternative	**2**	**3**
Unit Size	45 acres	45 acres
Volume	900 CCF	900 CCF
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew.	Thin to 50% canopy closure. 90 TPA. Suggested DxD spacing = about 16 ft Leave all cedar, pine, hardwoods and yew.
Wildlife Rx		
Heritage Rx		
Riparian Harvest Rx	No harvest in primary shade zone. Outside primary shade zone harvest Rx is the same as upland Rx.	No harvest in primary shade zone. Outside primary shade zone harvest Rx is the same as upland Rx.
Wildlife Rx	Leave 5 TPA for snags and down wood.	Leave 5 TPA for snags and down wood.
Unit Layout and Marking		
Alternatives	**2**	**3**
Marking		
Layout		
Botany	100 ft. no-havest buffer on one site of PSMA and one site of PSRA.	100 ft. no-havest buffer on one site of PSMA and one site of PSRA.
Fisheries		
Hydrology	Wet area in the NW portion of the stand, partially in wilderness. There is a stream along the SW portion of the unit (??buffer)	Wet area in the NW portion of the stand, partially in wilderness. There is a stream along the SW portion of the unit (??buffer)
Recreation	Verify wilderness boundary and pull unit boundary __ feet away from wilderness boundary (no survey)	Verify wilderness boundary and pull unit boundary __ feet away from wilderness boundary (no survey)
Soils	Some instabiliy along southern unit boundary.	Some instabiliy along southern unit boundary.
Special Habitats	50 ft. no-harvest buffer on wetland in NW corner of stand.	50 ft. no-harvest buffer on wetland in NW corner of stand.
Logging Operation		
Alternatives	**2**	**3**
Access Roads		
Construction		
Reconstruction		
Maintenance		
Closures		
Designated Skid Roads	Avoid placement of skid roads through special habitat areas described in general information section above.	Avoid placement of skid roads through special habitat areas described in general information section above.
Equipment Staging	Avoid equipment staging in special habitat areas described in general information section above.	Avoid equipment staging in special habitat areas described in general information section above.
Landings	Avoid placement of landings in special habitat areas described in general information section above.	Avoid placement of landings in special habitat areas described in general information section above.
Falling	Directionally fall away from special habitat areas described in general information section above.	Directionally fall away from special habitat areas described in general information section above.
Skyline Corridors	Avoid placement of skyline corridors through special habitat areas described in general information section above.	Avoid placement of skyline corridors through special habitat areas described in general information section above.
Suspension Requirements	Partial, some ground on bench along access road. Retain 50-705 of duff. No tailholds in wilderness.	Partial, some ground on bench along access road. Retain 50-705 of duff. No tailholds in wilderness.
Yarding	Ground-based - 21 acres Skyline - 24 acres	Ground-based - 21 acres Skyline - 24 acres
Yard tops/whole trees	Yard tops attached in skyline area.	Yard tops attached in skyline areas.
Hauling		
Seasonal Restrictions	Spotted owls March 1 - July 15.	Spotted owls March 1 - July 15.
Post Logging		

Alternatives	2	3
Botany		
Fuels	Yard tops in skyline area. Grapple pile in ground-based yarding area. Burn landings and piles.	Yard tops in skyline area. Grapple pile in ground-based yarding area. Burn landings and piles.
Fisheries		
Heritage		
Hydrology		
Silviculture		
Soils	Subsoil to reduce existing compaction to try to get near S & G of 20%.	Subsoil to reduce existing compaction to try to get near S & G of 20%.
Transportation		
Wildlife	Create snags and down wood.	Create snags and down wood.
Monitoring		

Sale Name : Middle Santiam Thin	Unit Number 36	Reforestation Number 110 and 110a	
General Stand Information			
Vegis Number	3001050	**Photo Number**	
Location		**Subdrainage**	Upper Middle Santiam
Plant Association	TSHE/MANE2	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope		**Elevation**	
Aspect		**Stand Year of Origin**	
Average Stand Height		**Ave. Stand Diameter**	
Other Info.			
Stand History	Clearcut and broadcast burned.		
Stand Health			
Alternative	**2**		**3**
Unit Size	10 acres		
Volume	200 CCF		
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew.		Thin to 50% canopy closure. 90 TPA. Suggested DxD spacing = about 16 ft Leave all cedar, pine, hardwoods and yew.
Wildlife Rx			
Riparian Harvest Rx			
Wildlife Rx	Leave 5 TPA for snags and down wood.		Leave 5 TPA for snags and down wood.
Unit Layout and Marking			
Alternatives	**2**		**3**
Marking			
Layout			
Botany	100 ft. no-harvest buffer on one site of PSMA and 100 ft. no-harvest buffer on two sites of PSRA. 100 ft. no-havest buffer on population of false brome in unit. Invasive plant, Scotch broom population on landing.		100 ft. no-harvest buffer on one site of PSMA and 100 ft. no-harvest buffer on two sites of PSRA. Invasive plant, Scotch broom population on landing and false brome in unit.
Hydrology			
Soils			
Weeds			
Fisheries			
Logging Operation			
Alternatives	**2**		**3**
Access Roads			
Construction			
Reconstruction			
Maintenance			
Closures			
Landings	Cover scotch broom on landing with filter cloth and six inches of gravel to avoid spreading seed to harvested stand.		Cover scotch brrom on landing with filter cloth and six inches of gravel to avoid spreading seed to harvested stand.
Falling			
Suspension Requirements			
Yarding			
Yard tops/whole trees			
Hauling			
Seasonal Restrictions	Spotted owls March 1 - July 15.		Spotted owls March 1 - July 15.
Heritage Restrictions			
Post Logging			
Alternatives	**2**		**3**
Botany			
Fuels	Burn landings.		Burn landings.
Fisheries			
Heritage			
Hydrology			
Silviculture			
Soils	Subsoil to reduce existing compaction to try to get near S & G of 20%.		Subsoil to reduce existing compaction to try to get near S & G of 20%.
Transportation			
Wildlife	Create snags and down wood.		Create snags and down wood.
Monitoring			

Sale Name : Middle Santiam Thin	Unit Number 37	Reforestation Number 110 and 110a	
General Stand Information			
Vegis Number	3001825 and 3001851	**Photo Number**	
Location	T 13 S, R 6 E, Sec. 17 and 18	**Subdrainage**	Upper Middle Santiam
Plant Association	TSHE/RHMA3/MANE2 and TSHE/MANE2	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope		**Elevation**	3200
Aspect	N to NE	**Stand Year of Origin**	1957 and 1957
Average Stand Height		**Ave. Stand Diameter**	
Other Info.			
Stand History	Clearcut and broadcast burned.		
Stand Health			
Alternative	**2**		**3**
Unit Size	15 acres		15 acres
Volume	300 CCF		300 CCF
Upland Harvest Rx	Thin to 60% Canopy Closure. About 110 TPA. Suggested DxD spacing = about 14 feet. Leave all cedar, pine, hardwoods and yew.		Thin to 60% canopy closure. About 110 TPA. Suggested DxD spacing = about 14 ft Leave all cedar, pine, hardwoods and yew.
Heritage Rx			
Riparian Harvest Rx			
Wildlife Rx	Leave 5 TPA for snags and down wood.		Leave 5 TPA for snags and down wood.
Unit Layout and Marking			
Alternatives	**2**		**3**
Marking			
Layout			
Botany			
Fisheries	100 ft. no-harvest buffer on Cougar Creek.		100 ft. no-harvest buffer on Cougar Creek.
Hydrology	110a is entirely within the Riparian Reserve. Leave the area between the two tributaries out of the unit.		110a is entirely within the Riparian Reserve. Leave the area between the two tributaries out of the unit.
Soils			
Fisheries	Leave 100 ft. no-harvest buffer on Cougar Creek.		Leave 100 ft. no-harvest buffer on Cougar Creek.
Logging Operation			
Alternatives	**2**		**3**
Access Roads	The road to the south in on private land. It will cost a lot to open this road and it only access a couple of acres of the unit. Don't use this road, instead downhill skyline this part of unit.		The road to the south in on private land. It will cost a lot to open this road and it only access a couple of acres of the unit. Don't use this road, instead downhill skyline this part of unit.
Construction			
Reconstruction			
Maintenance			
Closures			
Landings			
Falling			
Suspension Requirements	Partial, some gound north of road 2049. Retain 40-60% of duff. Will need to tailhold across creek		Partial, some gound north of road 2049. Retain 40-60% of duff. Will need to tailhold across creek
Yarding	Ground-based - 3 acres Skyline - 12 acres		Ground-based - 3 acres Skyline - 12 acres
Yard tops/whole trees	Yard tops attached in skyline area		Yard tops attached in skyline area.
Hauling			
Seasonal Restrictions	Spotted owls March 1 - July 15.		Spotted owls March 1 - July 15.
Post Logging			
Alternatives	**2**		**3**
Botany			
Fuels	Grapple pile in ground-based yarding area and along roadside. Burn landings and piles. Yard tops in skyline yarding area.		Grapple pile in ground-based yarding area and along roadside. Burn landings and piles. Yard tops in skyline yarding area.
Fisheries	Use KV selectively girdle and or cut trees to get wood for the streams in triangle piece between streams and in SW corner that was dropped and within 100 feet of Cougar Creek.		Use KV selectively girdle and or cut trees to get wood for the streams in triangle piece between streams and in SW corner that was dropped and within 100 feet of Cougar Creek.
Heritage			
Hydrology			
Silviculture			
Soils	Subsoil to reduce existing compaction to try to get near S & G of 20%.		Subsoil to reduce existing compaction to try to get near S & G of 20%.
Transportation			
Wildlife	Create snags and down wood.		Create snags and down wood.
Monitoring			

Sale Name : Middle Santiam Thin	Unit Number 38	Reforestation Number 160	
General Stand Information			
Vegis Number	3001950	**Photo Number**	
Location	T 13 S, R 6 E, Sec. 18	**Subdrainage**	Upper Middle Santiam
Plant Association	ABAM/RHMA3/XETE ABAM/RHMA3/MANE2	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope		**Elevation**	3800
Aspect	NW	**Stand Year of Origin**	1962
Average Stand Height		**Ave. Stand Diameter**	
Other Info.			
Stand History	Clearcut and broadcast burned.		
Stand Health	Phellinus weirii south of creek.		
Alternative	**2**		**3**
Unit Size	49 acres		49 acres
Volume	760 CCF		760 CCF
Upland Harvest Rx	Thin to 60% canopy closure. About 110 TPA. Suggested DxD = mabout 14 ft. Leave openings in about 10% of thinned upland area (DTR's) . Leave all cedar, pine, hardwoods and yew.		Thin to 60% canopy closure. About 110 TPA. Suggested DxD = about 14 ft. Leave openings in about 10% of thinned upland areas (DTR's). Leave all cedar, pine, hardwoods and yew.
Riparian Harvest Rx	No harvest in primary shade zone. Outside primary shade zone use same Rx as uplands except no DTR's in Riparian Reserves.		No harvest in primary shade zone. Outside primary shade zone use same Rx as uplands except no DTR's in Riparian Reserves.
Soils Rx	Approximately 1/10 acres will be cleared for expansion of rock pit adjacent to road 2049 617.		Approximately 1/10 acres will be cleared for expansion of rock pit adjacent to road 2049 617.
Wildlife Rx	Leave 5 TPA for snags and down wood.		Leave 5 TPA for snags and down wood.
Unit Layout and Marking			
Alternatives	**2**		**3**
Marking			
Layout	Need survey of private land line or pull unit boundary about 20 feet off boundary if corner can be located.		Need survey of private land line or pull unit boundary about 20 feet off boundary if corner can be located.
Botany			
Hydrology	50 ft. no-harvest buffer on stream and headwall.		50 ft. no-harvest buffer on stream and headwall.
Soils			
Wildlife	Leave 2.1 TPA for snags and down wood.		Leave 2.1 TPA for snags and down wood.
Logging Operation			
Alternatives	**2**		**3**
Access Roads			
Construction	Construct about 925 ft. of new temporary logger's spur road. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.		Construct about 925 ft. of new temporary logger's spur road. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.
Reconstruction			
Maintenance	Spur road will need spot rock. Can you small rock pit along road at east boundary for pit run rock source.		Spur road will need spot rock. Can you small rock pit along road at east boundary for pit run rock source.
Closures			
Landings	Do not use jct. with 620 road for a landing. Can use jct. with 617 road for landing.		Do not use jct. with 620 road for a landing. Can use jct. with 617 road for landing.
Falling			
Suspension Requirements	Partial, some ground. Retain 50-70% duff.		Partial, some ground. Retain 50-70% duff.
Yarding	Ground-based - 6 acres Skyline - 43 acres Do not use ground-based equipment near the 620 road jct.		Ground-based - 6 acres Skyline - 43 acres Do not use ground-based equipment near the 620 road jct.
Yard tops/whole trees			
Hauling			
Seasonal Restrictions	Spotted owls March 1 - July 15. Dry weather haul on native surface roads.		Spotted owls March 1 - July 15. Dry weathe haul on native surface roads.
Heritage Restrictions	Do not stage equipment on 620 road. No ground disturbance to NW of unit.		Do not stage equipment on 620 road. No ground disturbance to NW of unit.
Post Logging			

Alternatives	2	3
Botany		
Fuels	Burn landings.	Burn landings.
Fisheries		
Heritage		
Hydrology		
Silviculture		
Soils	Subsoil to reduce existing compaction to try to get near S & G of 20%.	Subsoil to reduce existing compaction to try to get near S & G of 20%.
Transportation		
Wildlife	Create snags and down wood.	Create snags and down wood.
Monitoring		

Sale Name : Middle Santiam Thin	Unit Number 41	Reforestation Number 441 and 441a	
General Stand Information			
Vegis Number	3001478 and 3001480	**Photo Number**	797 - 50 and 797 - 51
Location	T 13 S, R 5 E, Sec. 2	**Subdrainage**	Upper Middle Santiam
Plant Association	ABAM/VAAL/COCA and TSHE/MANE2	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope	15-30%	**Elevation**	3400
Aspect	variable	**Stand Year of Origin**	1955 and 1965
Average Stand Height	60-70'	**Ave. Stand Diameter**	10-12"
Other Info.	Both stands are predominantly Douglas-fir. Associated species include western hemlock (which is the most prominent), noble fir, silver fir and western redcedar.		
Special Habitats	Large mesic/wet meadow and seasonal pond in western portion of stand.		
Stand History	Clearcut and broadcast burned.		
Stand Health	Some snow down and snap outs. Rocky soils.		
Alternative	**2**		**3**
Unit Size	38 acres		38 acres
Volume	760 CCF		760 CCF
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine,		Thin to 50% canopy closure. 90 TPA. Suggested DxD spacing = about 16 ft Leave all cedar, pine, hardwoods
Wildlife Rx			
Riparian Harvest Rx	No harvest in primary shade zone. Outside primary shade zone use same Rx as uplands.		No harvest in primary shade zone. Outside primary shade zone use same Rx as uplands.
Wildlife Rx	Leave 5 TPA for snag and down wood.		Leave 5 TPA for snags and down wood.
Unit Layout and Marking			
Alternatives	**2**		**3**
Marking			
Layout			
Botany	Mesic meadow, seasonal pond.		Mesic meadow, seasonal pond.
Heritage	Buffer meadow 1 to 2 tree heights.		Buffer meadow 1 to 2 tree heights.
Hydrology	Marshy area near landing in NW portion of unit.		Marshy area near landing in NW portion of unit.
Soils			
Special Habitats	50 ft. no-harvest buffer on meadow and seasonal pond in western portion of stand.		50 ft. no-harvest buffer on meadow and seasonal pond in western portion of stand.
Logging Operation			
Alternatives	**2**		**3**
Access Roads			Do not surface, widen, etc. road 161.
Construction	550 ft. of logger's spur. Of this 300 ft. is existing and 250 ft. is new. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.		550 ft. of logger's spur. Of this 300 ft. is existing and 250 ft. is new. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.
Reconstruction			
Maintenance	Active rock pit in unit.		Active rock pit in unit.
Closures			
Designated Skid Roads	Utilize old skid roads as much as possible. Avoid placement of skid roads through special habitat areas described in general information section above.		Utilize old skid roads as much as possible. Avoid placement of skid roads through special habitat areas described in general information section above.
Equipment Staging	Avoid equipment staging in special habitat areas described in general information section above. Do not stage equipment on spur road 161.		Avoid equipment staging in special habitat areas described in general information section above. Do not stage equipment on spur road 161.
Landings	Do not use wet area in northern unit boundary as a landing. Avoid placement of landings in special habitat areas described in general information section above.		Do not use wet area in northern unit boundary as a landing. Avoid placement of landings in special habitat areas described in general information section above.
Falling	Directionally fall away from special habitat areas described in general information section above.		Directionally fall away from special habitat areas described in general information section above.
Skyline Corridors	Avoid placement of skyline corridors through special habitat areas described in general information section above.		Avoid placement of skyline corridors through special habitat areas described in general information section above.
Suspension Requirements	441 portion of unit is ground. Retain 30-50% of duff. 441a portion of unit is partial suspension. Retain 50-70% of duff.		441 portion of unit is ground. Retain 30-50% of duff. 441a portion of unit is partial suspension. Retain 50-70% of duff.
Yarding	Ground-based - 22 acres Skyline - 16 acres		Ground-based - 22 acres Skyline - 16 acres
Yard tops/whole trees			
Hauling			
Seasonal Restrictions	Spotted owls March 1 - July 15. Dry weather haul on native surface roads.		Spotted owls March 1 - July 15. Dry weather haul on native surface roads.
Other Info.	Check with planner before any ground disturbance.		Check with planner before any ground disturbance.
Post Logging			
Alternatives	**2**		**3**
Botany			

Fuels	Grapple pile along roadside. Burn landings and piles.	Grapple pile along roadside. Burn landings and piles.
Fisheries		
Heritage		
Hydrology		
Silviculture		
Soils		
Transportation		
Wildlife	Create snags and down wood.	Create snags and down wood.
Monitoring		

Sale Name : Middle Santiam Thin	Unit Number 42	Reforestation Number 442	
General Stand Information			
Vegis Number	3001590	**Photo Number**	897 - 11
Location	T 13 S, R 5 E, Section 10	**Subdrainage**	Upper Middle Santiam
Plant Association	ABAM/VAAL/COCA	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope	25%	**Elevation**	3500
Aspect		**Stand Year of Origin**	1957
Average Stand Height	60-70'	**Ave. Stand Diameter**	10-12"
Other Info.	Stand density variable from 150-400 TPA. Primary species are about 1/3 Douglas-fir, 1/3 noble fir and 1/3 western hemlock. Some silver fir mostly in the understory. Some parts of the stand are not yet ready to thin and there is a meadow within the stand.		
Special Habitats	Large mesic meadow and wet meadow and talus/vine maple along western edge of stand.		
Stand History	Clearcut and broadcast burned.		
Stand Health	Some snow down and snap outs. Rocky soils.		
Alternative	**2**		**3**
Unit Size	16 acres		16 acres
Volume	320 CCF		320 CCF
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew.		Thin to 50% canopy closure. 90 TPA. Suggested DxD spacing = about 16 ft Leave all cedar, pine, hardwoods and yew.
Riparian Harvest Rx	No harvest in primary shade zone. Outside of primary shade zone thin to same Rx as upland Rx.		No harvest in primary shade zone. Outside of primary shade zone thin to same Rx as upland Rx.
Wildlife Rx	Leave 5 TPA for snags and down wood.		Leave 5 TPA for snags and down wood.
Unit Layout and Marking			
Alternatives	**2**		**3**
Marking			
Layout			
Botany	Large population of invasive plant Yellow toadflax in mesic meadow in unit.		Large population of invasive plant yellow toadflax in mesic meadow in unit.
Hydrology	No not include riparian area to south of unit.		No not include riparian area to south of unit.
Soils			
Special Habitats	50 ft. no-havest buffer on wet and mesic meadows		50 ft. no-harvest buffer on wet and mesic meadows
Logging Operation			
Alternatives	**2**		**3**
Access Roads			
Construction			
Reconstruction			
Maintenance			
Closures	Close roads		Close roads
Designated Skid Roads	Utilize existing spur roads as much as possible. Avoid placement of skid roads through special habitat areas described in general information section above.		Utilize existing spur roads as much as possible. Avoid placement of skid roads through special habitat areas described in general information section above.
Equipment Staging	Avoid equipment staging in special habitat areas described in general information section above.		Avoid equipment staging in special habitat areas described in general information section above.
Landings	Avoid placement of landings in special habitat areas described in general information section above.		Avoid placement of landings in special habitat areas described in general information section above.
Falling	Directionally fall away from special habitat areas described in general information section above.		Directionally fall away from special habitat areas described in general information section above.
Skyline Corridors	Avoid placement of skyline corridors through special habitat areas described in general information section above.		Avoid placement of skyline corridors through special habitat areas described in general information section above.
Suspension Requirements	North half is ground and south half is partial suspension. Retain 50-70% of duff.		North half is ground and south half is partial suspension. Retain 50-70% of duff.
Yarding	Ground-based - 14 acres Skyline - 2 acres		Ground-based - 14 acres Skyline - 2 acres
Yard tops/whole trees			
Hauling			
Seasonal Restrictions	Spotted owls March 1 - July 15.		Spotted owls March 1 - July 15.
Post Logging			
Alternatives	**2**		**3**
Botany			
Fuels	Grapple pile in ground-based yarding area. Burn landings and piles.		Grapple pile in ground-based yarding area. Burn landings and piles.
Fisheries			
Heritage			
Hydrology			
Silviculture			
Soils	Subsoil to reduce existing compaction to try to get near S & G of 20%.		Subsoil to reduce existing compaction to try to get near S & G of 20%.
Transportation			
Wildlife	Create snags and down wood.		Create snags and down wood.
Monitoring			

Sale Name : Middle Santiam Thin	Unit Number 43	Reforestation Number 170b	
General Stand Information			
Vegis Number	3001668	**Photo Number**	1997 - 126
Location	T 13 S, R 6 E, Sec. 17	**Subdrainage**	Upper Middle Santiam
Plant Association	ABAM/MANE2	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope		**Elevation**	3500
Aspect	SW	**Stand Year of Origin**	1964
Average Stand Height		**Ave. Stand Diameter**	
Other Info.			
Stand History	Clearcut and broadcast burned.		
Stand Health			
Alternative	**2**		**3**
Unit Size	3 acres		3 acres
Volume	60 CCF		60 CCF
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew.		Thin to 50% canopy closure. 90 TPA. Suggested DxD spacing = about 16 ft Leave all cedar, pine, hardwoods and yew.
Riparian Harvest Rx	No harvest in primary shade zones. Thin outside of primaryshade zones with same Rx as uplands.		No harvest in primary shade zones. Thin outside of primary shade zones with same Rx as uplands.
Wildlife Rx	Leave 5 TPA for snags and down wood.		Leave 5 TPA for snags and down wood.
Unit Layout and Marking			
Alternatives	**2**		**3**
Marking			
Layout			
Botany			
Hydrology	50 ft no-havest buffer on stream in northern-most portion of unit		50 ft no-harvest buffer on stream in northern-most portion of unit.
Soils			
Logging Operation			
Alternatives	**2**		**3**
Access Roads	Will need access to road on private land. Road access should be in the share cost area.		Will need access to road on private land. Road access should be in share cost area.
Construction			
Reconstruction			
Maintenance			
Closures			
Landings			
Falling			
Suspension Requirements	Ground. Retain 30-50% of duff.		Ground. Retain 30-50% of duff.
Yarding	Ground-based - 3 acres. Can get a temporary land use agreement and log from the north or fall to the road and drag them to the road or could winch them. Get a land use agreement for the road and could also get agreement to use a landing and yard through their timber. NE portion of the unit is a little steep but will do ground-based here too.		Ground-based - 3 acres. Can get a temporary land use agreement and log from the north or fall to the road and drag them to the road or could winch them. Get a land use agreement for the road and could also get agreement to use a landing and yard through thei timber. NE portion of the unit is a little steep but will do ground-based here too.
Yard tops/whole trees			
Hauling			
Seasonal Restrictions	Spotted owls March 1 - July 15.		Spotted owls March 1- July 15.
Post Logging			
Alternatives	**2**		**3**
Botany			
Fuels	Burn landings.		Burn landings.
Fisheries			
Heritage			
Hydrology			
Silviculture			
Soils	Subsoil to reduce existing compaction to try to get near S & G of 20%.		Subsoil to reduce existing compaction to try to get near S & G of 20%.
Transportation			
Wildlife	Create snags and down wood.		Create snags and down wood.
Monitoring			

Sale Name : Middle Santiam Thin	Unit Number 44	Reforestation Number 180 and 180a	
General Stand Information			
Vegis Number	3001668	**Photo Number**	1997 - 126
Location	T 13 S, R 6 E, Sec. 8	**Subdrainage**	Upper Middle Santiam
Plant Association	TSHE/RHMA3/MANE2	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope	30%	**Elevation**	3500
Aspect		**Stand Year of Origin**	1960
Average Stand Height	80-85'	**Ave. Stand Diameter**	8-14"
Other Info.	Mostly Douglas-fir with some western hemlock. Miinor amount of western redcedar.		
Special Habitats	Doug says there is a rocky area with brush in the unit interior on the north side and a wetland in the interior south end.		
Stand History	Clearcut and broadcast burned.		
Stand Health			
Alternative	**2**	**3**	
Unit Size	36 acres	11 acres	
Volume	720 CCF	110 CCF	
Upland Harvest Rx	Thin to 50% canopy. About 90 TPA. Suggested DxD = about 16 ft. Leave all cedar, pine, hardwoods and yew.	Thin to 50% canopy closure. About 90 TPA. Suggested DxD = about 16 ft. Leave all cedar, pine, hardwoods and yew.	
Riparian Harvest Rx	No harvest in primary shade zone. Thin Rx outside primary shade zone same as upland Rx	No harvest in primary shade zone. Thin Rx outside primary shade zone same as upland Rx	
Wildlife Rx	Leave 5 TPA for snags and down wood.	Leave 5 TPA for snags and down wood.	
Unit Layout and Marking			
Alternatives	**2**	**3**	
Marking			
Layout			
Botany	PSRA (2 sites) leave 100 ft. no-harvest buffer on SW side of unit.	PSRA (2 sites) leave 100 ft. no-harvest buffer on SW side of unit.	
Hydrology	Two intermittent streams in unit. Stream extends farther into unit than map shows.	Two intermittent streams in unit. Stream extends farther into unit than map shows.	
Soils			
Logging Operation			
Alternatives	**2**	**3**	
Access Roads			
Construction			
Reconstruction			
Maintenance			
Closures			
Landings	Helicopter landing is in this unit. One existing landings for this unit is in the Riparian Reserve.	One existing landings for this unit is in the Riparian Reserve.	
Falling			
Suspension Requirements	Partial, some ground at south boundary. Retain 50-70% of duff.	Partial, some ground at south boundary. Retain 50-70% of duff.	
Yarding	Ground-based - 4 acres Skyline - 7 acres Helicopter - 25 acres	Ground-based - 4 acres Skyline - 7 acres Helicopter - 25 acres	
Yard tops/whole trees			
Hauling			
Seasonal Restrictions	Spotted owls March 1 - July 15.	Spotted owls March 1 - July 15.	
Other Restrictions	Do not use road 643 past landing in SE-most portion of unit.	Do not use road 643 past landing in SE-most portion of unit.	
Post Logging			
Alternatives	**2**	**3**	
Botany			
Fuels	Burn landings.	Burn landings.	
Fisheries			
Heritage			
Hydrology			
Silviculture	Subsoil to reduce existing compaction to try to get near S & G of 20%.	Subsoil to reduce existing compaction to try to get near S & G of 20%.	
Soils			
Transportation			
Wildlife	Create snags and down wood.	Create snags and down wood.	
Monitoring			

Sale Name : Middle Santiam Thin	Unit Number 46	Reforestation Number 106 and 138	
General Stand Information			
Vegis Number	3002095	**Photo Number**	
Location	T 13 S, R 5 E, Sec. 24	**Subdrainage**	Upper Middle Santiam
Plant Association	ABAM/MANE2 ABAM/RHMA3/XETE	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope		**Elevation**	
Aspect		**Stand Year of Origin**	1954
Average Stand Height		**Ave. Stand Diameter**	
Other Considerations			
Special Habitats	Multiple rock outcrops; cave		
Stand History	Clearcut and broadcast burned.		
Stand Health			
Alternative	**2**		**3**
Unit Size	76 acres		76 acres
Volume	1520 CCF		1520 CCF
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew.		Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew.
Riparian Harvest Rx	No harvest in primary shade zone. Thin outside of primary shade zone same as upland Rx.		No harvest in primary shade zone. Thin outside of primary shade zone same as upland Rx.
Soils Rx.	Approximately 0.2 acres will be cleared for expansion of rock pit adjacent to road 2049.		Approximately 0.2 acres will be cleared for expansion of rock pit adjacent to road 2049.
Wildlife Rx	Leave 5 TPA for snags and down wood.		Leave 5 TPA for snags and down wood.
Unit Layout and Marking			
Alternatives	**2**		**3**
Marking			
Layout			
Botany	100 ft. no-havest buffer on multiple sites of LERI in creek and 100 ft. no-harvest buffer on one site of PEPA.		100 ft. no-havest buffer on multiple sites of LERI in creek and 100 ft. no-harvest buffer on one site of PEPA.
Hydrology	There may be a stream along the NE boundary. 100 ft. no-harvest buffer on Middle Santiam River in area that will be winched.		There may be a stream along the NE boundary. 100 ft. no-harvest buffer on Middle Santiam River in area that will be winched.
Soils			
Wildlife	250 ft. no-harvest buffer around cave. Leave 2.1 trees per acre for snags and down wood.		250 ft. no-harvest buffer around cave. Leave 2.1 trees per acre for snags and down wood.
Logging Operation			
Alternatives	**2**		**3**
Access Roads			
Construction			
Reconstruction			
Maintenance			
Closures			
Equipment Staging	Avoid equipment staging in special habitat areas described in general information section above.		Avoid equipment staging in special habitat areas described in general information section above.
Landings	Avoid placement of landings in special habitat areas described in general information section above.		Avoid placement of landings in special habitat areas described in general information section above.
Falling	Directionally fall away from special habitat areas described in general information section above.		Directionally fall away from special habitat areas described in general information section above.
Skyline Corridors	Avoid placement of skyline corridors through special habitat areas described in general information section above.		Avoid placement of skyline corridors through special habitat areas described in general information section above.
Suspension Requirements	Partial, some ground at SE boundary. Retain 5-70% duff.		Partial, some ground at SE boundary. Retain 5-70% duff.
Yarding	Skyline - 76 acres		Skyline - 76 acres
Yard tops			
Hauling			
Seasonal Restrictions	Seaonal restriction spotted owl nesting period March 1- July 15. Dry weather haul on native surface roads.		Seaonal restriction spotted owl nesting period March 1- July 15. Dry weather haul on native surface roads.
Post Logging			
Alternatives	**2**		**3**
Botany			
Fuels	Grapple pile along roadside. Burn landings and piles.		Grapple pile along roadside. Burn landings and piles.
Fisheries			
Heritage			
Hydrology			
Silviculture			
Soils			
Transportation			
Wildlife	Create snags and down wood		Create snags and down wood
Monitoring			

Sale Name : Middle Santiam Thin	Unit Number 47	Reforestation Number 107	
General Stand Information			
Vegis Number	3002004	**Photo Number**	
Location	T 13 S, R 5 E, Sec. 24	**Subdrainage**	Upper Middle Santiam
Plant Association	ABAM/RHMA3-VAAL/COCA13	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope		**Elevation**	3300
Aspect		**Stand Year of Origin**	1955
Average Stand Height		**Ave. Stand Diameter**	
Other Considerations			
Special Habitats	Wetland along southwestern boundary.		
Stand History	Clearcut and broadcast burned.		
Stand Health			
Alternative	**2**		**3**
Unit Size	58 acres		58 acres
Volume	560 CCF		560 CCF
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew.		Thin to 50% canopy closure. 90 TPA. Suggested DxD spacing = about 16 ft Leave all cedar, pine, hardwoods and yew.
Riparian Harvest Rx	No harvest in primary shade zone. Thin Rx in secondary shade zone same as upland Rx.		No harvest in primary shade zone. Thin Rx in secondary shade zone same as upland Rx.
Wildlife Rx	Leave 5 TPA for snags and down wood.		Leave 5 TPA for snags and down wood.
Unit Layout and Marking			
Alternatives	**2**		**3**
Marking			
Layout			
Botany	100 ft. no-harvest buffer on one site of each of the following: PEPA, PSMA and PSRA.		100 ft. no-harvest buffer on one site of each of the following: PEPA, PSMA and PSRA.
Hydrology	50 ft. no harvest buffer on stream to north. Mark trees contributing to streambank stability within 25 ft. of stream just north of temporary road.		50 ft. no harvest buffer on stream to north. Mark trees contributing to streambank stability within 25 ft. of stream just north of temporary road.
Soils			
Logging Operation			
Alternatives	**2**		**3**
Access Roads			
Construction	175 feet of new temporary logger's spur road. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.		175 feet of new temporary logger's spur road. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.
Reconstruction			
Maintenance			
Closures			
Landings			
Falling			
Suspension Requirements	Partial, some areas of ground along road. Retain 40-60% of duff.		Partial, some areas of ground along road. Retain 40-60% of duff.
Yarding	Ground-based - 3 acres Skyline - 25 acres		Ground-based - 3 acres Skyline - 25 acres
Yard tops			
Hauling			
Seasonal Restrictions	Spotted owls March 1 - July 15. Dry weather haul on native surface roads.		Spotted owls March 1 - July 15. Dry weather haul on native surface roads.
Post Logging			
Alternatives	**2**		**3**
Botany			
Fuels	Grapple pile along roadside. Burn landings and piles.		Grapple pile long roadside. Burn landings and piles.
Fisheries			
Heritage			
Hydrology			
Silviculture			
Soils			
Transportation			
Wildlife	Create snags and down wood.		Create snags and down wood.
Monitoring			

Sale Name : Middle Santiam Thin	Unit Number 48	Reforestation Number 108	
General Stand Information			
Vegis Number	3001831	**Photo Number**	
Location	T 13 S, R6 E, Sec. 18	**Subdrainage**	Upper Middle Santiam
Plant Association	ABAM/RHMA3-VAAL/COCA13	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope		**Elevation**	
Aspect		**Stand Year of Origin**	1951
Average Stand Height		**Ave. Stand Diameter**	
Other Considerations			
Special Habitats	Wetland		
Stand History	Clearcut and broadcast burned.		
Stand Health			
Alternative	**2**		**3**
Unit Size	58 acres		58 acres
Volume	1160 CCF		1160 CCF
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew.		Thin to 50% canopy closure. 90 TPA. Suggested DxD spacing = about 16 ft Leave all cedar, pine, hardwoods and yew.
Riparian Harvest Rx	No harvest in primary shade zone. Thin outside of primary shade zone same as upland Rx except no gaps in Riparian Reserve.		No harvest in primary shade zone. Thin outside of primary shade zone same as upland Rx except no gaps in Riparian Reserve.
Wildlife rx	Leave 5 TPA for snags and down wood.		Leave 5 TPA for snags and down wood.
Unit Layout and Marking			
Alternatives	**2**		**3**
Marking			
Layout			
Botany			
Hydrology	50 ft. no harvest buffer on stream and wet area.		50 ft. no harvest buffer on stream and wet area.
Soils			
Special Habitats	50 ft. no-harvest buffer on wetland.		50 ft. no-harvest buffer on wetland.
Logging Operation			
Alternatives	**2**		**3**
Access Roads	Do no open road that comes off of private land in the northern portion of this unit.		Do no open road that comes off of private land in the northern portion of this unit.
Construction	Construct 300 ft. of new temporary loggers spur road. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.		Construct 300 ft. of new temporary loggers spur road. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.
Reconstruction			
Maintenance			
Closures			
Designated Skid Roads	Avoid placement of skid roads through special habitat areas described in general information section above.		Avoid placement of skid roads through special habitat areas described in general information section above.
Equipment Staging	Avoid equipment staging in special habitat areas described in general information section above. Do not stage on road 2049 or do any ground-disturning activities here.		Avoid equipment staging in special habitat areas described in general information section above. No staging or ground-disturning activities on/along road 2049.
Landings	Avoid placement of landings in special habitat areas described in general information section above.		Avoid placement of landings in special habitat areas described in general information section above.
Falling	Directionally fall away from special habitat areas described in general information section above.		Directionally fall away from special habitat areas described in general information section above.
Skyline Corridors	Avoid placement of skyline corridors through special habitat areas described in general information section above.		Avoid placement of skyline corridors through special habitat areas described in general information section above.
Suspension Requirements	Partial and ground depending on side slope. Retain 40-60% of duff.		Partial and ground depending on side slope. Retain 40-60% of duff.
Yarding	Ground-based - 22 acres Skyline - 36 acres		Ground-based - 22 acres Skyline - 36 acres
Yard tops	Yard tops attached in skyline yarding area.		Yard tops attached in skyline yarding area.
Hauling			
Seasonal Restrictions	Spotted owls March 1 - July 15. Dry weather haul on native surface roads.		Spotted owls March 1 - July 15. Dry weather haul on native surface roads.
Post Logging			
Alternatives	**2**		**3**
Botany			
Fuels	Grapple pile in ground-based yarding area and along roadside. Yard tops in skyline yarding area. Burn landings and piles.		Grapple pile in ground-based yarding area and along roadside. Yard tops in skyline yarding area. Burn landings and piles.
Fisheries			
Heritage			
Hydrology			
Silviculture			
Soils			
Transportation			
Wildlife	Create snags and down wood.		Create snags and down wood.
Monitoring			

Sale Name : Middle Santiam Thin	Unit Number 49	Reforestation Number 109	
General Stand Information			
Vegis Number	3001871	**Photo Number**	
Location	T 13 S, R6 E, Sec. 18	**Subdrainage**	Upper Middle Santiam
Plant Association	TSHE/RHMA3/MANE2	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope		**Elevation**	3200 ft.
Aspect		**Stand Year of Origin**	1955
Average Stand Height		**Ave. Stand Diameter**	
Other Considerations			
Special Habitats	Three wetlands		
Stand History	Clearcut and broadcast burned.		
Stand Health			

Alternative	**2**	**3**
Unit Size	49 acres	43 acres
Volume	980 CCF	860 CCF
Upland Harvest Rx	Thin to 60% canopy closure. About 110 TPA. Suggested DxD = about 14 ft. Leave openings on about 10% of the thinned upland areas (DTR's). Leave all cedar, pine, hardwoods and yew.	Thin to 60% canopy closure. About 110 TPA. Suggested DxD = about 14 ft. Leave openings on about 10% of the thinned upland areas (DTRs). Leave all cedar, pine, hardwoods and yew.
Riparian Harvest Rx	No harvest in primary shade zone. Thin Rx in secondary shade zone same as upland Rx except no DTR's in riparian reserve.	No harvest in primary shade zone. Thin Rx in secondary shade zone same as upland Rx except no DTR's in riparian reserve.
Wildlife Rx	Leave 5 TPA for snags and down wood.	Leave 5 TPA for snags and down wood.

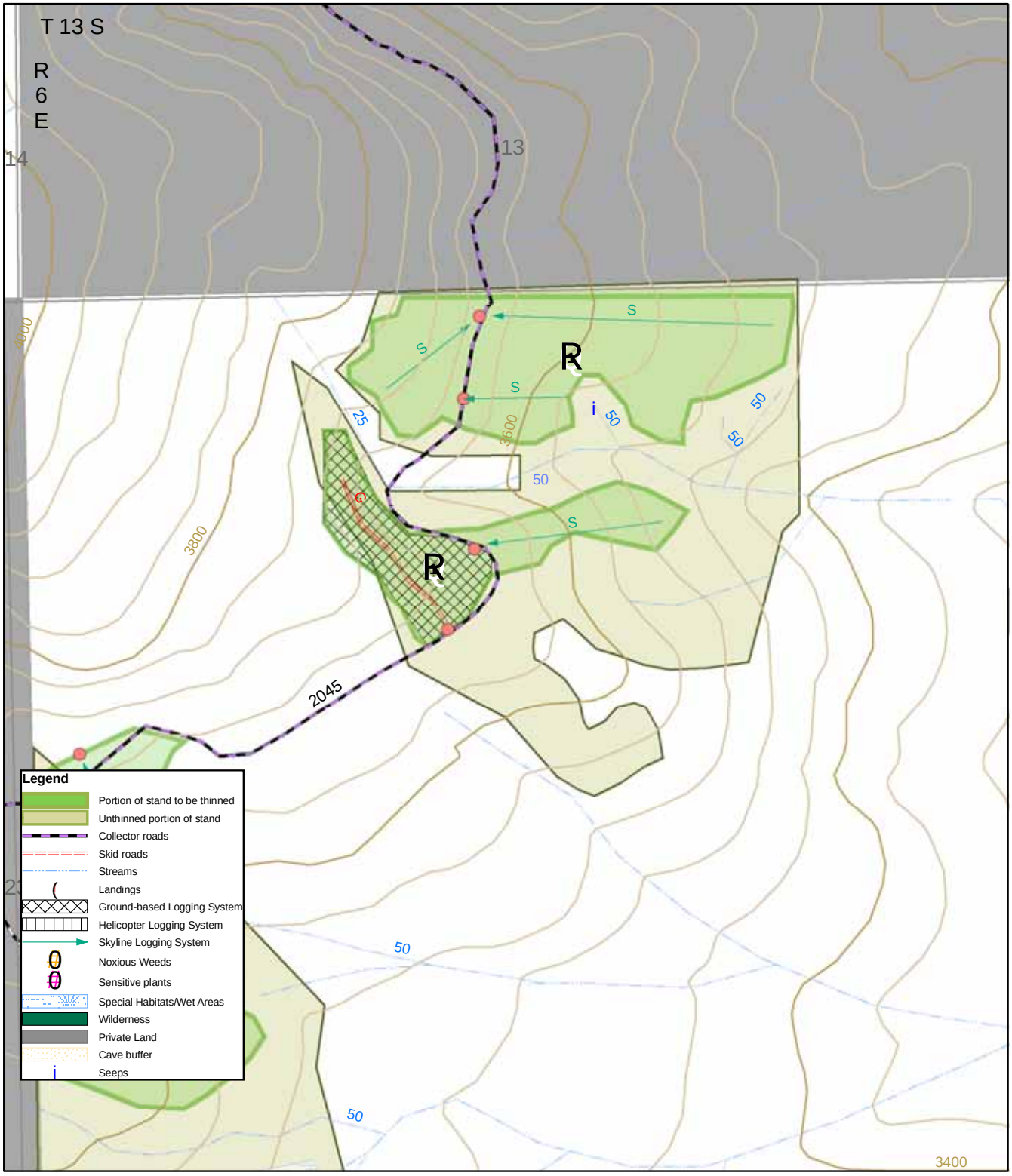
Unit Layout and Marking		
Alternatives	**2**	**3**
Marking		
Layout		
Botany	100 ft. no-harvest buffer on multiple sites of LERI in creek.	100 ft. no-harvest buffer on multiple sites of LERI in creek.
Hydrology	50 ft. no harvest buffer on perennial streams and wet areas. 25 ft. no-harvest on intermittent streams in eastern portion of unit.	50 ft. no harvest buffer on perennial streams and wet areas. 25 ft. no-harvest on intermittent streams in eastern portion of unit.
Soils		
Special Habitats	50 ft. no-harvest buffer on three wetlands.	50 ft. no-harvest buffer on wetlands.

Logging Operation		
Alternatives	**2**	**3**
Access Roads		
Construction	500 ft. of new temporary logger's spur road. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.	500 ft. of new temporary logger's spur road. At end of harvest activities, berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming seed due to vehicular traffic.
Reconstruction		
Maintenance		
Closures		
Equipment Staging	Avoid equipment staging in special habitat areas described in general information section above..	Avoid equipment staging in special habitat areas described in general information section above..
Landings	Helicopter landing is on the east side of this unit on road 2049. Do not use area by jct. of 525 road for landing or other ground disturbing activities. Avoid placement of landings in	Do not use area by jct. of 525 road for landing or other ground disturbing activities. Avoid placement of landings in special habitat areas described above.
Falling	Directionally fall away from special habitat areas described in general information section above..	Directionally fall away from special habitat areas described in general information section above..
Skyline Corridors	Avoid placement of skyline corridors through special habitat areas described in general information section above..	Avoid placement of skyline corridors through special habitat areas described in general information section above..
Suspension Requirements	Partial, small areas of ground along road. Retain 40-60% of duff.	Partial, small areas of ground along road. Retain 40-60% of duff.
Yarding	Skyline - 43 acres Helicopter - 6 acres	Skyline - 43 acres
Yard tops/whole trees		
Hauling		
Seasonal Restrictions	Spotted owl March 1 - July 15. Dry weather haul on native surface roads.	Spotted owl March 1 - July 15. Dry weather haul on native surface roads.

Post Logging			
Alternatives	**1**	**2**	**3**
Botany			
Fuels	Grapple pile along roadside. Burn landings and piles.		Grapple pile along roadside. Burn landings and piles.
Fisheries			
Heritage			
Hydrology			
Silviculture			
Soils			
Transportation			
Wildlife	Create snags and down wood.		Create snags and down wood.
Monitoring			

Sale Name : Middle Santiam Thin	Unit Number 52	Reforestation Number 452	
General Stand Information			
Vegis Number	3001296	**Photo Number**	
Location	T 12 S, R 5 E, Sec. 36	**Subdrainage**	Upper Middle Santiam
Plant Association	ABAM/MENE2	**Management Allocation(s)**	Matrix and Riparian Reserves
Average Slope		**Elevation**	
Aspect		**Stand Year of Origin**	1970
Average Stand Height		**Ave. Stand Diameter**	
Other Considerations			
Special Habitats	Talus patch		
Stand History	Clearcut and broadcast burned.		
Stand Health			
Alternative	**2**		**3**
Unit Size	38 acres		38 acres
Volume	760 CCF		760 CCF
Upland Harvest Rx	Thin to 50% Canopy Closure. 90 TPA. Suggested DxD spacing = about 16 feet. Leave all cedar, pine, hardwoods and yew.		Thin to 50% canopy closure. 90 TPA. Suggested DxD spacing = about 16 ft Leave all cedar, pine, hardwoods and yew.
Riparian Harvest Rx	No harvest in primary shade zone. Outside primary shade zone thin to same Rx as upland Rx		No harvest in primary shade zone. Outside primary shade zone thin to same Rx as upland Rx
Wildlife Rx	Leave 5 TPA for snags and down wood.		Leave 5 TPA for snags and down wood.
Unit Layout and Marking			
Alternatives	**2**		**3**
Marking			
Layout			
Botany	100 ft. no harvest buffer on three sites of PSRA on SW side of unit.		100 ft. no harvest buffer on three sites of PSRA on SW side of unit.
Hydrology	Stream extends farther into unit than map shows.		Stream extends farther into unit than map shows.
Soils	Rocky area at southwest boundary of stand - delete from unit.		Rocky area at southwest boundary of stand - delete from unit.
Logging Operation			
Alternatives	**2**		**3**
Access Roads			
Construction			
Reconstruction			
Maintenance			
Closures			
Designated Skid Roads	Avoid placement of skid roads through special habitats described in general information section above.		Avoid placement of skid roads through special habitats described in general information section above.
Equipment Staging	Avoid equipment staging in special habitats described in general information section above.		Avoid equipment staging in special habitats described in general information section above.
Landings	Avoid placement landings in special habitats described in general information section above.		Avoid placement landings in special habitats described in general information section above.
Falling	Directionally fall away from special habitats described in general information section above.		Directionally fall away from special habitats described in general information section above.
Skyline Corridors	Avoid placement of skyline corridors through special habitats described in general information section above.		Avoid placement of skyline corridors through special habitats described in general information section above.
Suspension Requirements	Partial, some areas of ground lead. Retain 40-60% of duff.		Partial, some areas of ground lead. Retain 40-60% of duff.
Yarding	Ground-based - 6 acres	Skyline - 32 acres	Ground-based - 6 acres Skyline - 32 acres
Yard tops/whole trees			
Hauling			
Seasonal Restrictions	Spotted owls March 1 - July 15.		Spotted owls March 1 - July 15.
Post Logging			
Alternatives	**2**		**3**
Botany			
Fuels	Grapple pile along roadside. Burn landings and piles.		Grapple pile along roadside. Burn landings and piles.
Fisheries			
Heritage			
Hydrology			
Silviculture			
Soils	Subsoil to reduce existing compaction to try to get near S & G of 20%.		Subsoil to reduce existing compaction to try to get near S & G of 20%.
Transportation			
Wildlife	Create snags and down wood.		Create snags and down wood.
Monitoring			

Middle Santiam Thin
Unit 1



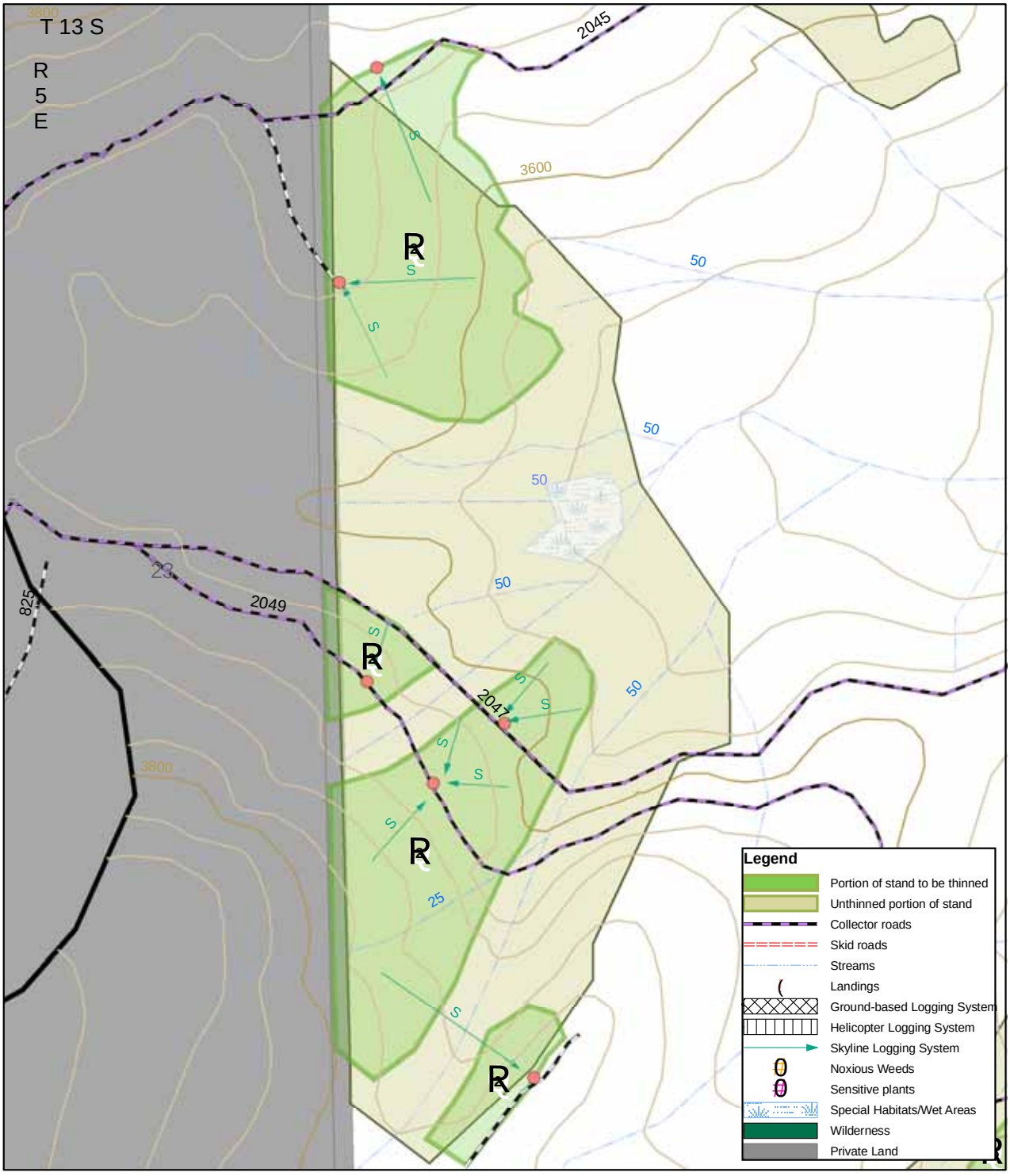
0 125 250 500 750 1,000 Feet

1 inch equals 330 feet

11 acres
skyline/ground

agl
11/06

Middle Santiam Thin
Unit 2



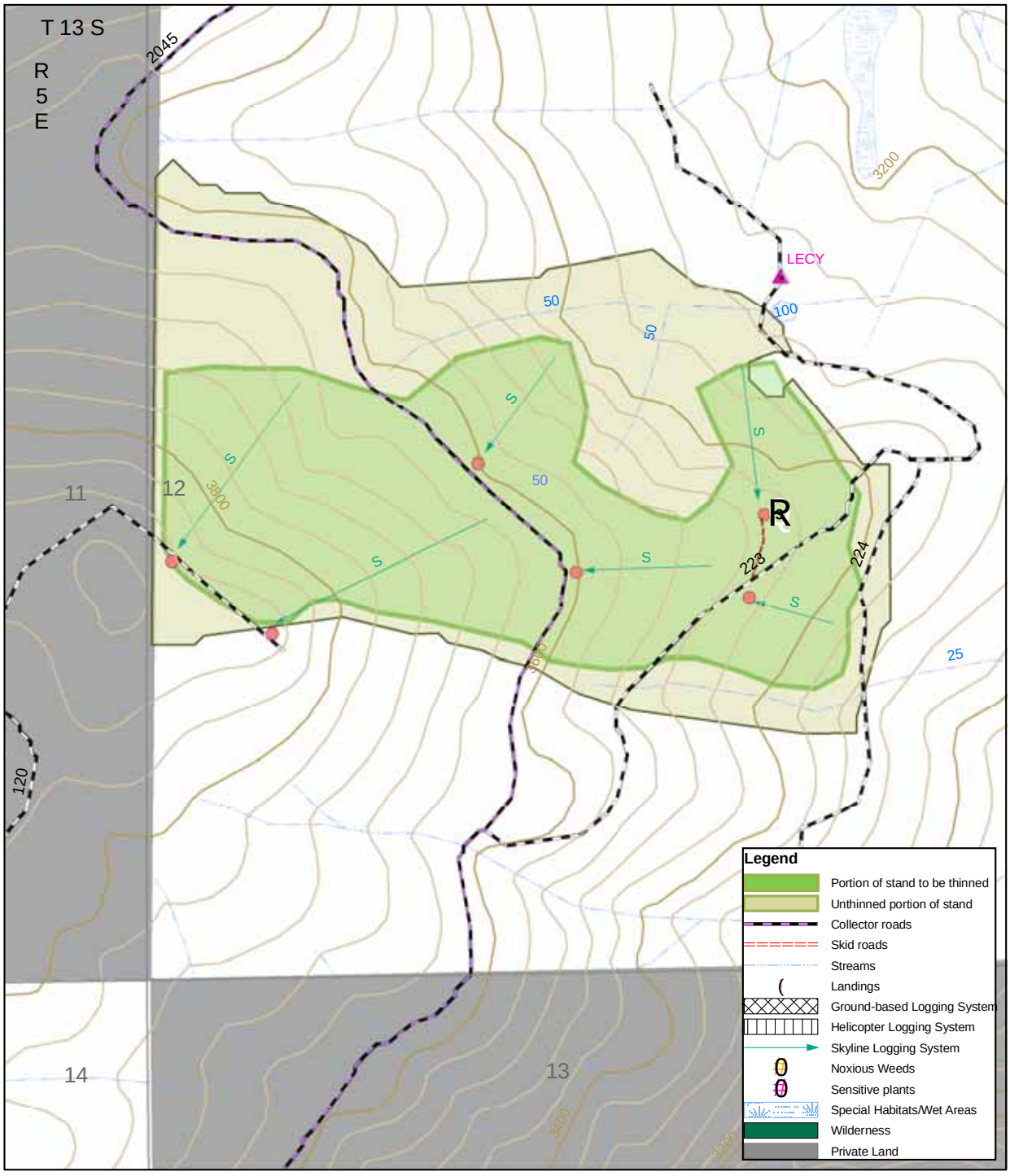
0 125 250 500 750 1,000 Feet

1 inch equals 330 feet

20 acres
skyline

agl
11/06

Middle Santiam Thin
Unit 3



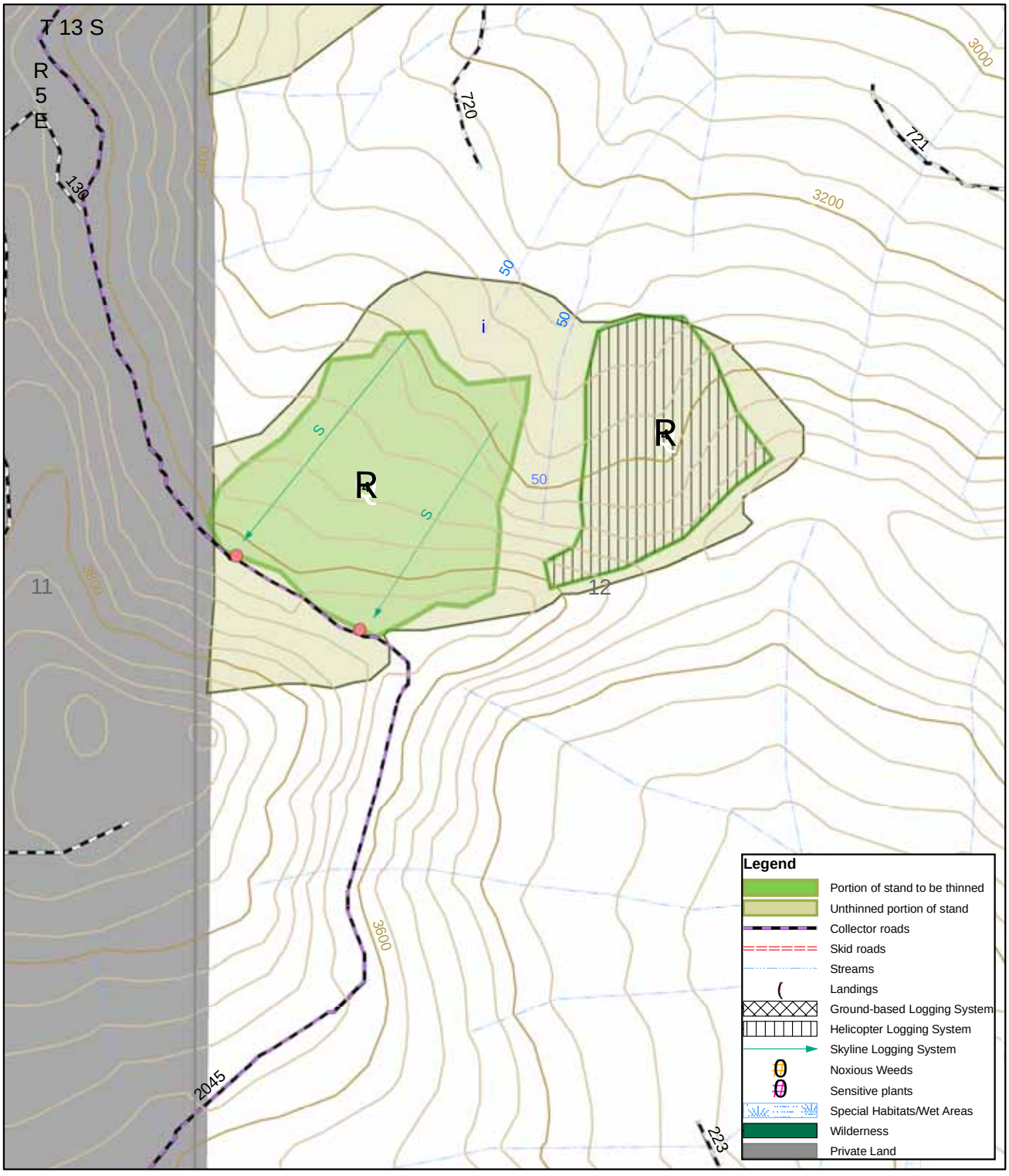
0 125 250 500 750 1,000 Feet

1 inch equals 330 feet

24acres
skyline

agl
11/06

Middle Santiam Thin
Unit 4



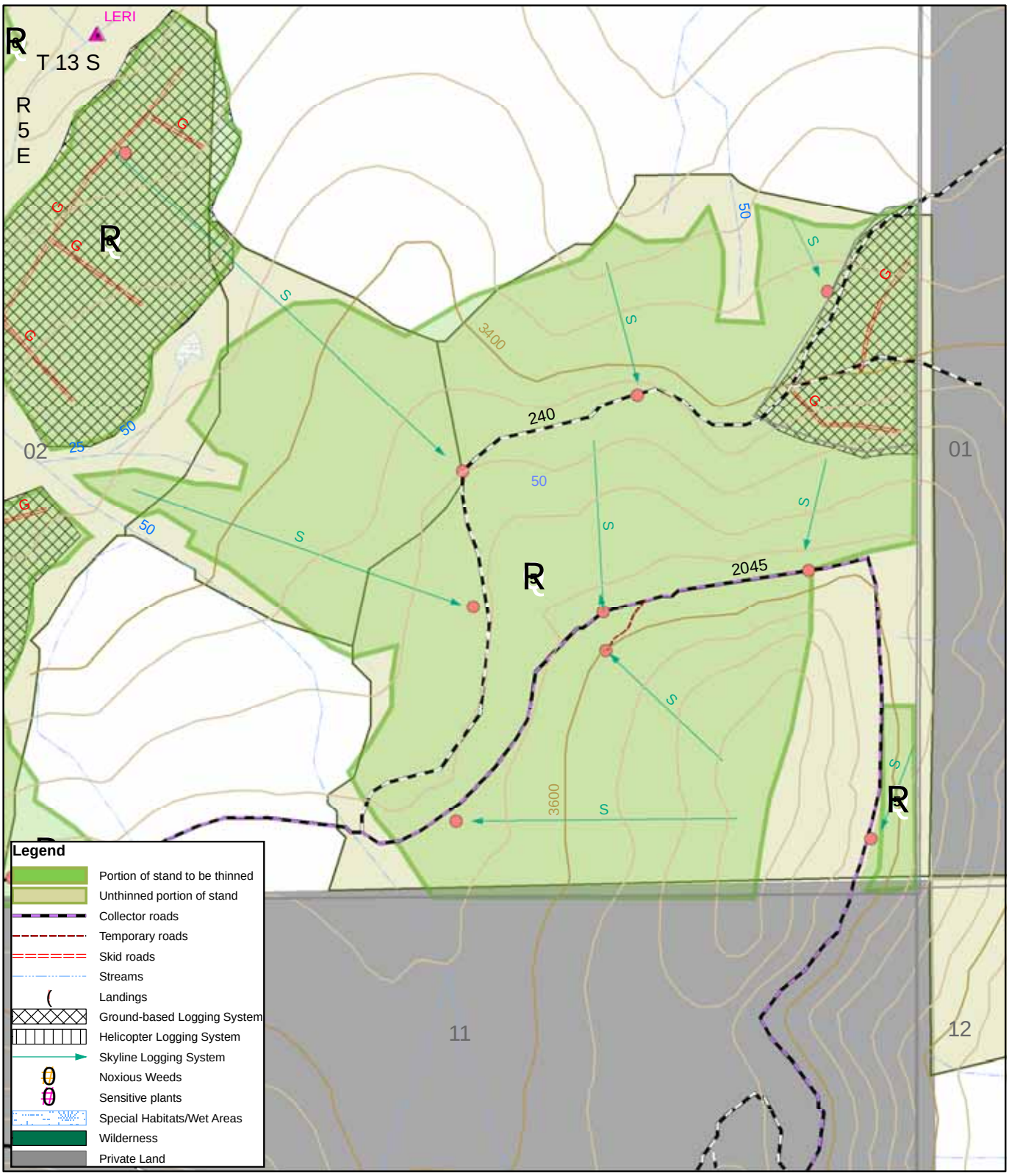
0 125 250 500 750 1,000 Feet

1 inch equals 330 feet

14 acres
skyline/helicopter

agl
11/06

Middle Santiam Thin
Unit 5



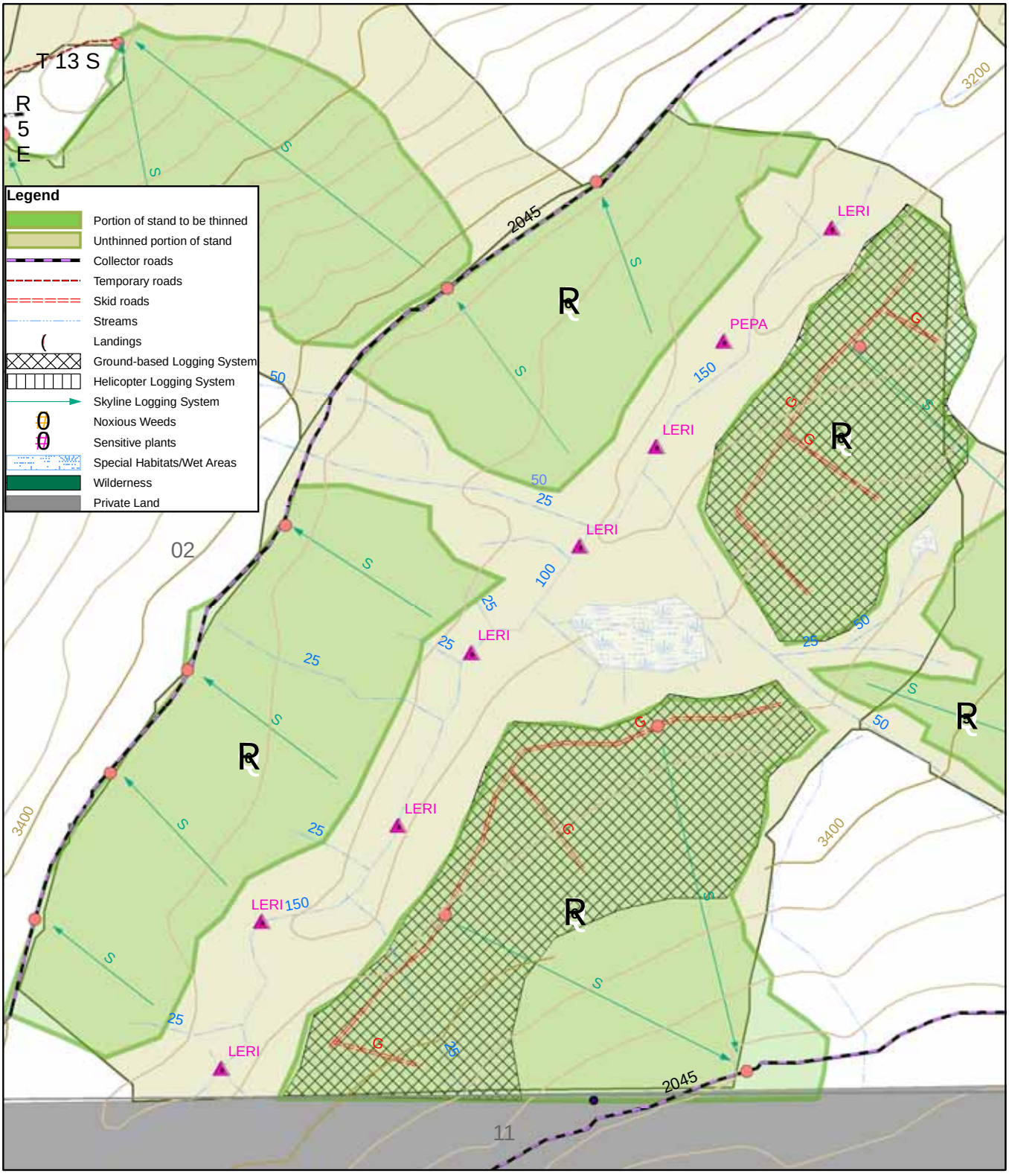
0 125 250 500 750 1,000 Feet

1 inch equals 330 feet

52 acres
skyline/ground

agl
11/06

Middle Santiam Thin
Unit 6



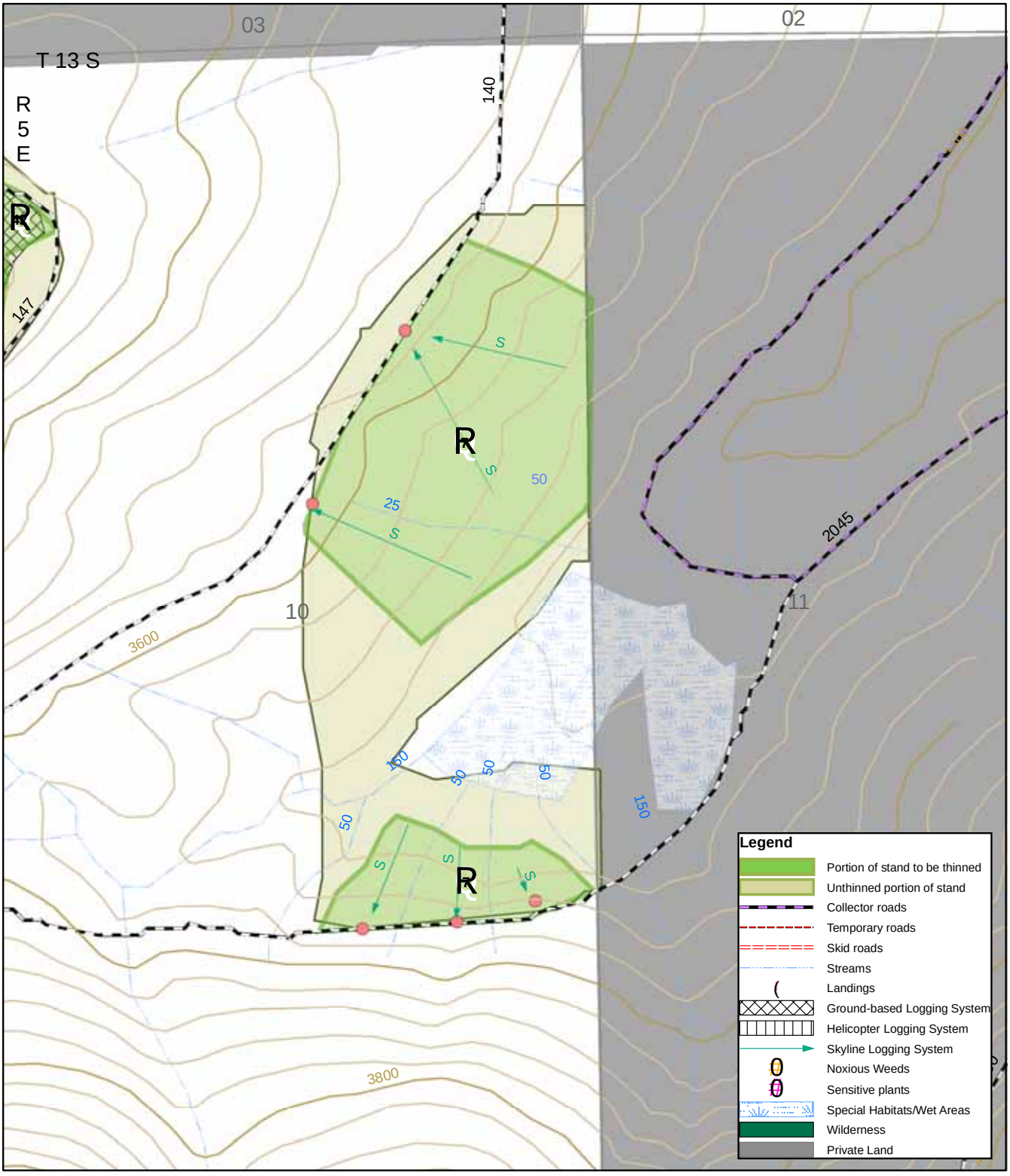
0 125 250 500 750 1,000 Feet

1 inch equals 330 feet

59 acres
skyline/ground

agl
11/06

Middle Santiam Thin
Unit 7



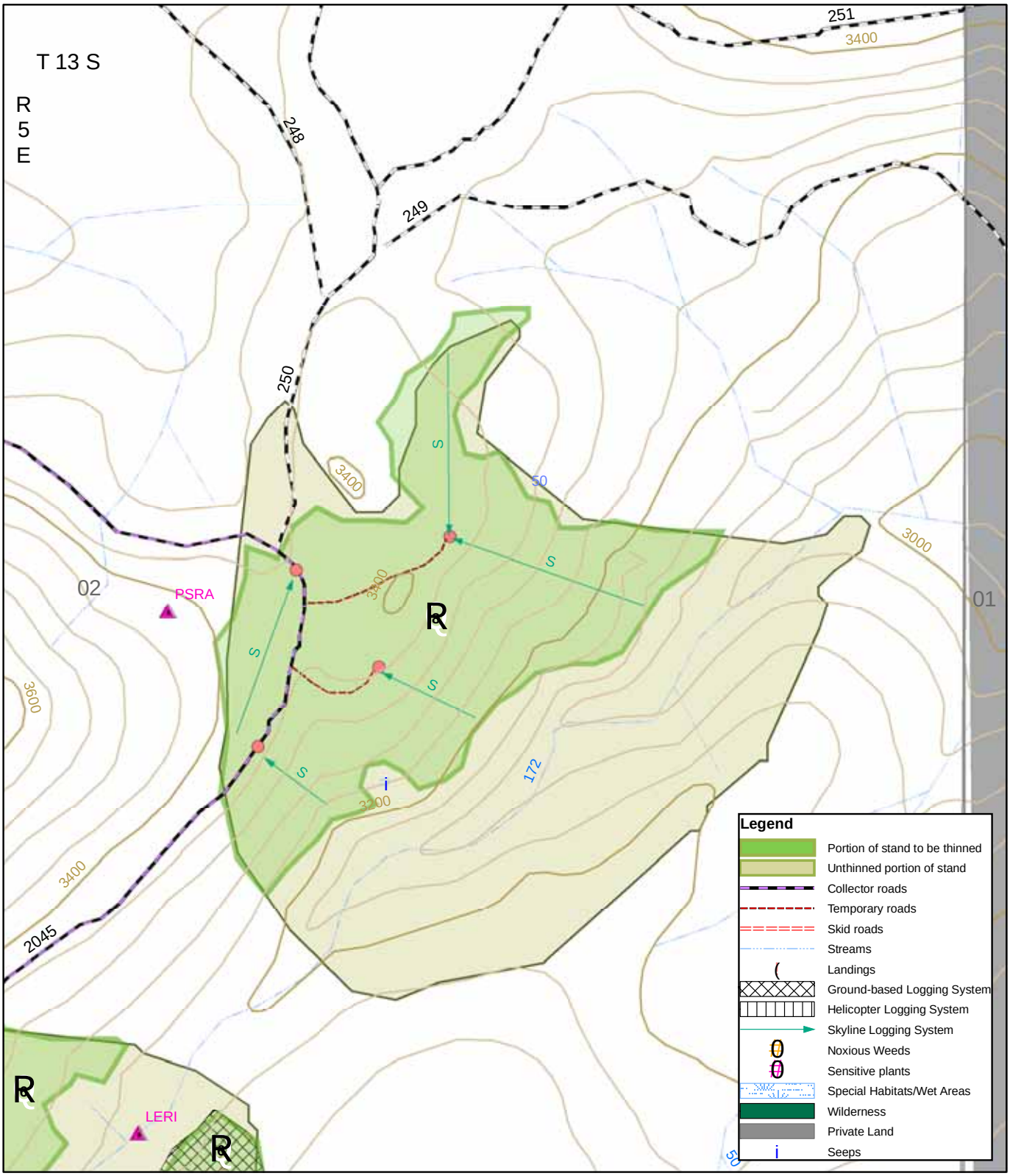
0 125 250 500 750 1,000 Feet

1 inch equals 330 feet

13 acres
skyline

agl
11/06

Middle Santiam Thin
Unit 8



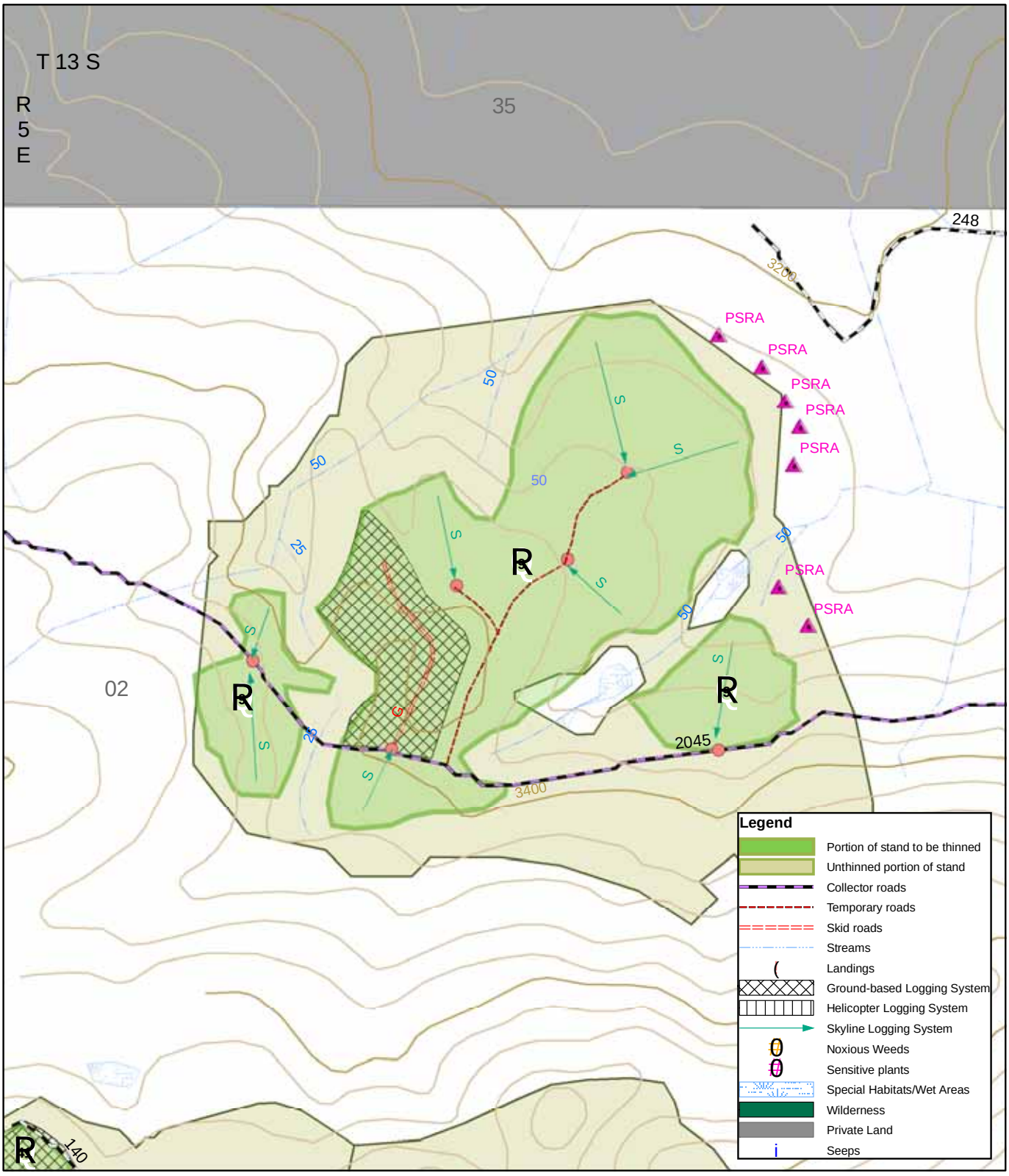
0 125 250 500 750 1,000 Feet

1 inch equals 330 feet

17 acres
skyline

agl
11/06

Middle Santiam Thin
Unit 9



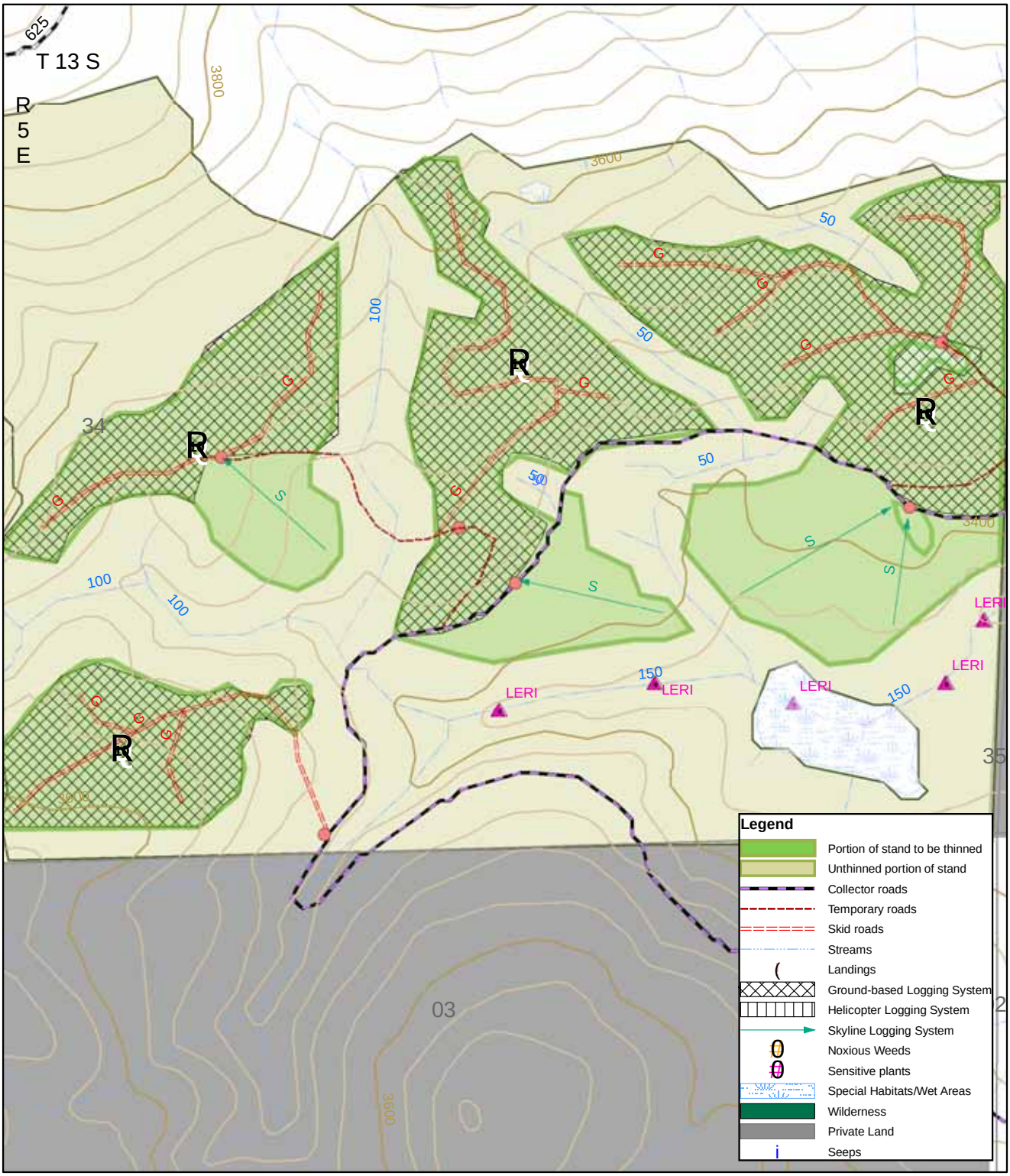
0 125 250 500 750 1,000 Feet

1 inch equals 330 feet

21 acres
skyline/ground

agl
11/06

Middle Santiam Thin
Unit 10



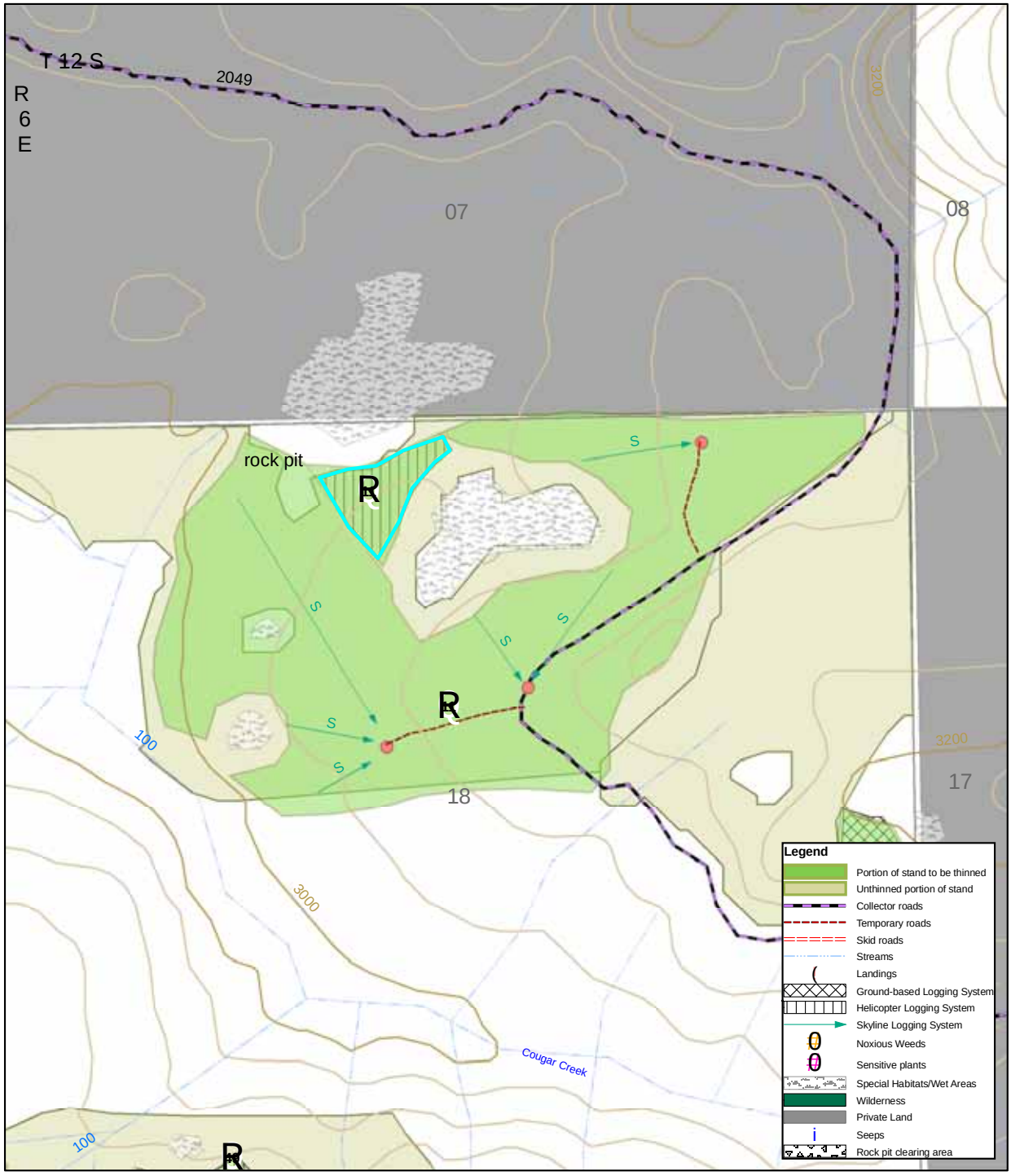
0 125 250 500 750 1,000 Feet

1 inch equals 330 feet

40 acres
skyline/ground

agl
11/06

Middle Santiam Thin
Unit 11



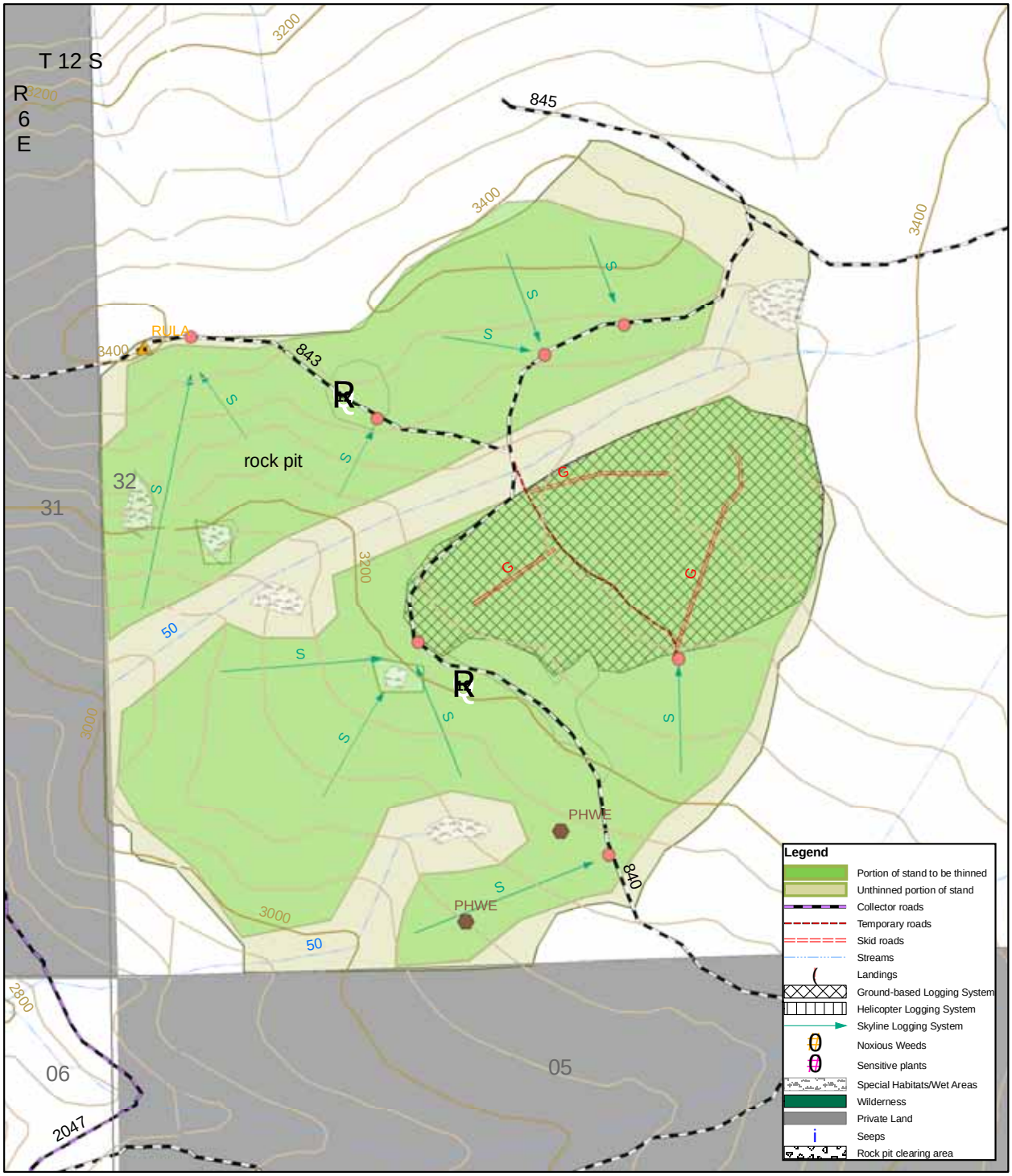
0 125 250 500 750 1,000 Feet

1 inch equals 330 feet

22 acres
skyline/helicopter

agl
11/06

Middle Santiam Thin
Unit 12



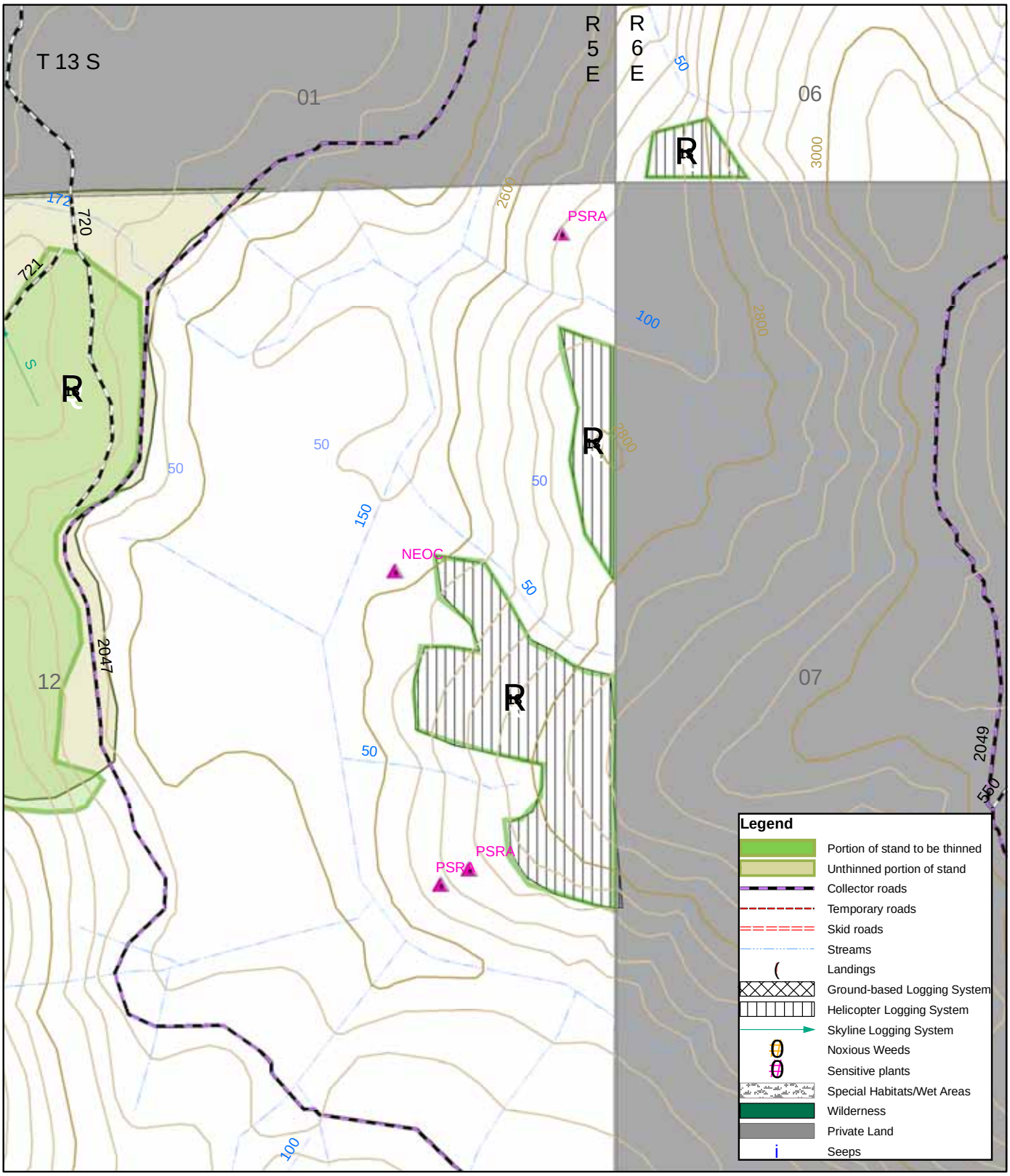
0 125 250 500 750 1,000 Feet

1 inch equals 330 feet

48 acres
skyline/ground

agl
11/06

Middle Santiam Thin
Unit 13



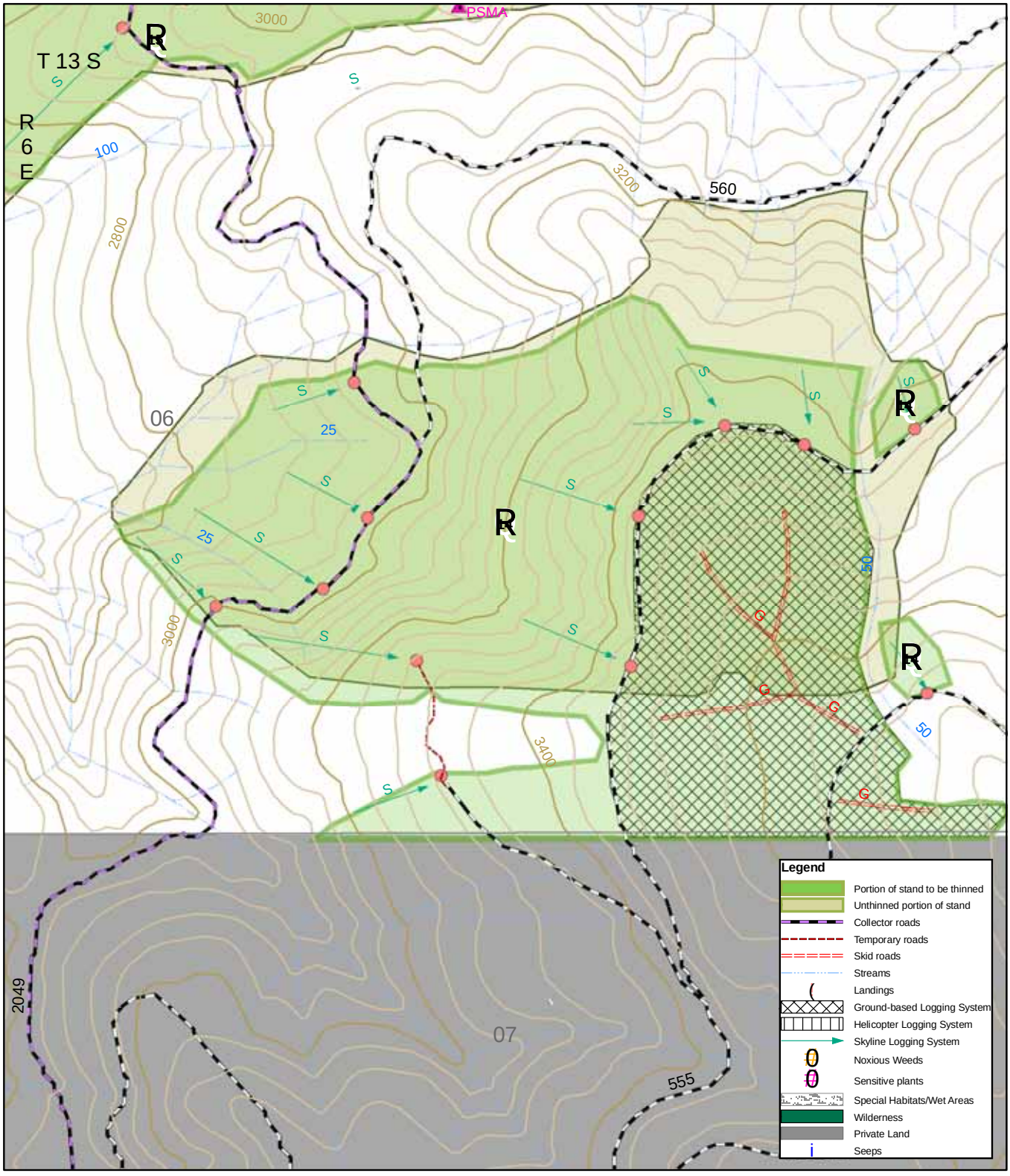
0 125 250 500 750 1,000 Feet

1 inch equals 330 feet

7 acres
helicopter

agl
11/06

Middle Santiam Thin
Unit 14



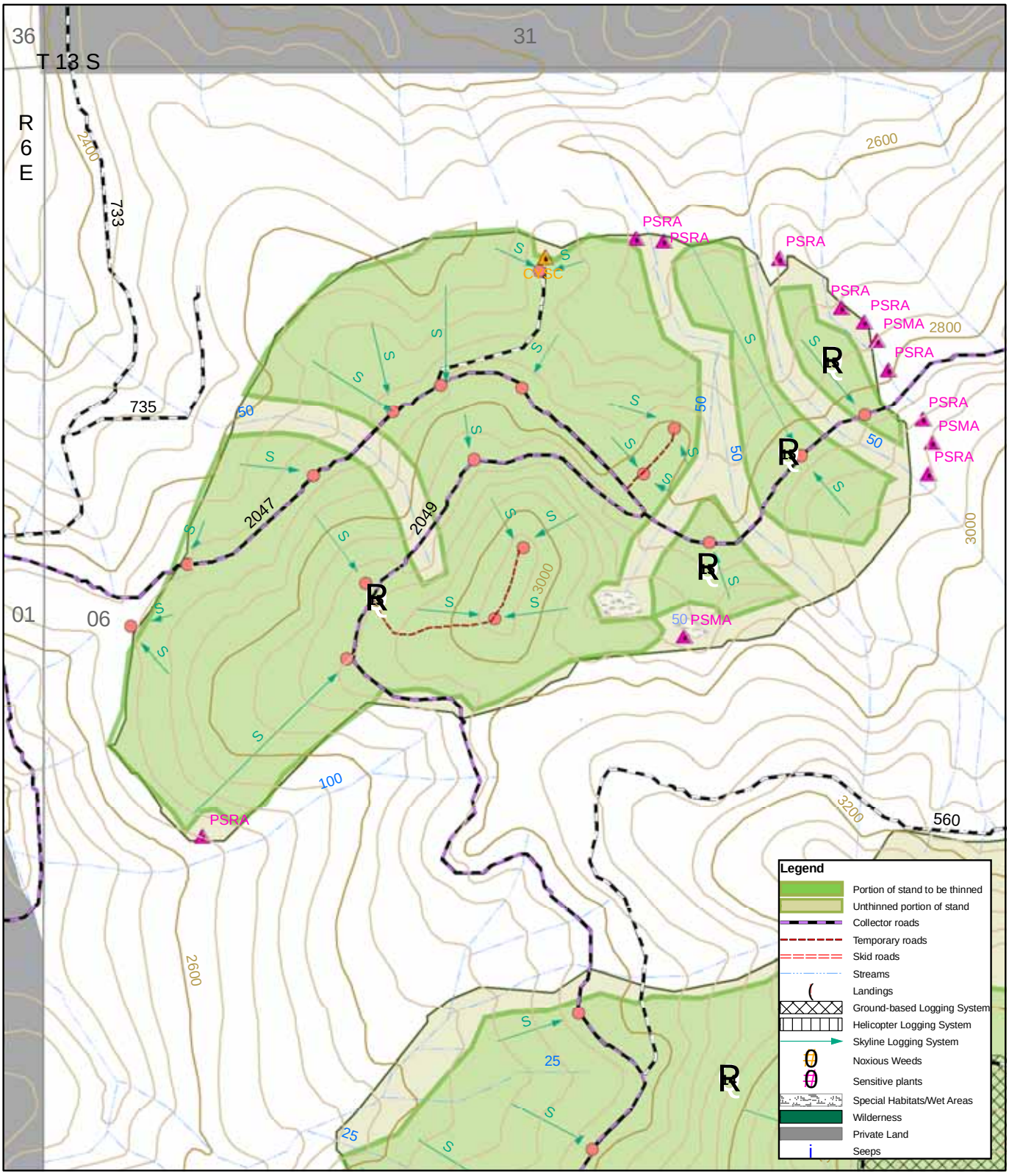
0 125 250 500 750 1,000 Feet

1 inch equals 500 feet

98 acres
skyline/ground

agl
11/06

Middle Santiam Thin
Unit 15



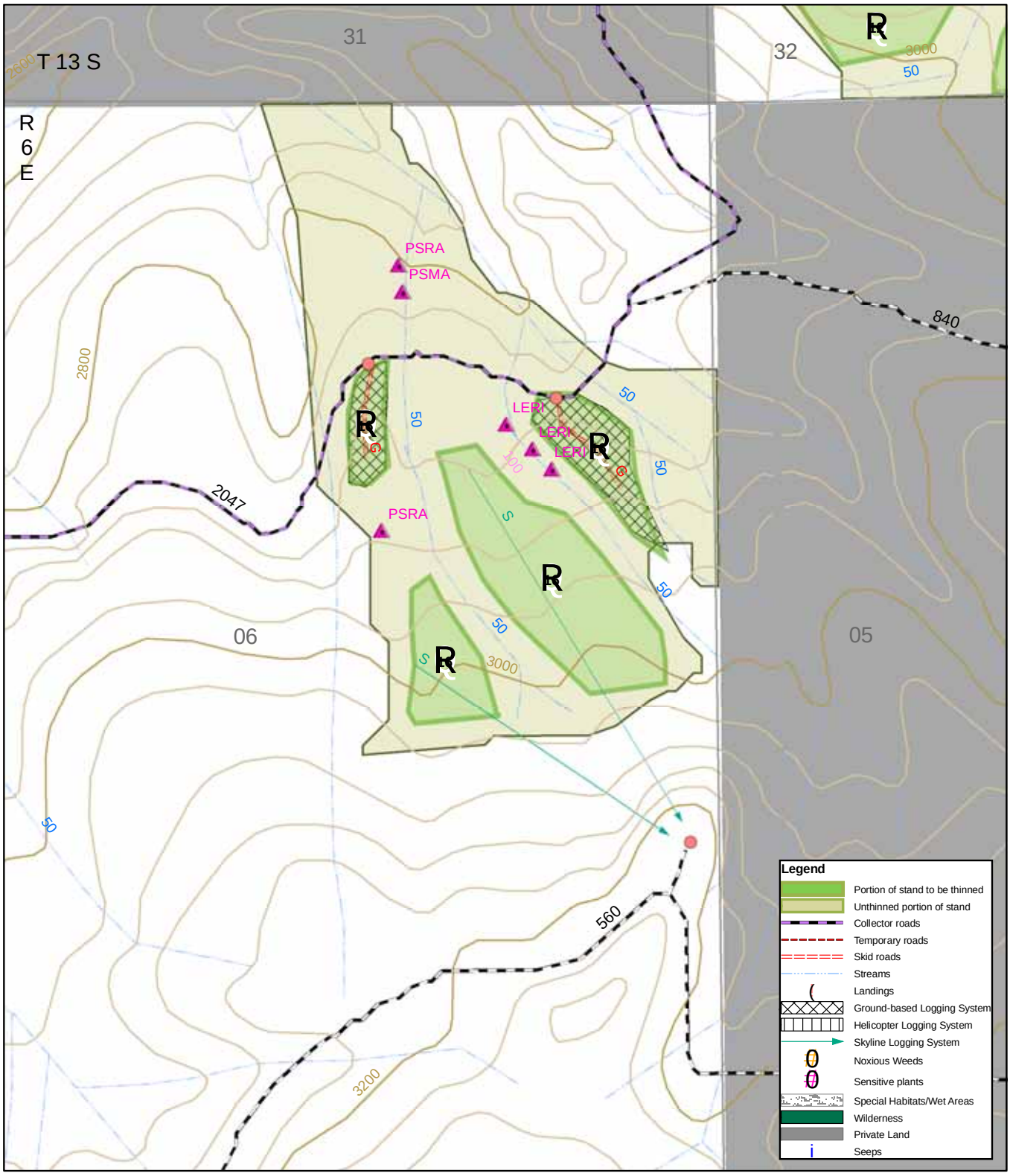
0 125 250 500 750 1,000 Feet

1 inch equals 500 feet

80 acres
skyline

agl
11/06

Middle Santiam Thin
Unit 16



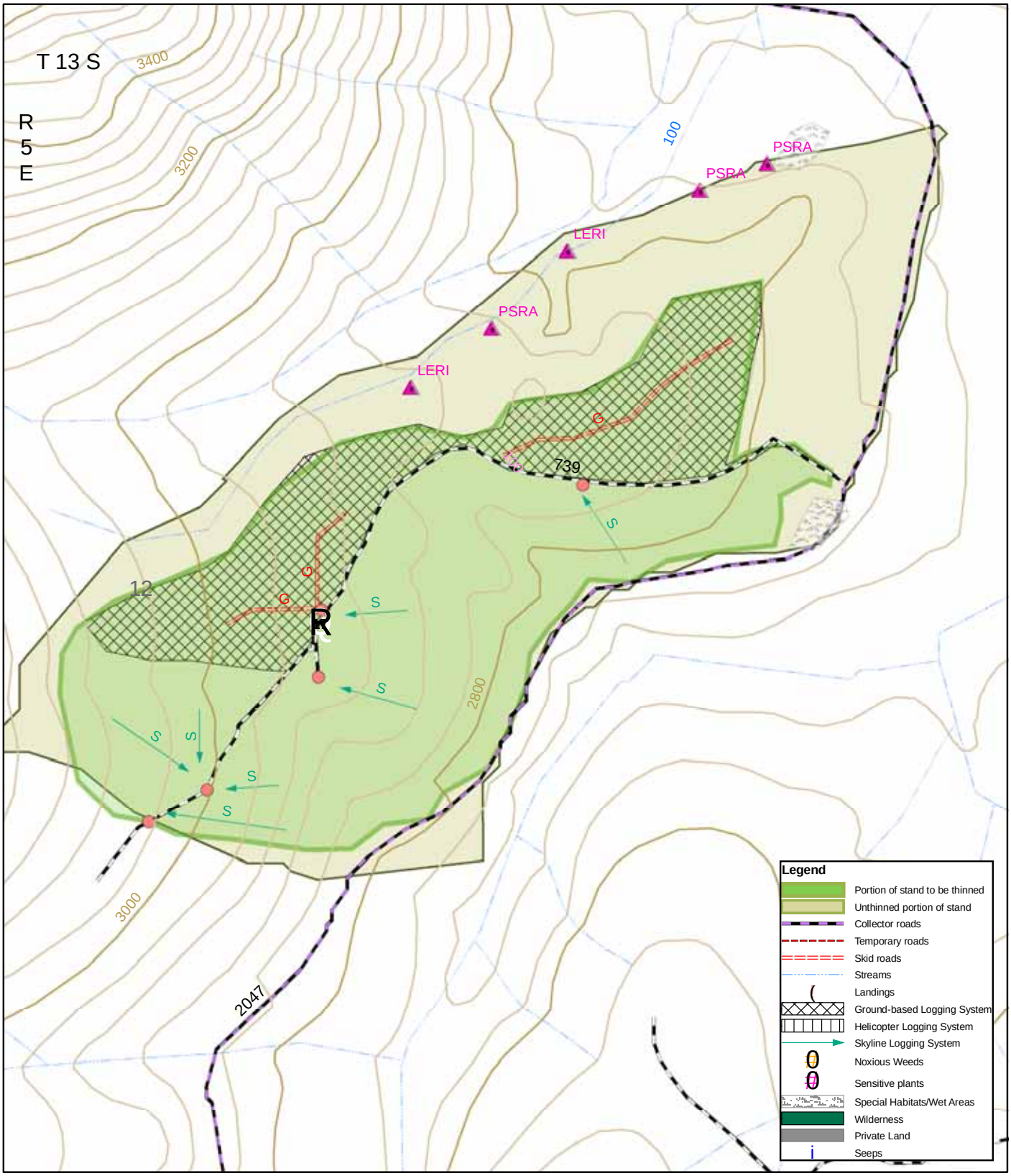
0 125 250 500 750 1,000 Feet

1 inch equals 330 feet

7 acres
skyline/ground

agl
11/06

Middle Santiam Thin
Unit 17



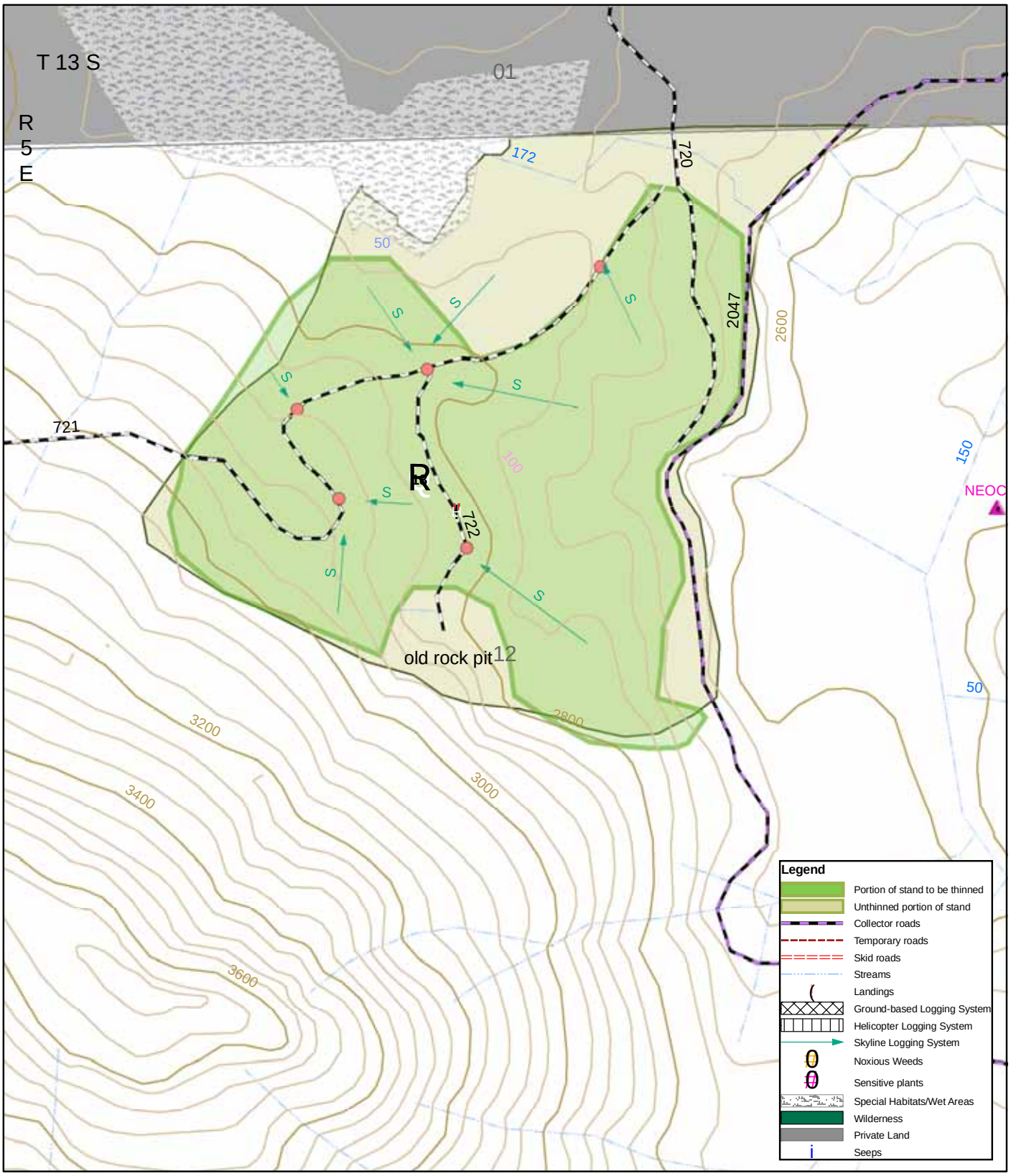
0 125 250 500 750 1,000 Feet

1 inch equals 330 feet

34 acres
skyline/ground

agl
11/06

Middle Santiam Thin
Unit 18



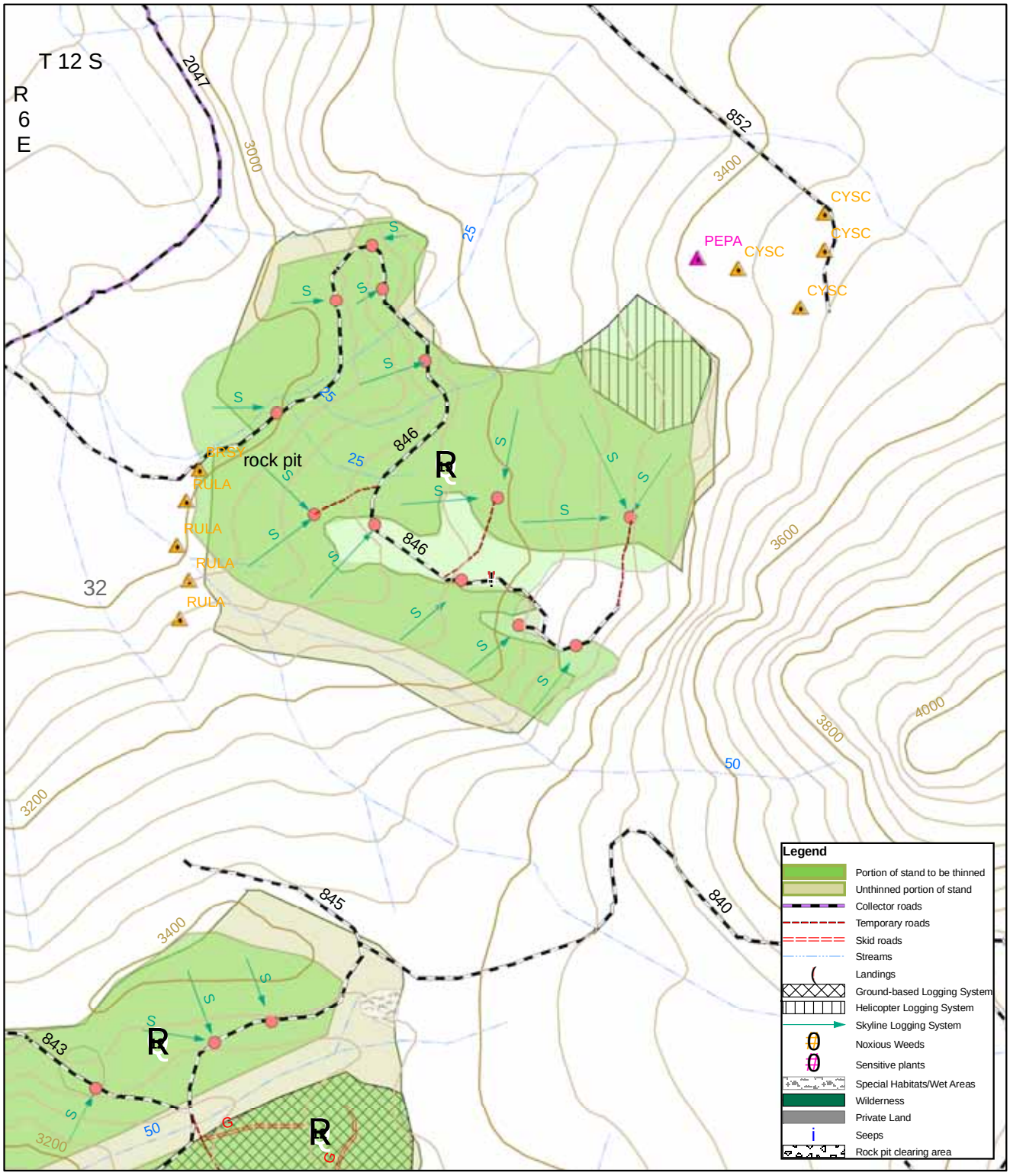
0 125 250 500 750 1,000 Feet

1 inch equals 330 feet

27 acres
skyline

agl
11/06

Middle Santiam Thin
Unit 19



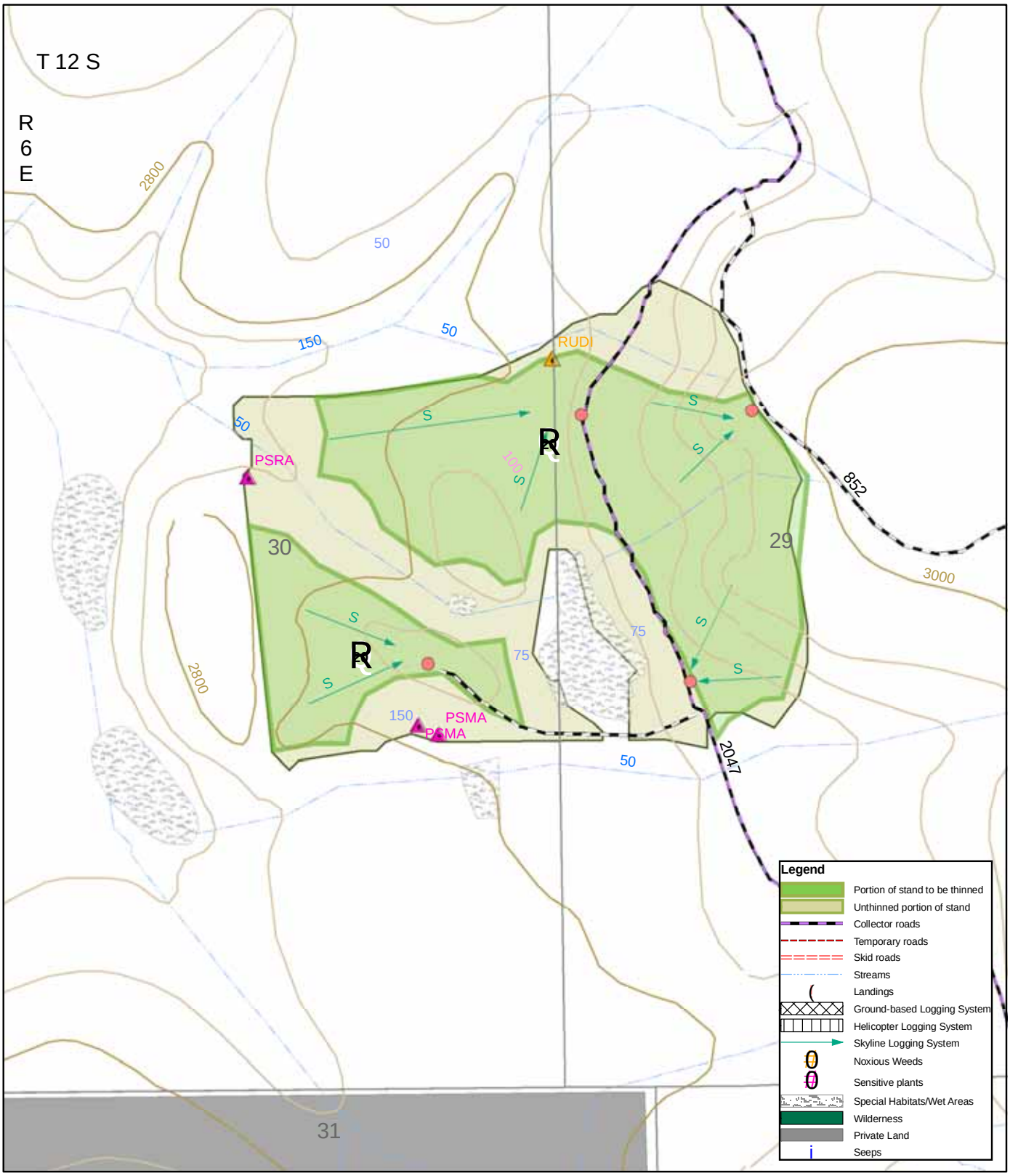
0 125 250 500 750 1,000 Feet

1 inch equals 463 feet

43 acres
skyline/helicopter

agl
11/06

Middle Santiam Thin
Unit 20



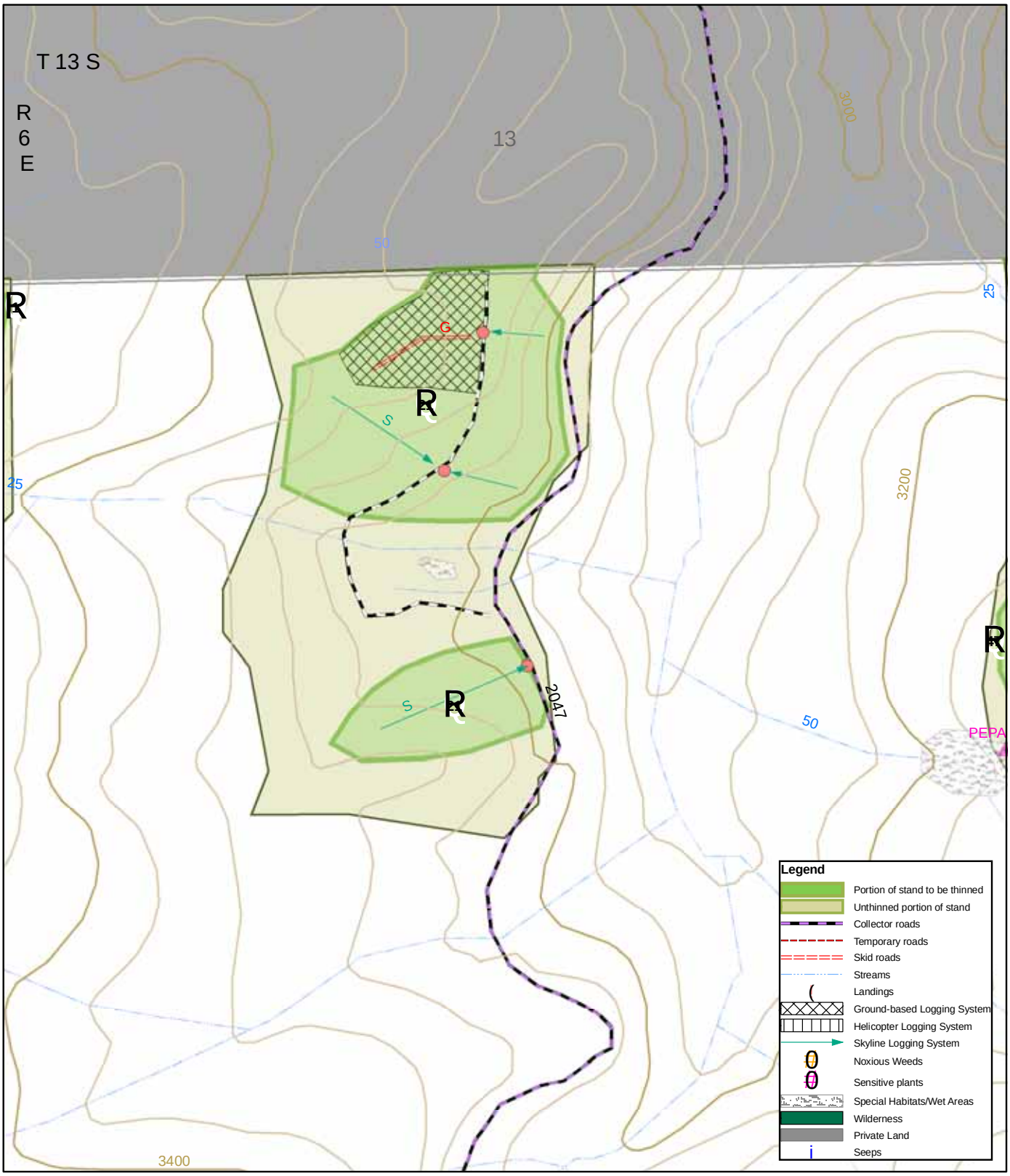
0 125 250 500 750 1,000 Feet

1 inch equals 330 feet

18 acres
skyline

agl
11/06

Middle Santiam Thin
Unit 21



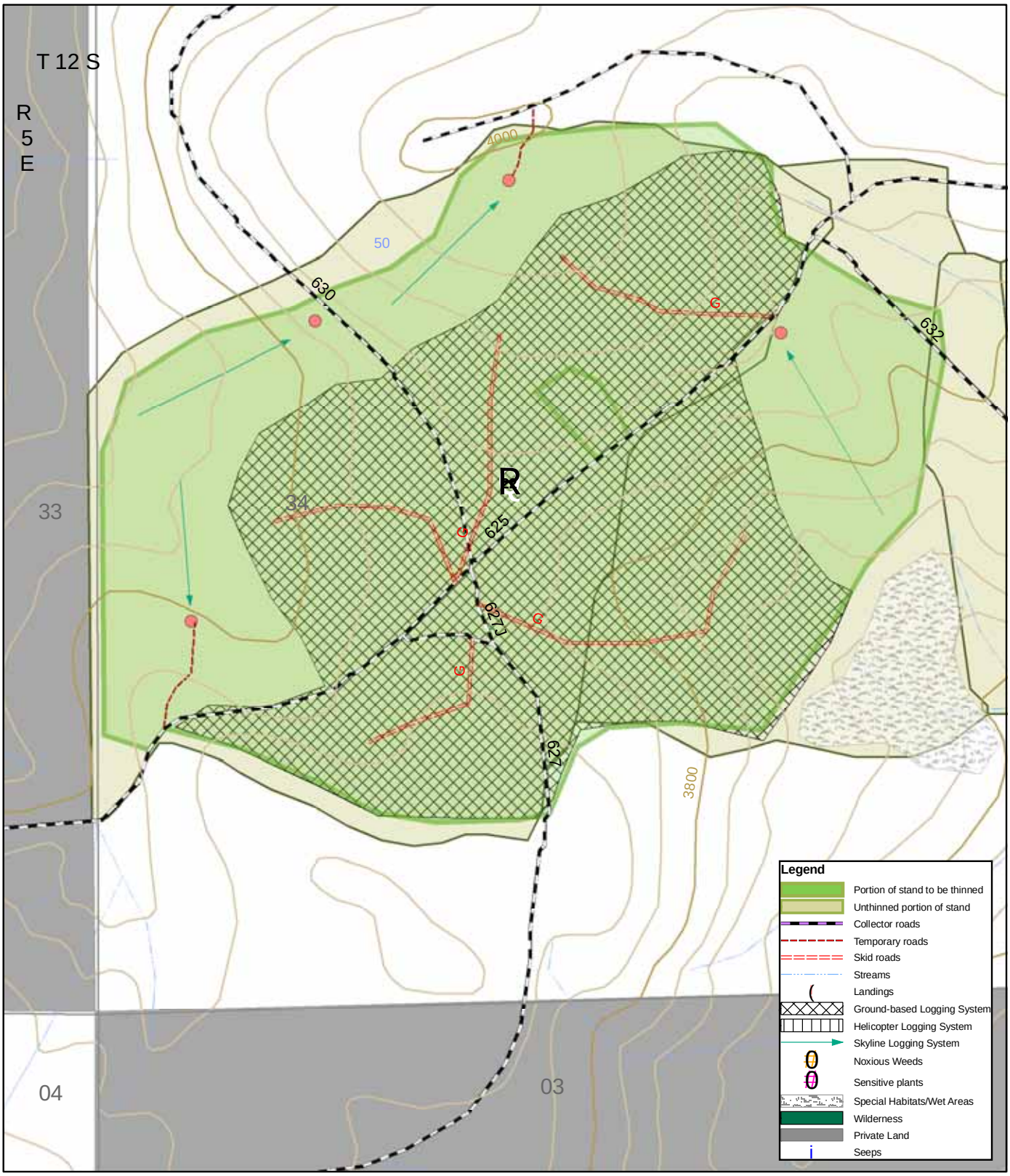
0 125 250 500 750 1,000 Feet

1 inch equals 330 feet

10 acres
skyline/ground

agl
11/06

Middle Santiam Thin
Unit 22



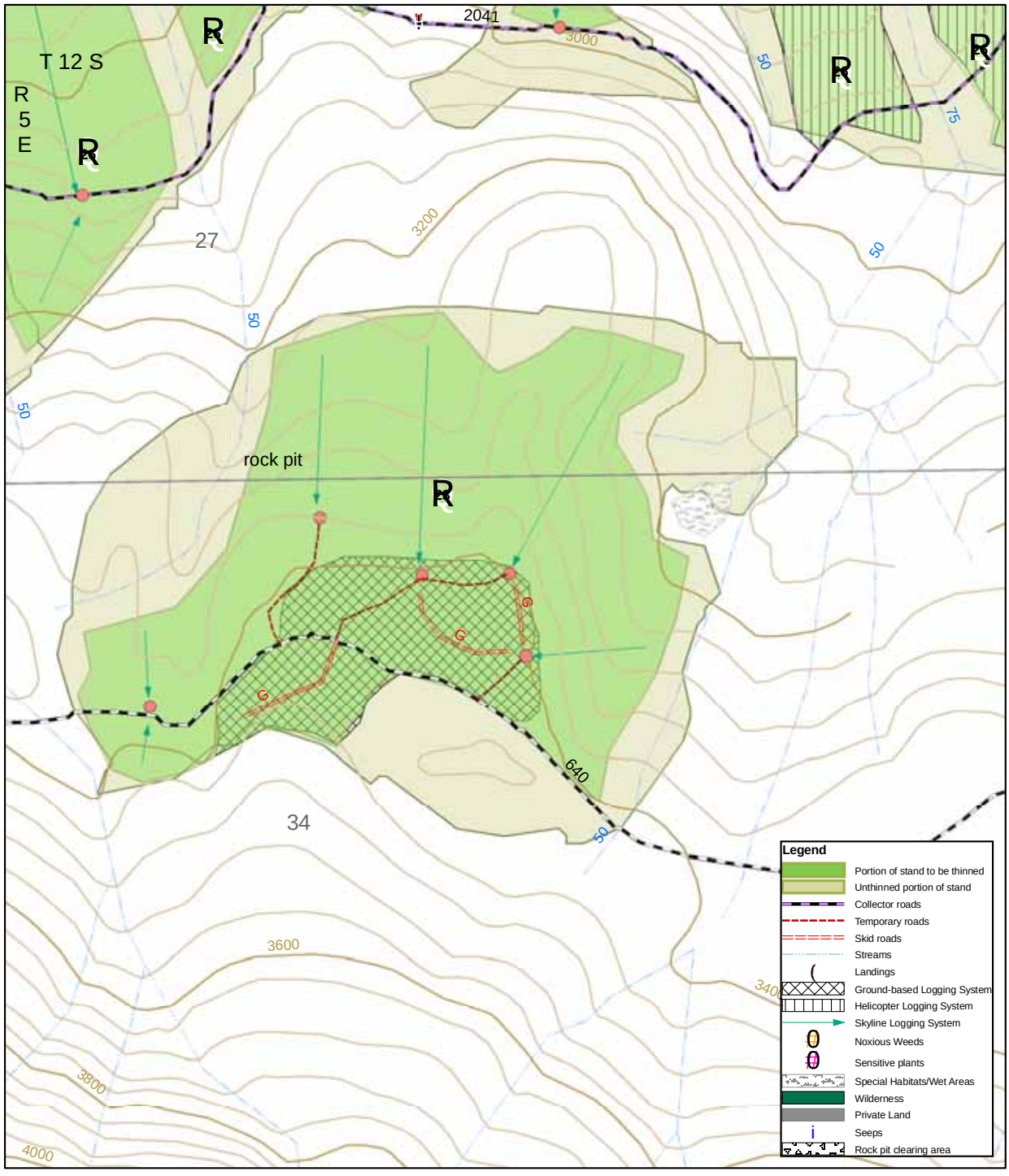
0 125 250 500 750 1,000 Feet

1 inch equals 330 feet

59 acres
skyline/ground

agl
11/06

Middle Santiam Thin
Unit 23



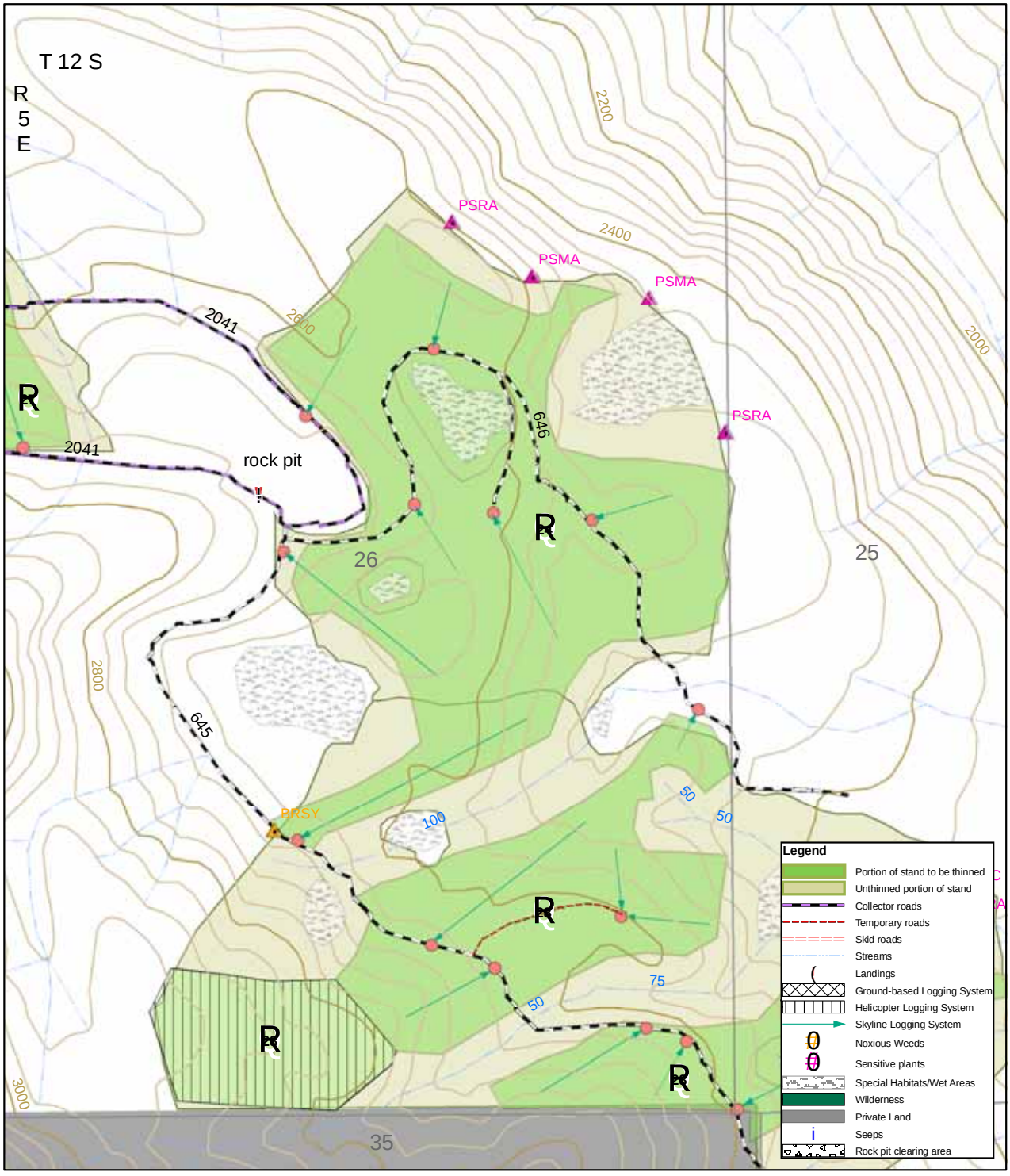
0 140 280 560 840 1,120 Feet

1 inch equals 367 feet

33 acres
skyline/ground

agl
11/06

Middle Santiam Thin
Unit 24



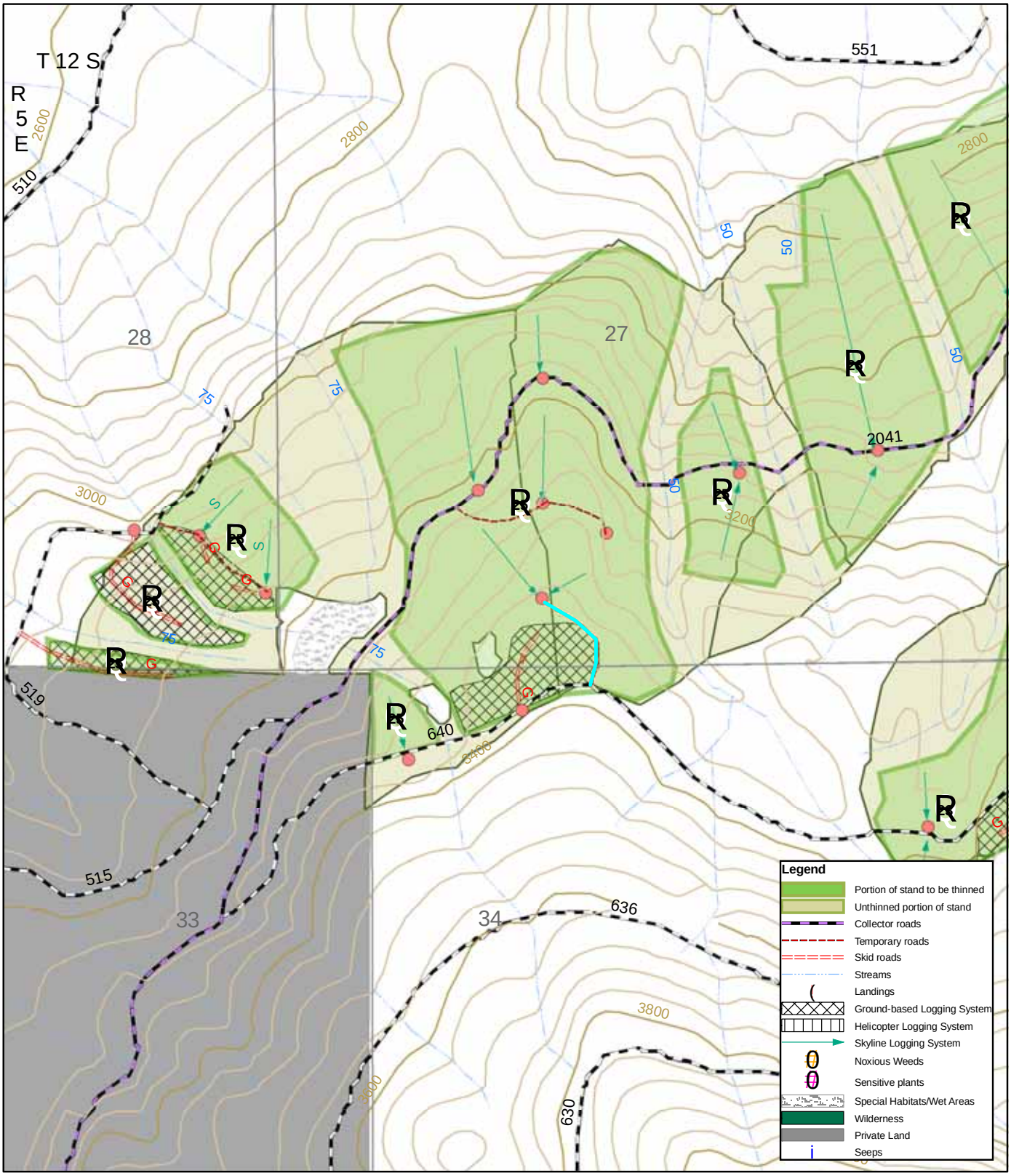
0 160 320 640 960 1,280 Feet

1 inch equals 417 feet

30 acres
skyline

agl
11/06

Middle Santiam Thin
Unit 25



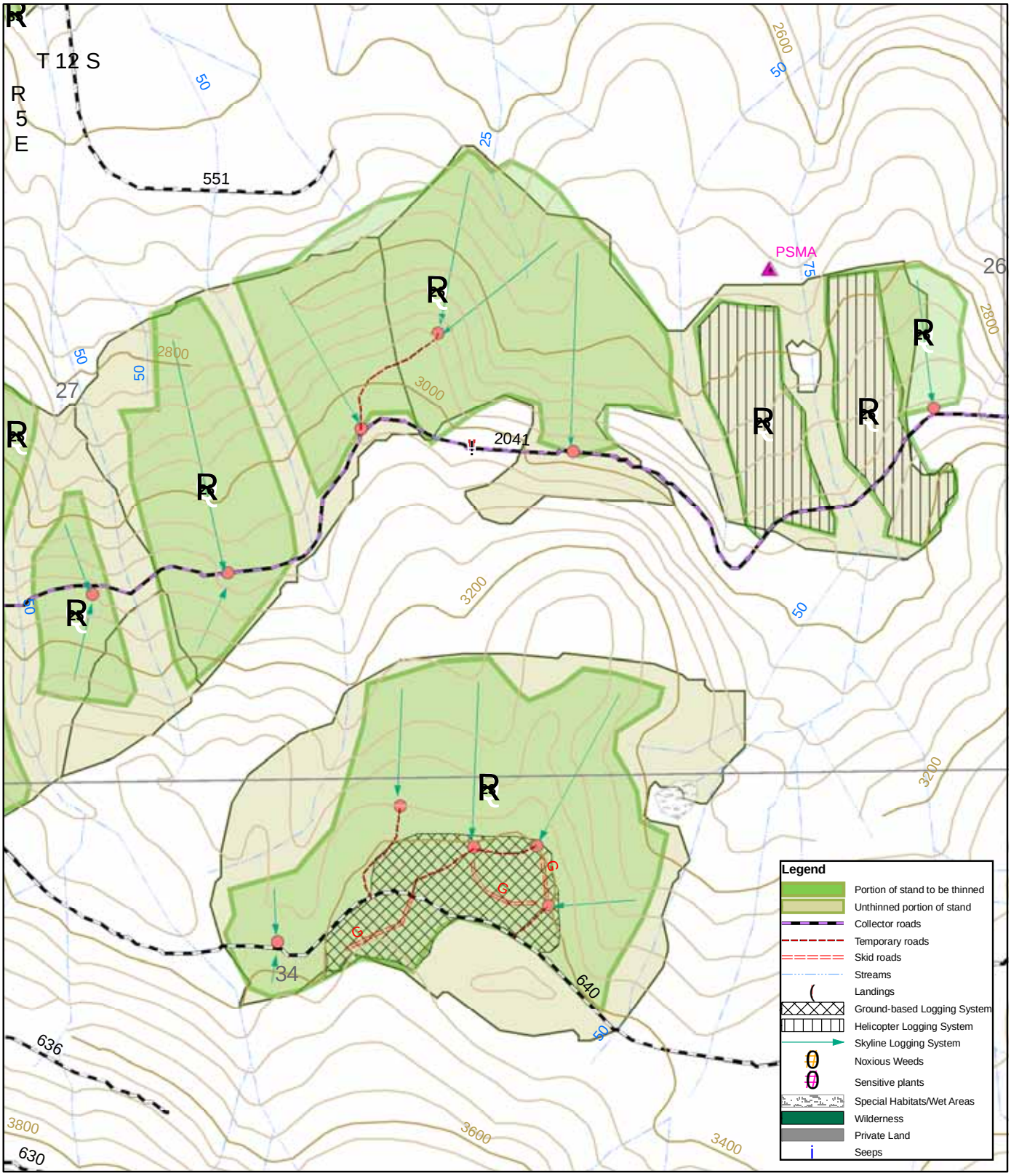
0 200 400 800 1,200 1,600 Feet

1 inch equals 500 feet

51acres
skyline/ground

agl
11/06

Middle Santiam Thin
Unit 26



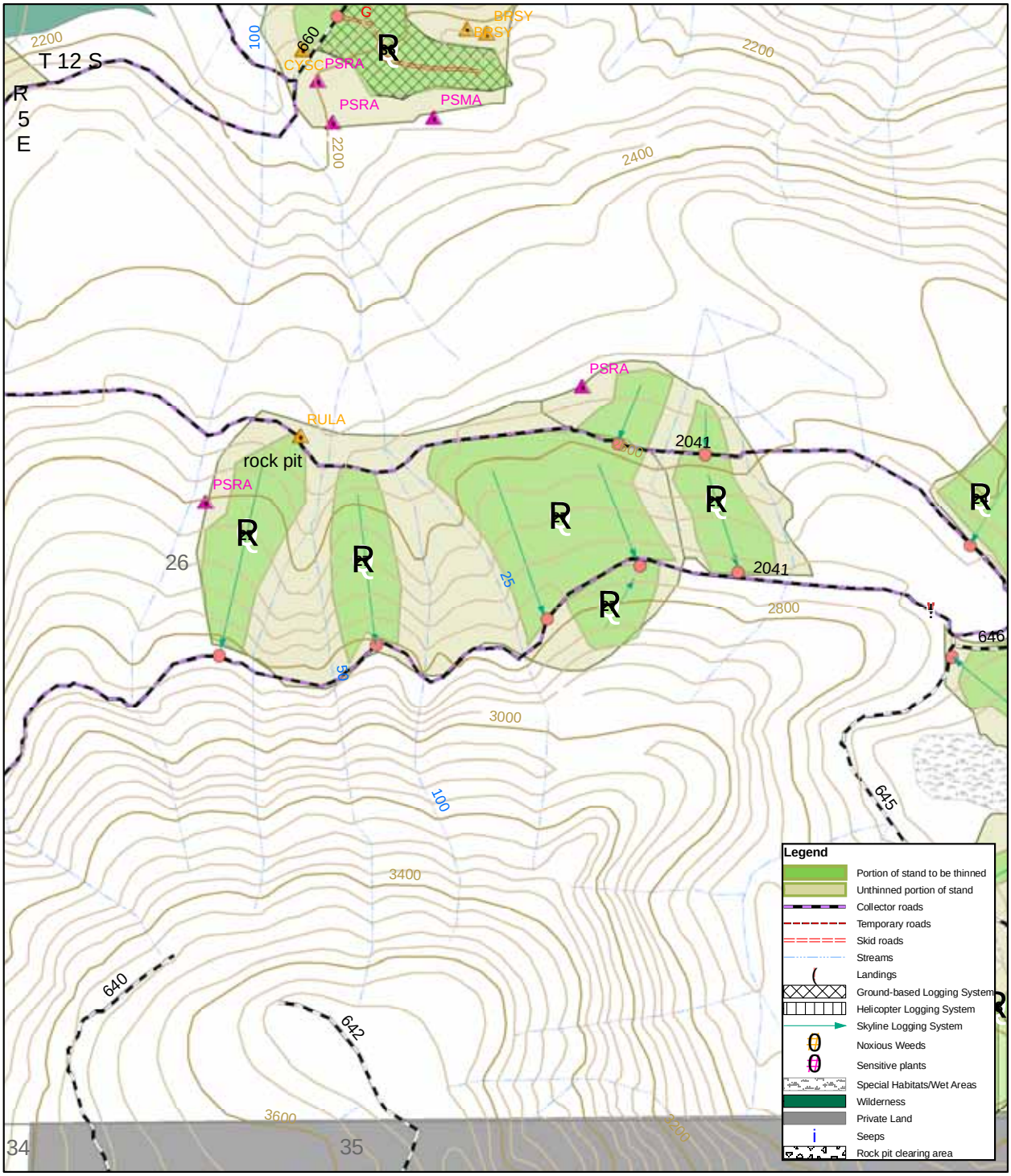
0 205 410 820 1,230 1,640 Feet

1 inch equals 510 feet

58 acres
skyline/helicopter

agl
11/06

Middle Santiam Thin
Unit 27



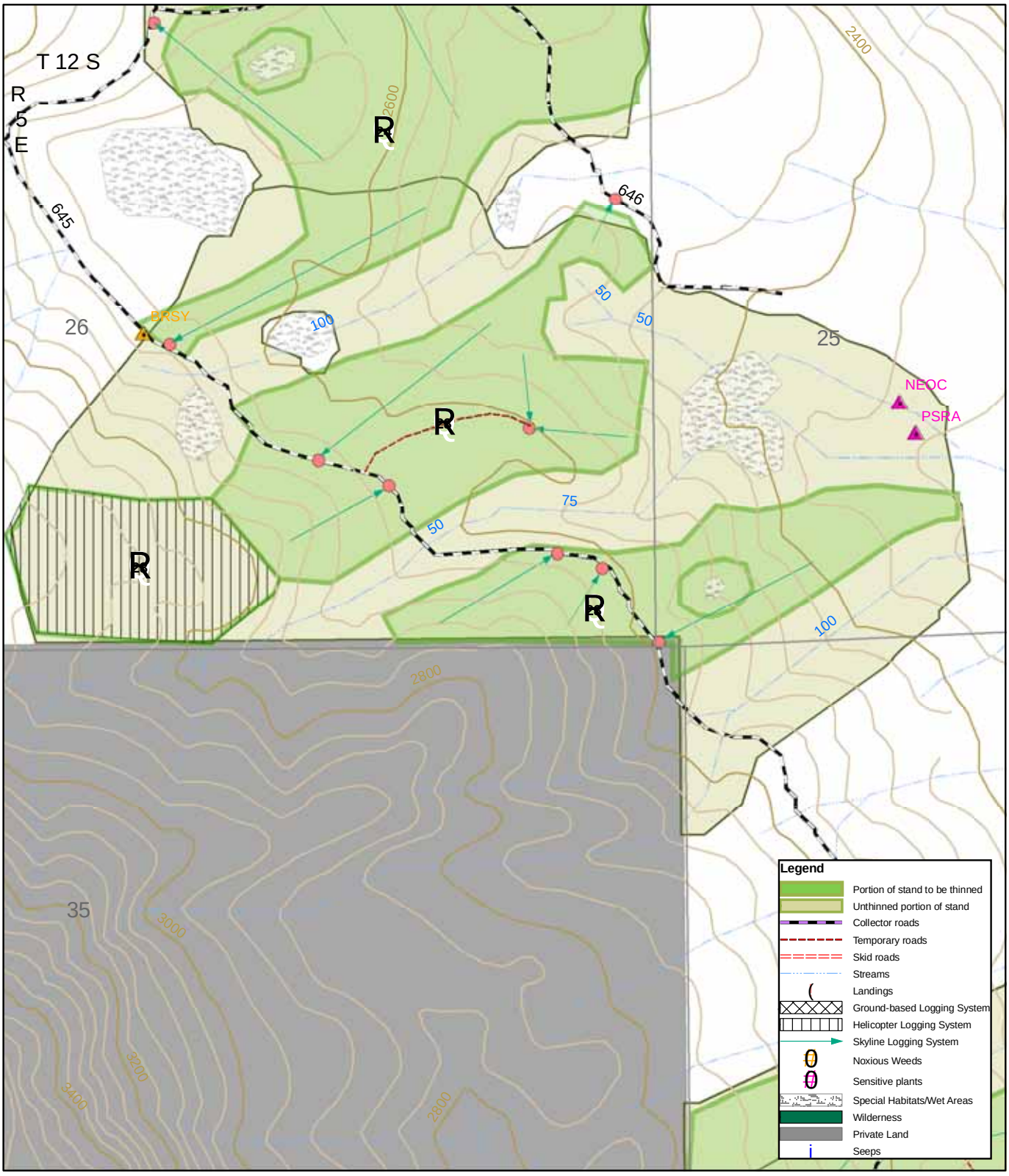
0 195 390 780 1,170 1,560 Feet

1 inch equals 510 feet

24 acres
skyline

agl
11/06

Middle Santiam Thin
Unit 28



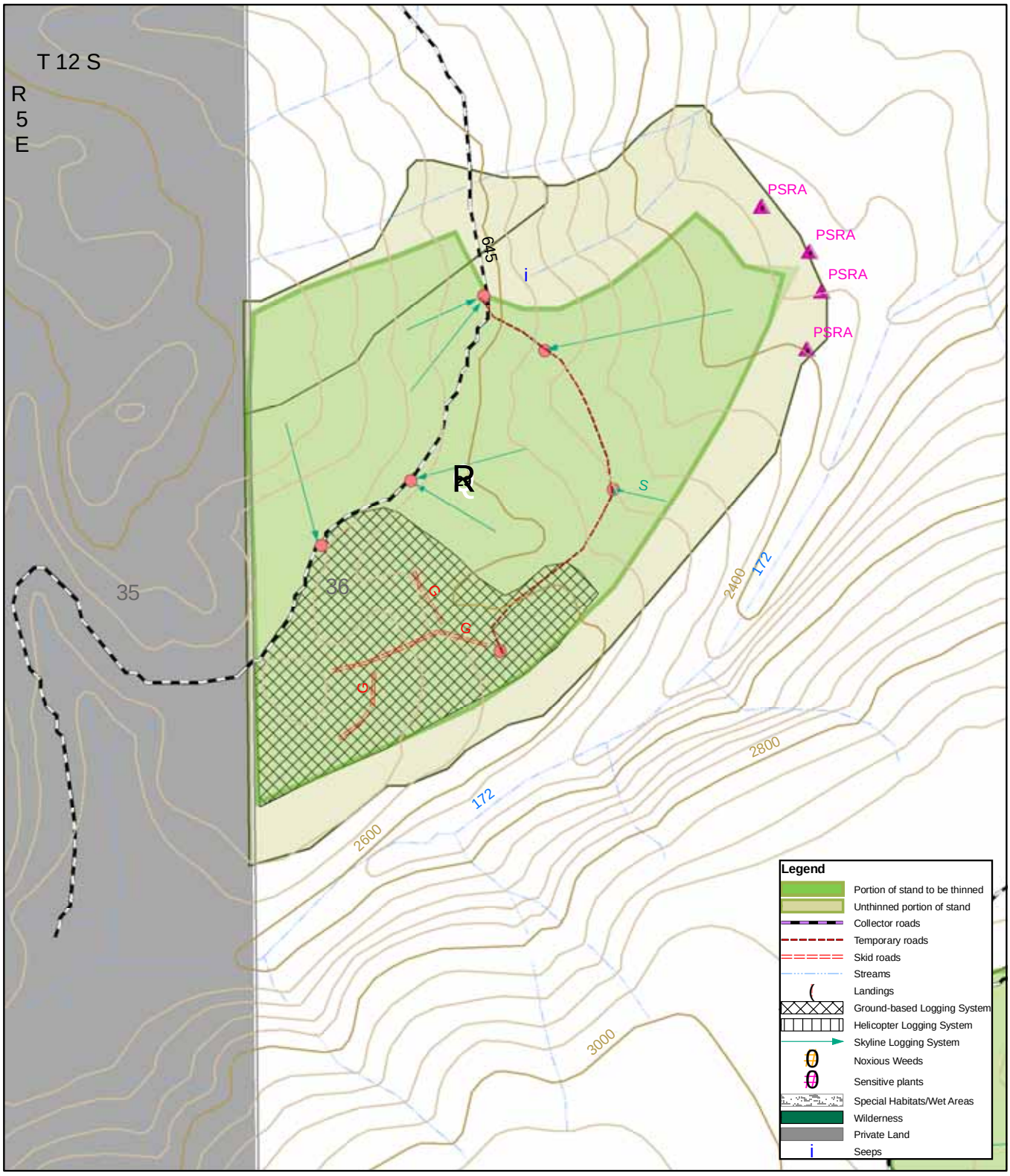
0 125 250 500 750 1,000 Feet

1 inch equals 375 feet

29 acres
skyline/helicopter

agl
11/06

Middle Santiam Thin
Unit 29



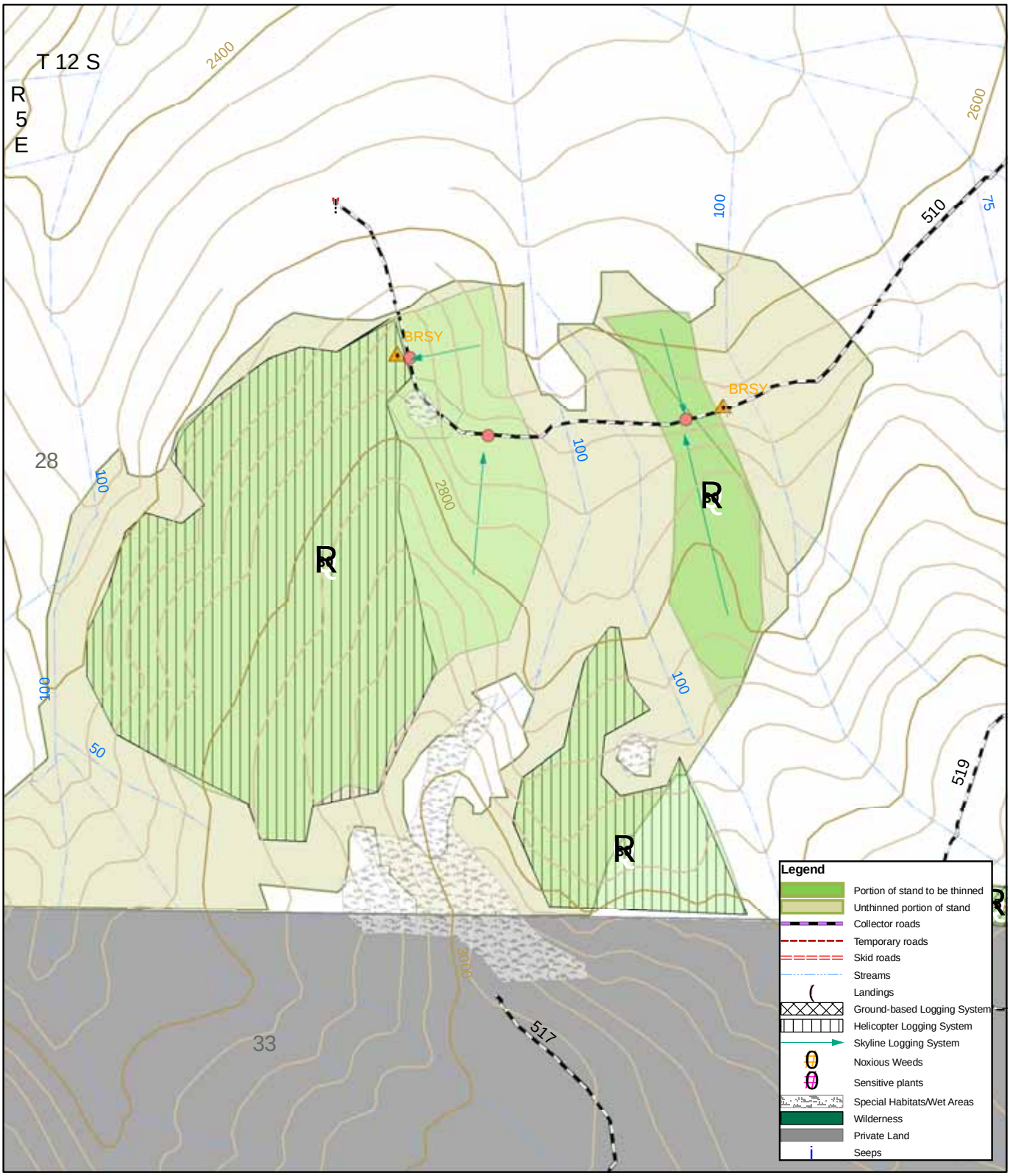
0 110 220 440 660 880 Feet

1 inch equals 330 feet

28 acres
skyline/ground

agl
11/06

Middle Santiam Thin
Unit 30



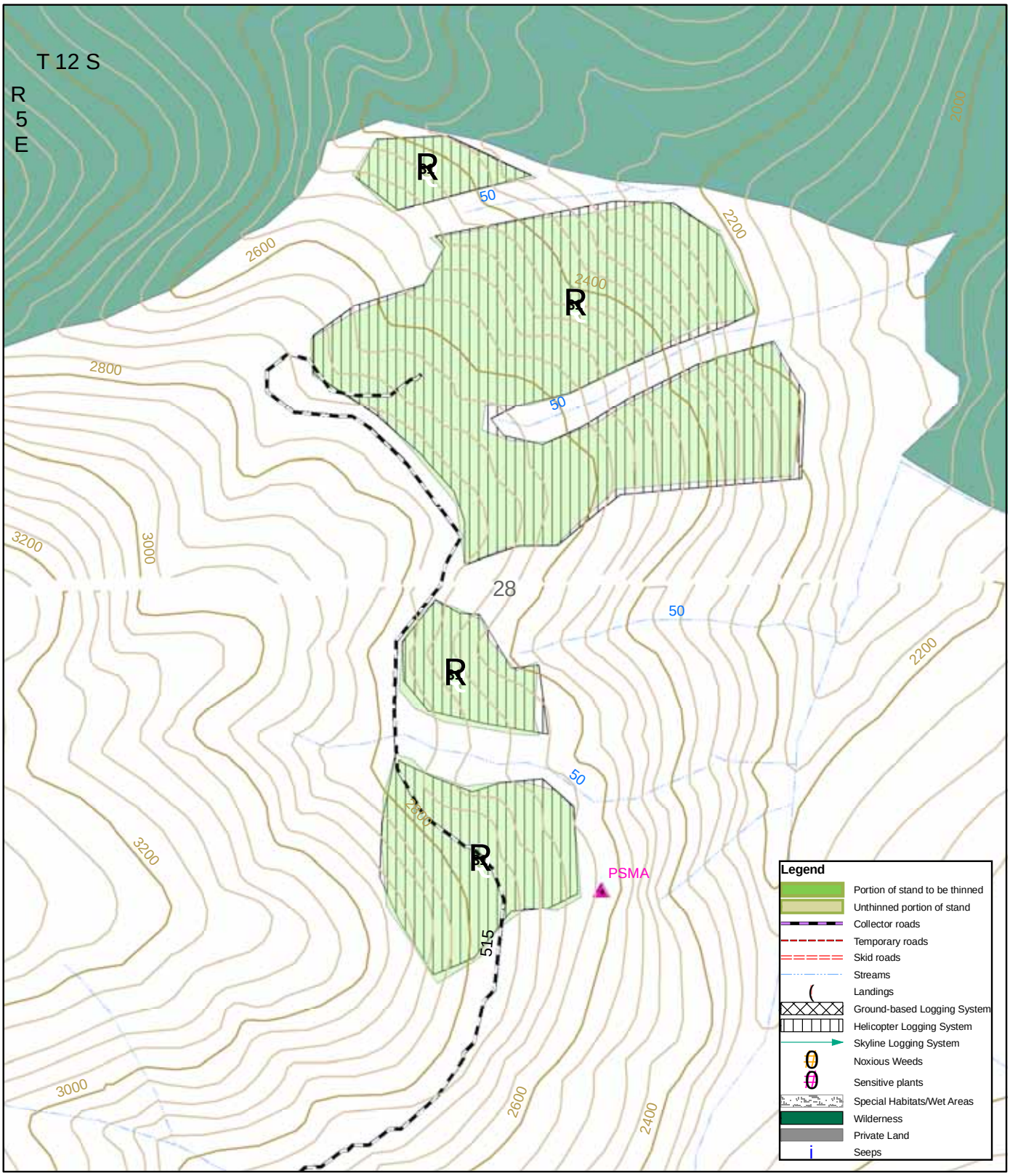
0 125 250 500 750 1,000 Feet

1 inch equals 330 feet

31 acres
skyline/helicopter

agl
11/06

Middle Santiam Thin
Unit 31



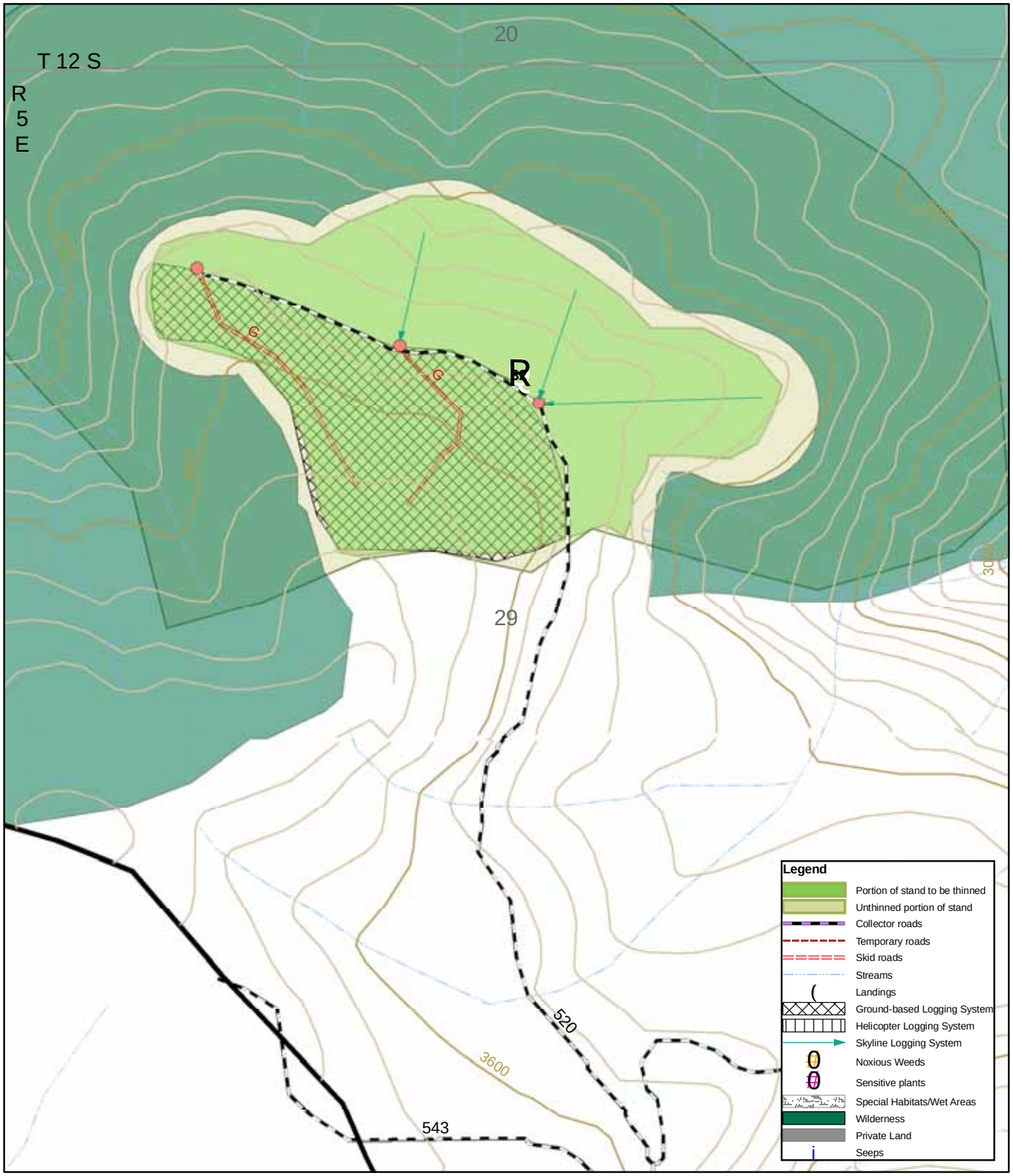
0 125 250 500 750 1,000 Feet

1 inch equals 330 feet

22 acres
helicopter

agl
11/06

Middle Santiam Thin
Unit 32



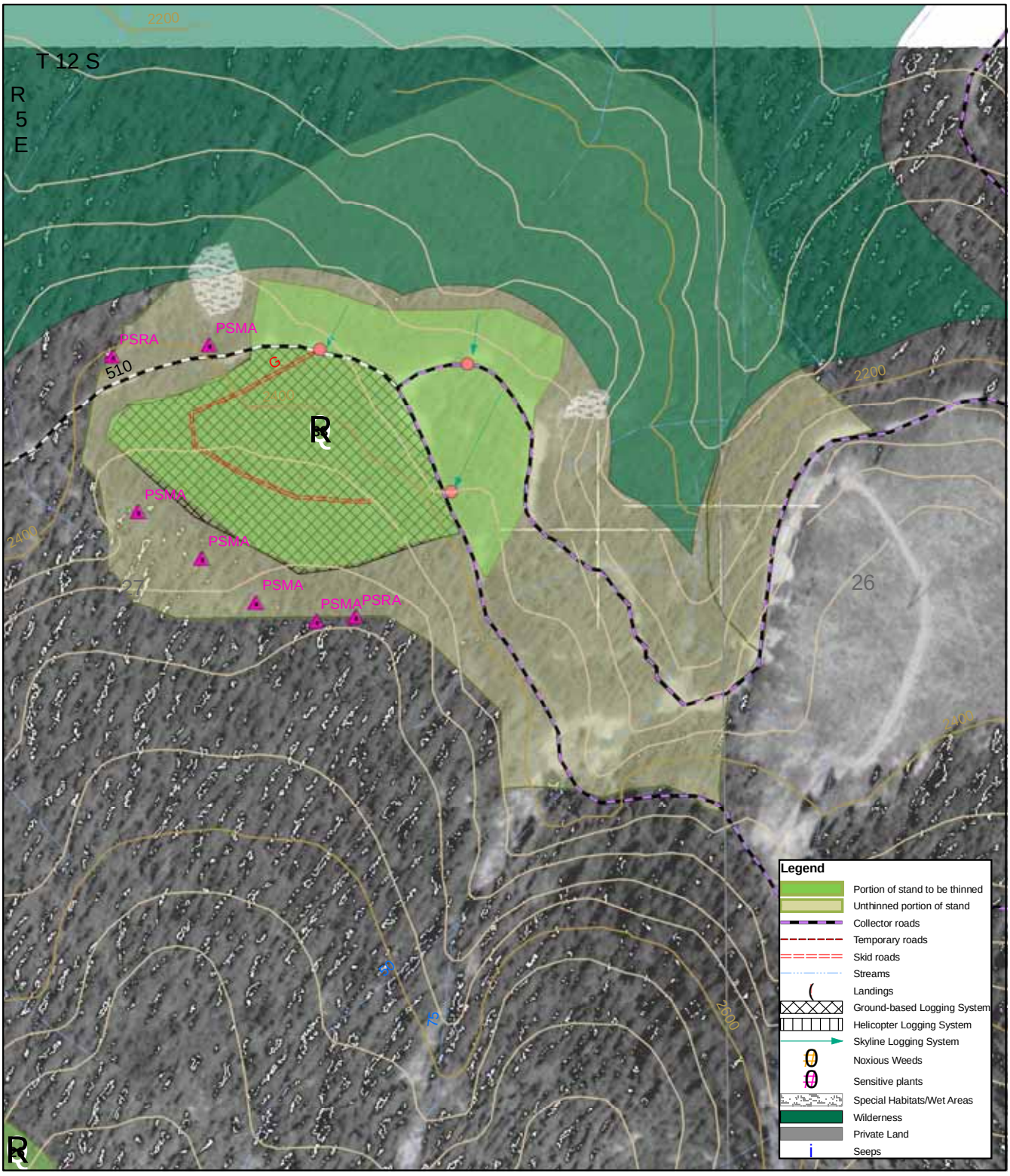
0 125 250 500 750 1,000 Feet

1 inch equals 330 feet

20 acres
skyline/ground

agl
11/06

Middle Santiam Thin
Unit 33



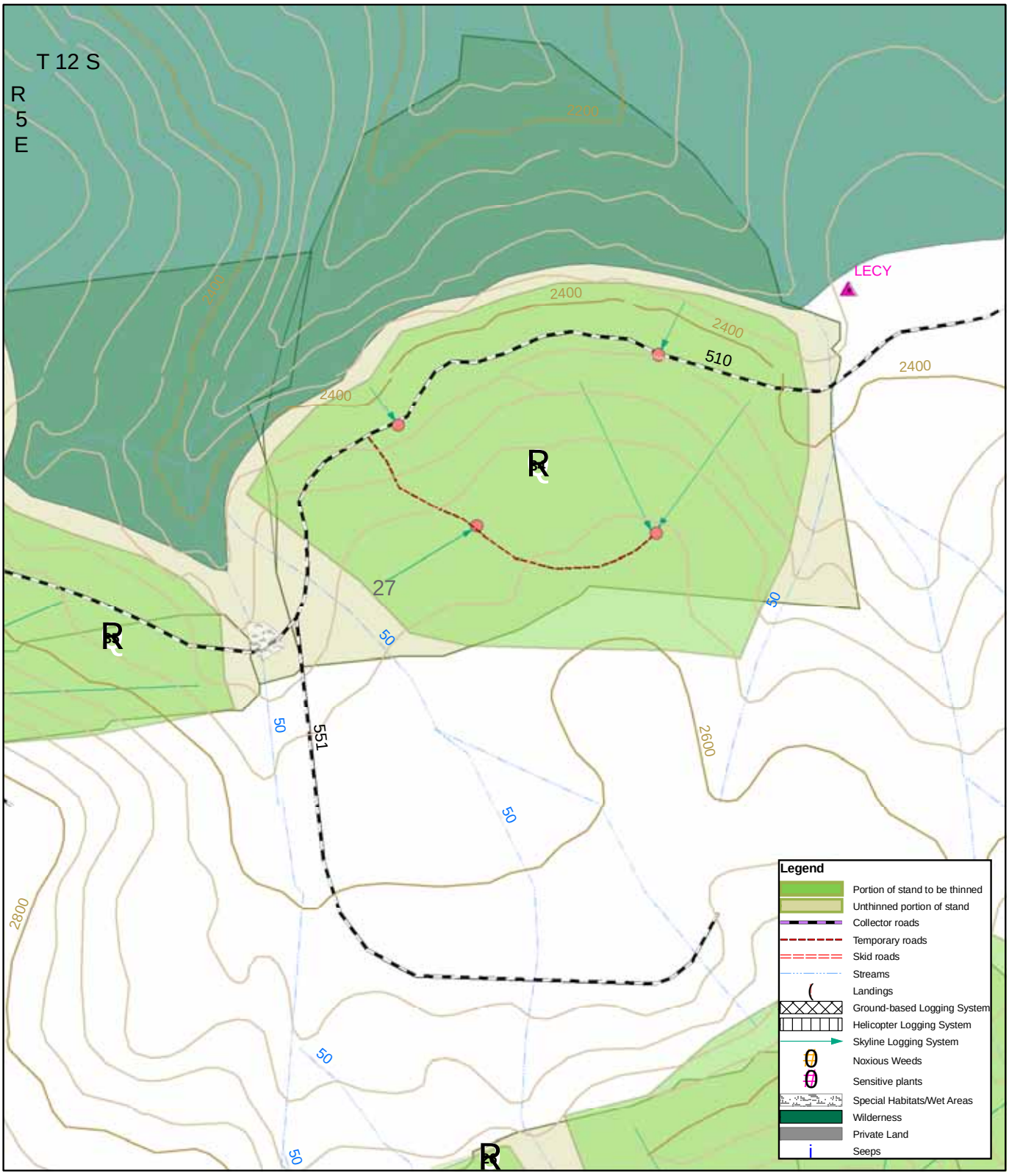
0 125 250 500 750 1,000 Feet

1 inch equals 330 feet

13 acres
skyline/ground

agl
11/06

Middle Santiam Thin
Unit 34



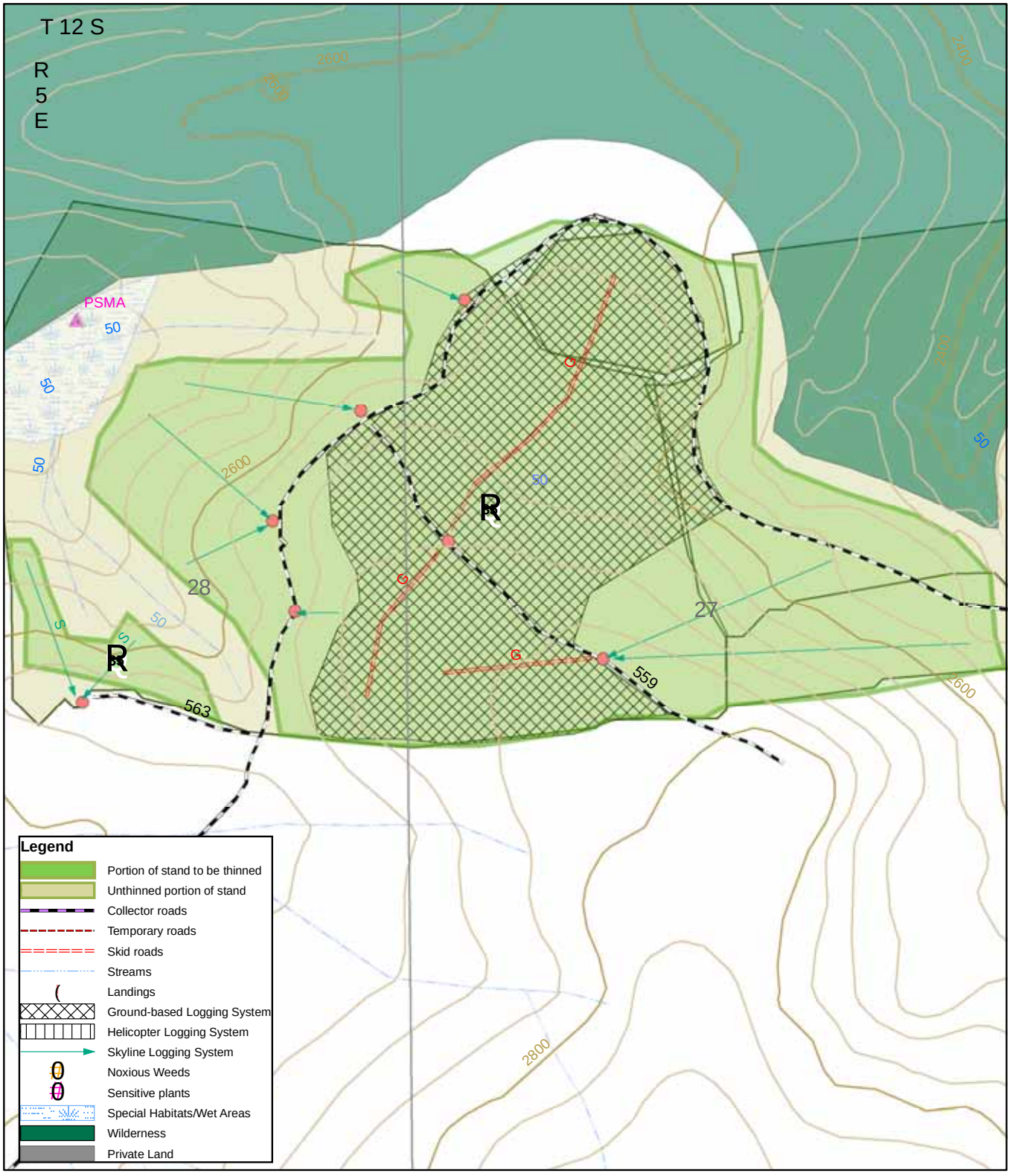
0 125 250 500 750 1,000 Feet

1 inch equals 330 feet

23 acres
skyline

agl
11/06

Middle Santiam Thin
Unit 35



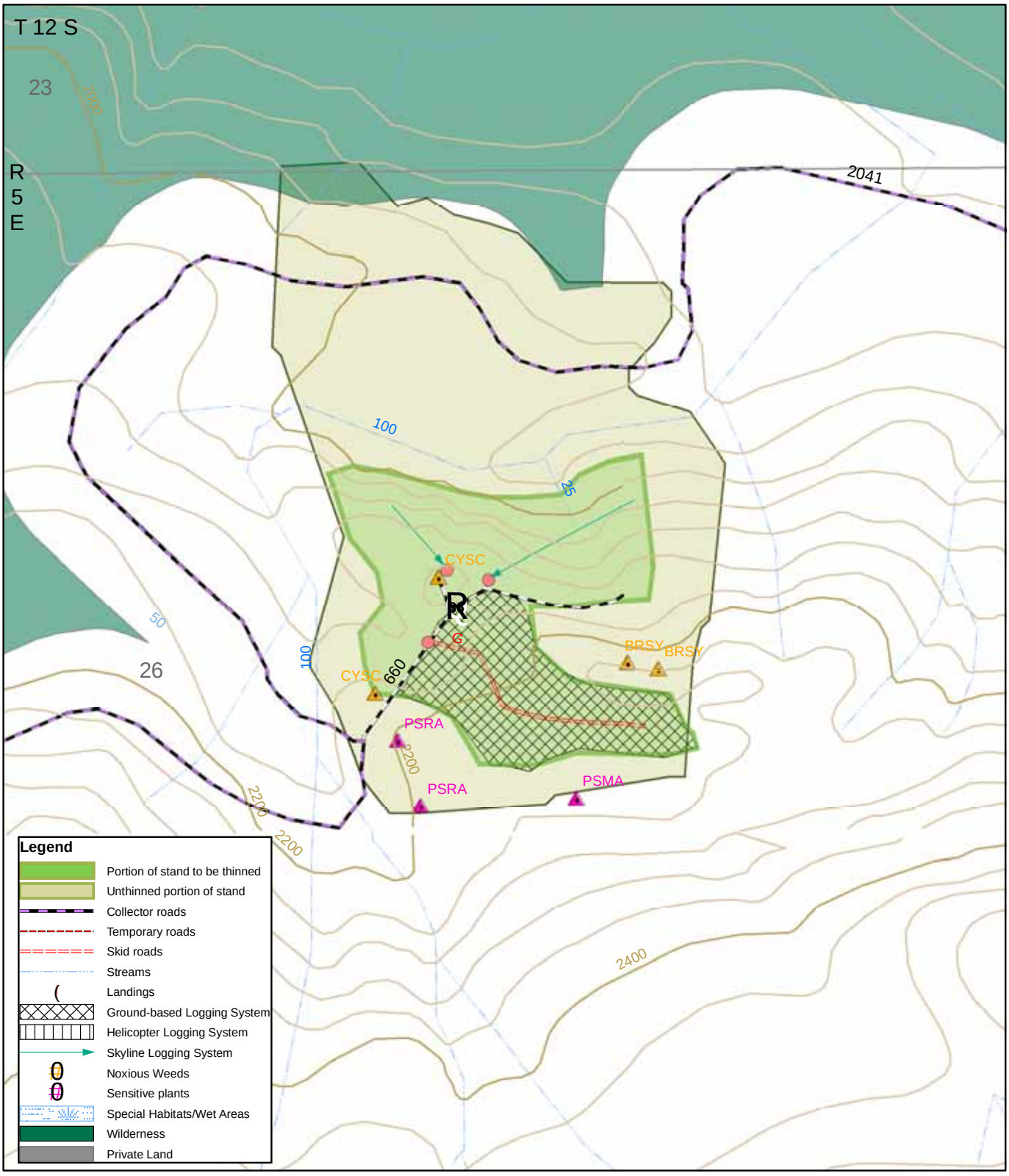
0 125 250 500 750 1,000 Feet

1 inch equals 330 feet

45 acres
skyline/ground

agl
11/06

Middle Santiam Thin
Unit 36



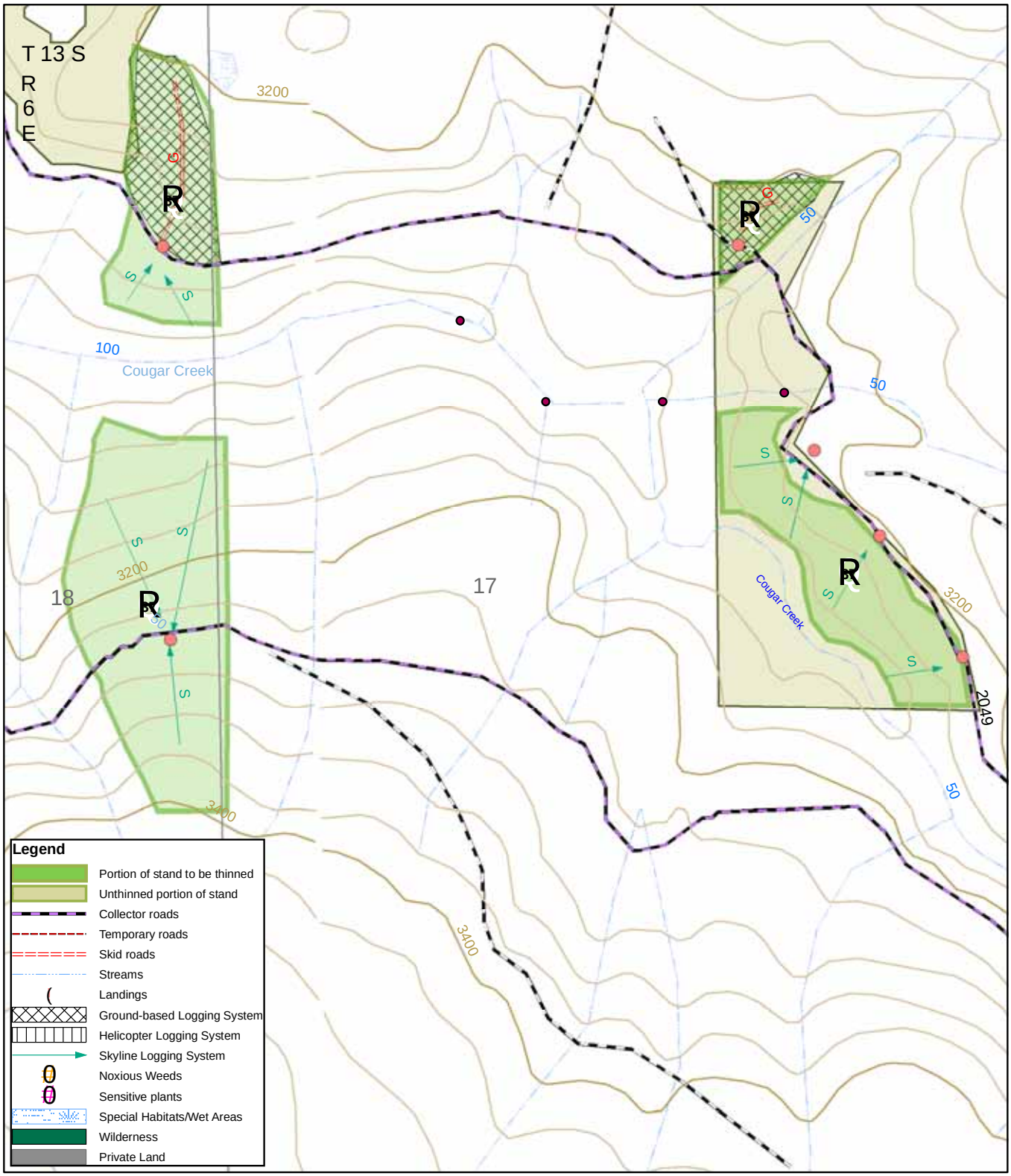
0 125 250 500 750 1,000 Feet

1 inch equals 330 feet

10 acres
skyline/ground

agl
11/06

Middle Santiam Thin
Unit 37



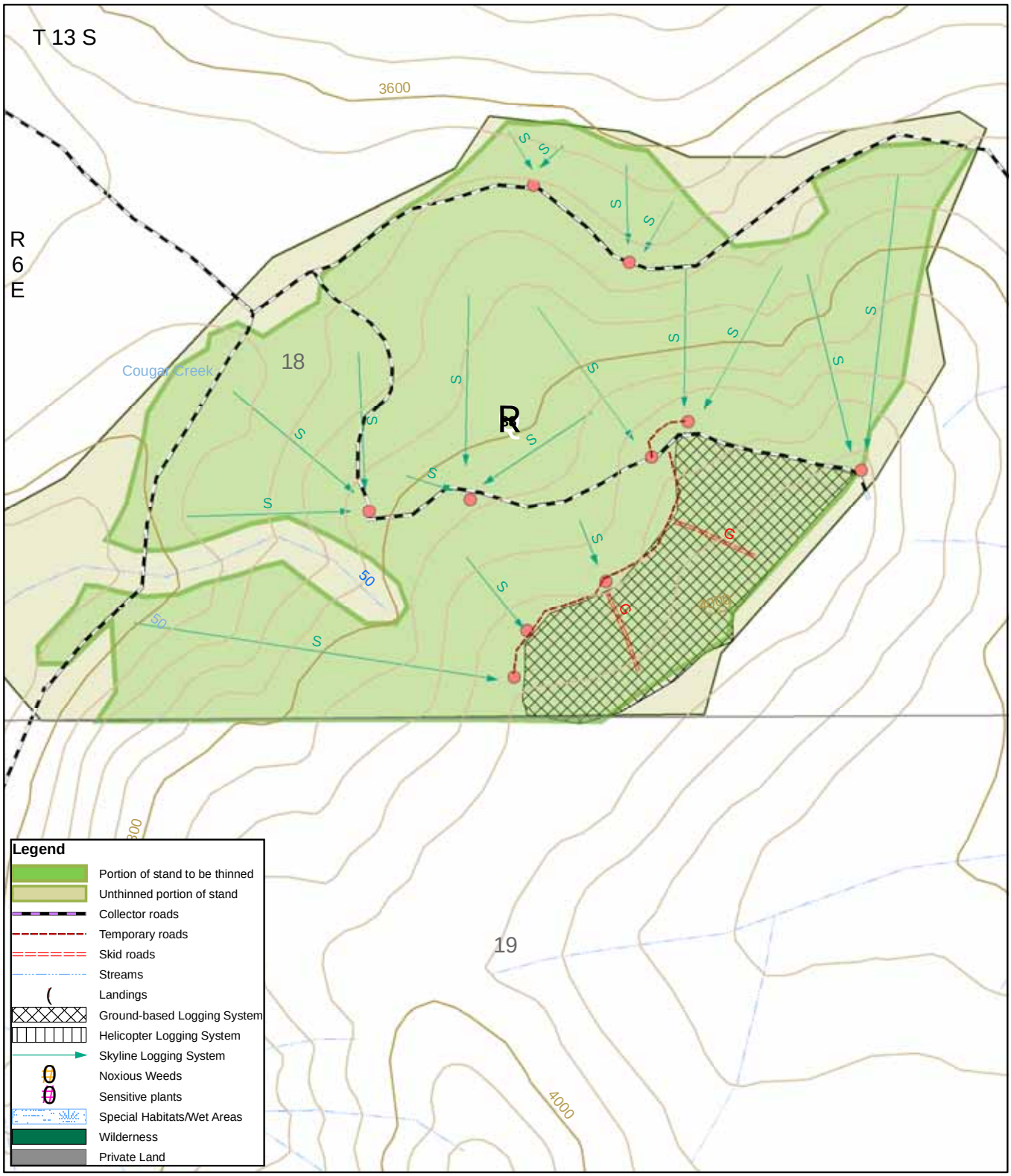
0 125 250 500 750 1,000 Feet

1 inch equals 330 feet

15 acres
skyline/ground

agl
11/06

Middle Santiam Thin
Unit 38



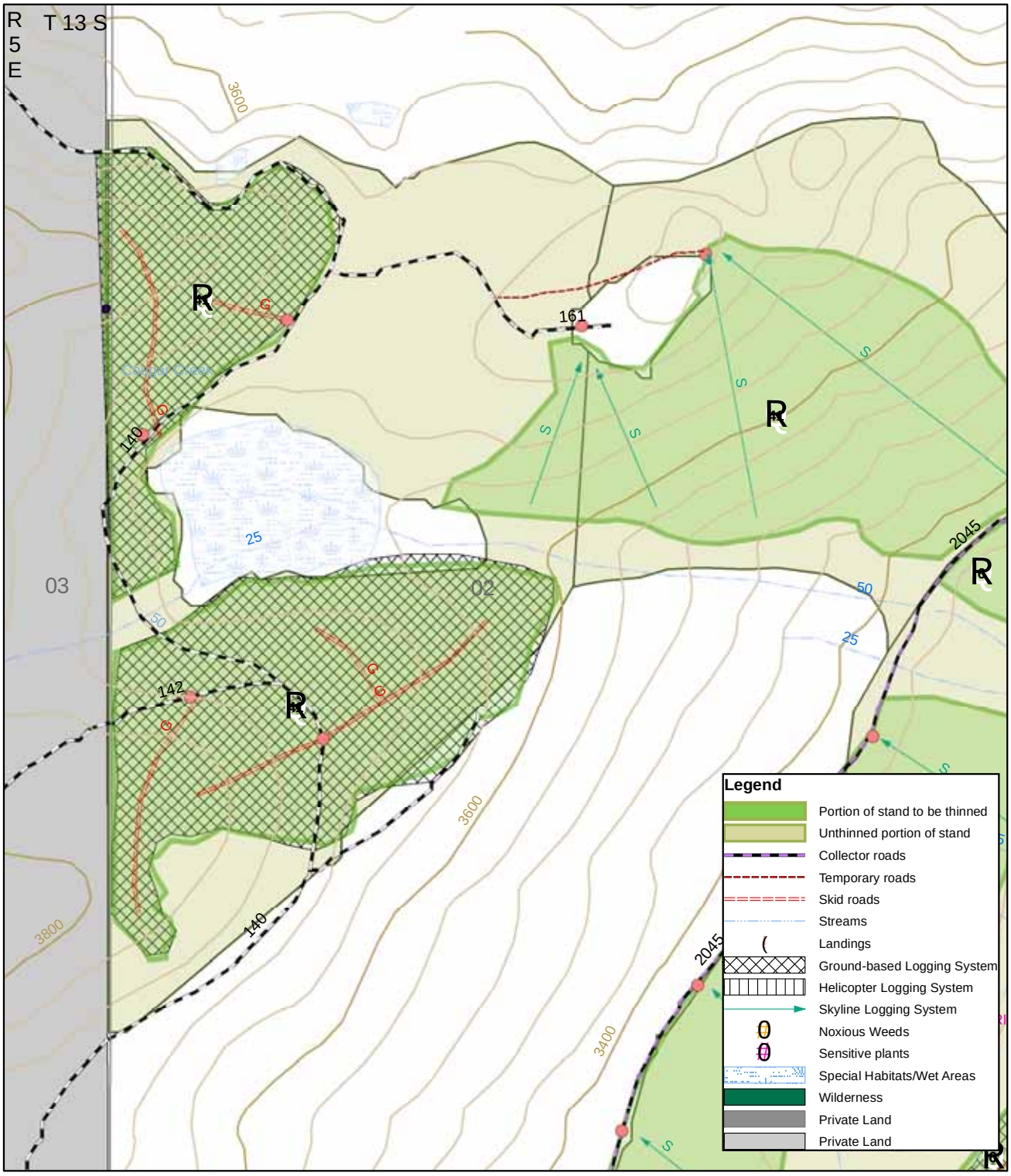
0 125 250 500 750 1,000 Feet

1 inch equals 330 feet

49 acres
skyline/ground

agl
11/06

Middle Santiam Thin
Unit 41



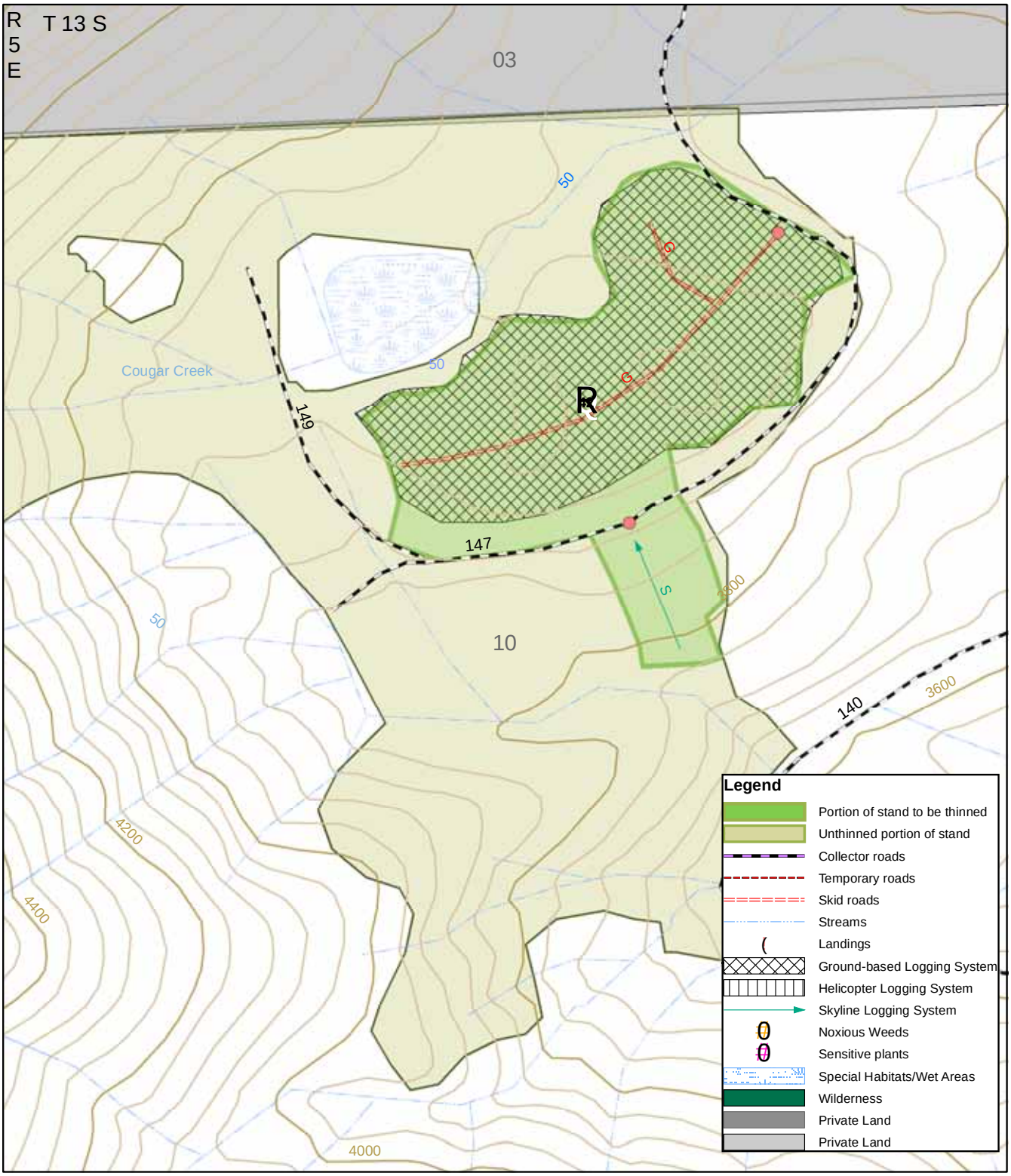
0 125 250 500 750 1,000 Feet

1 inch equals 330 feet

38 acres
skyline/ground

agl
11/06

Middle Santiam Thin
Unit 42



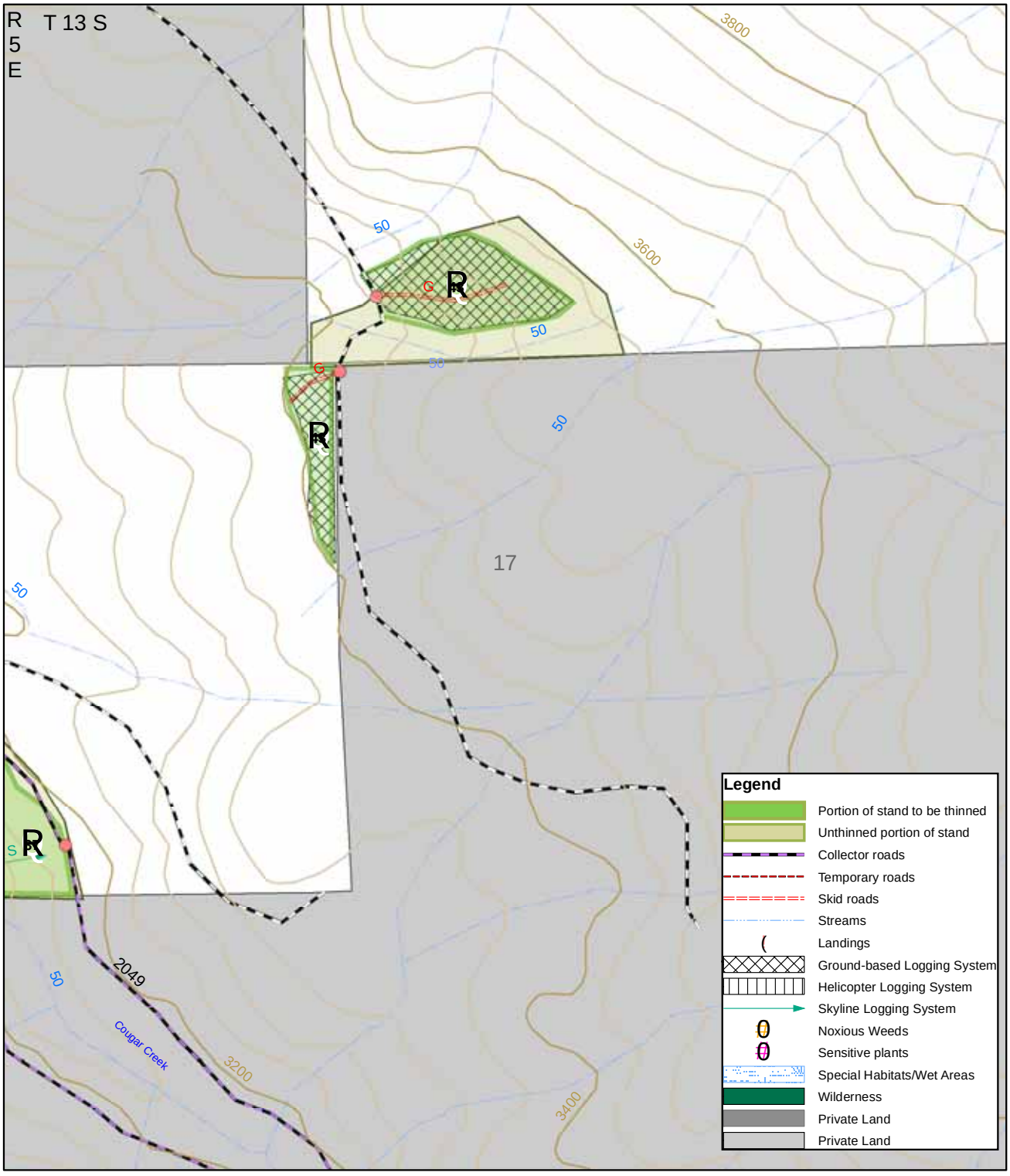
0 125 250 500 750 1,000 Feet

1 inch equals 330 feet

16 acres
skyline/ground

agl
11/06

Middle Santiam Thin
Unit 43



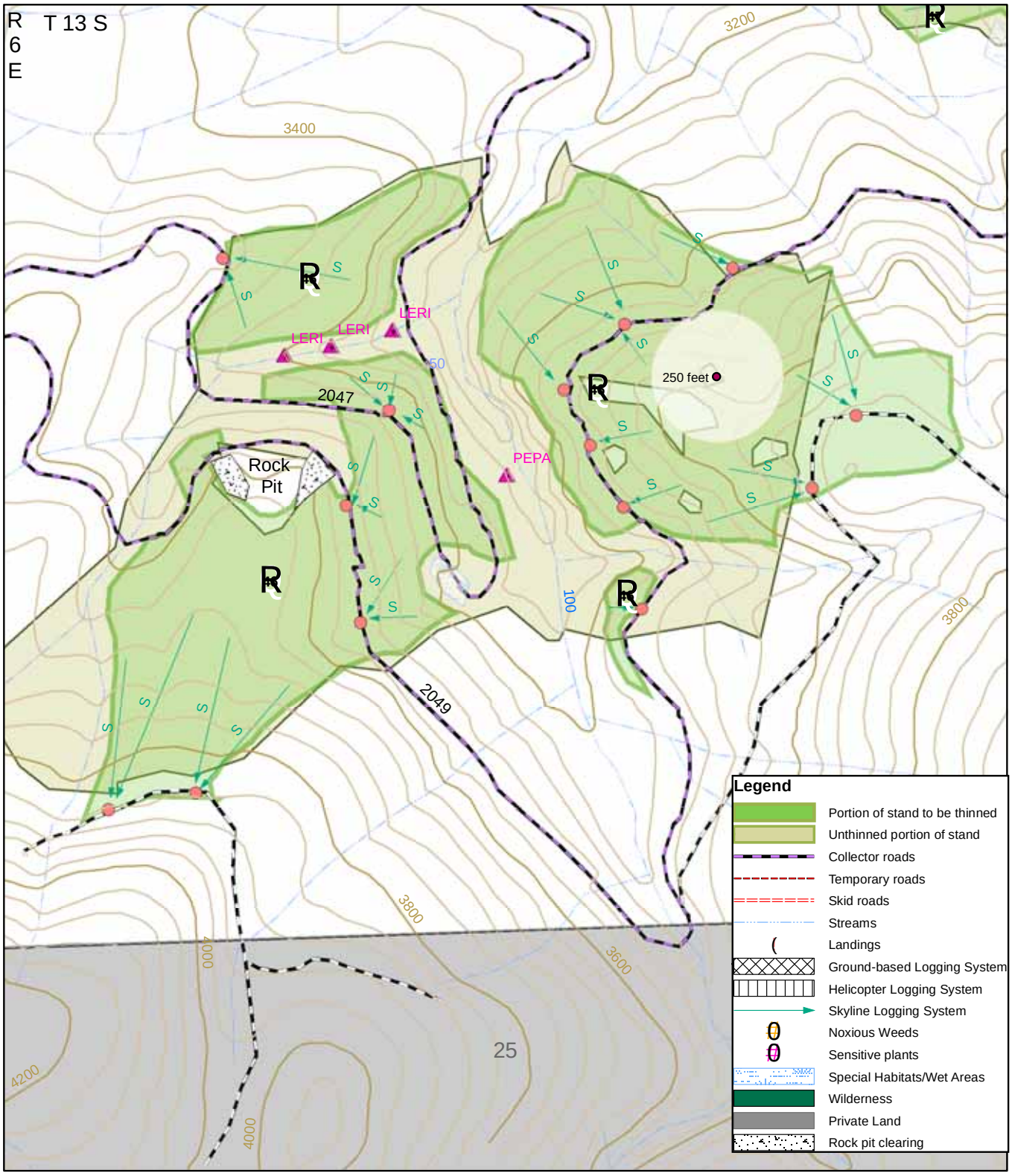
0 125 250 500 750 1,000 Feet

1 inch equals 330 feet

3 acres
ground

agl
11/06

Middle Santiam Thin
Unit 46



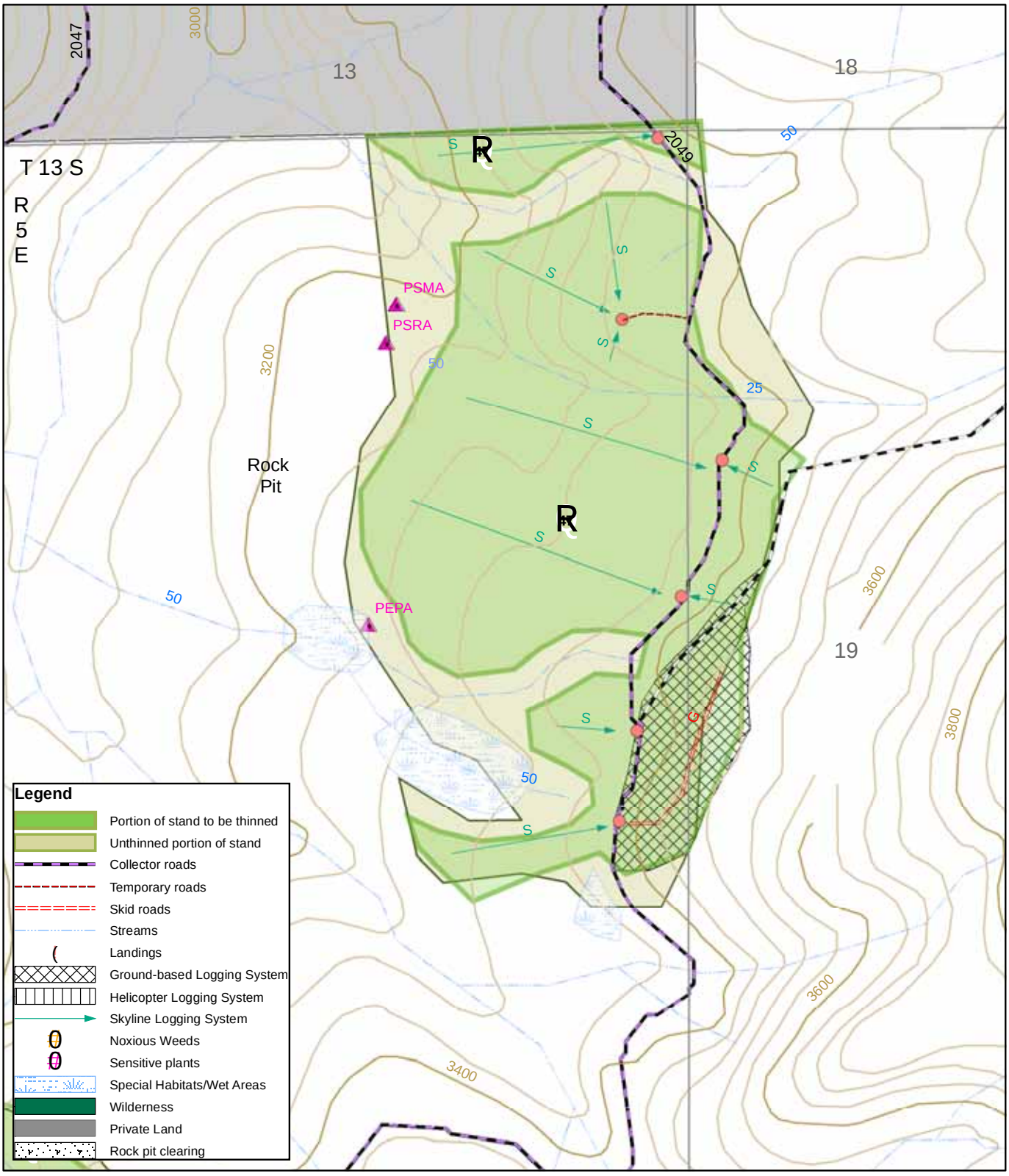
0 125 250 500 750 1,000 Feet

1 inch equals 500 feet

76 acres
skyline

agl
11/06

Middle Santiam Thin
Unit 47



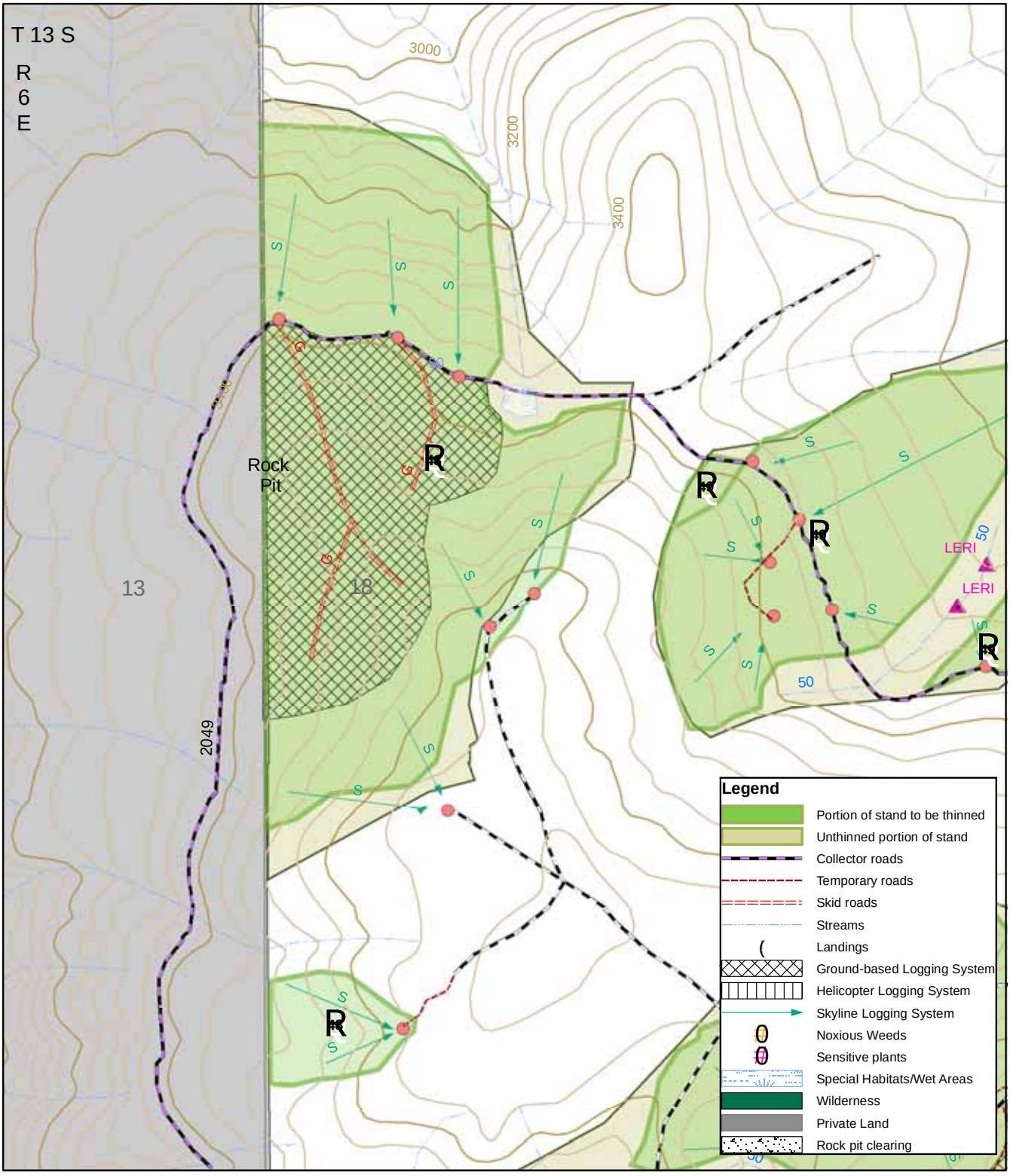
0 125 250 500 750 1,000 Feet

1 inch equals 330 feet

28 acres
skyline/ground

agl
11/06

Middle Santiam Thin
Unit 48



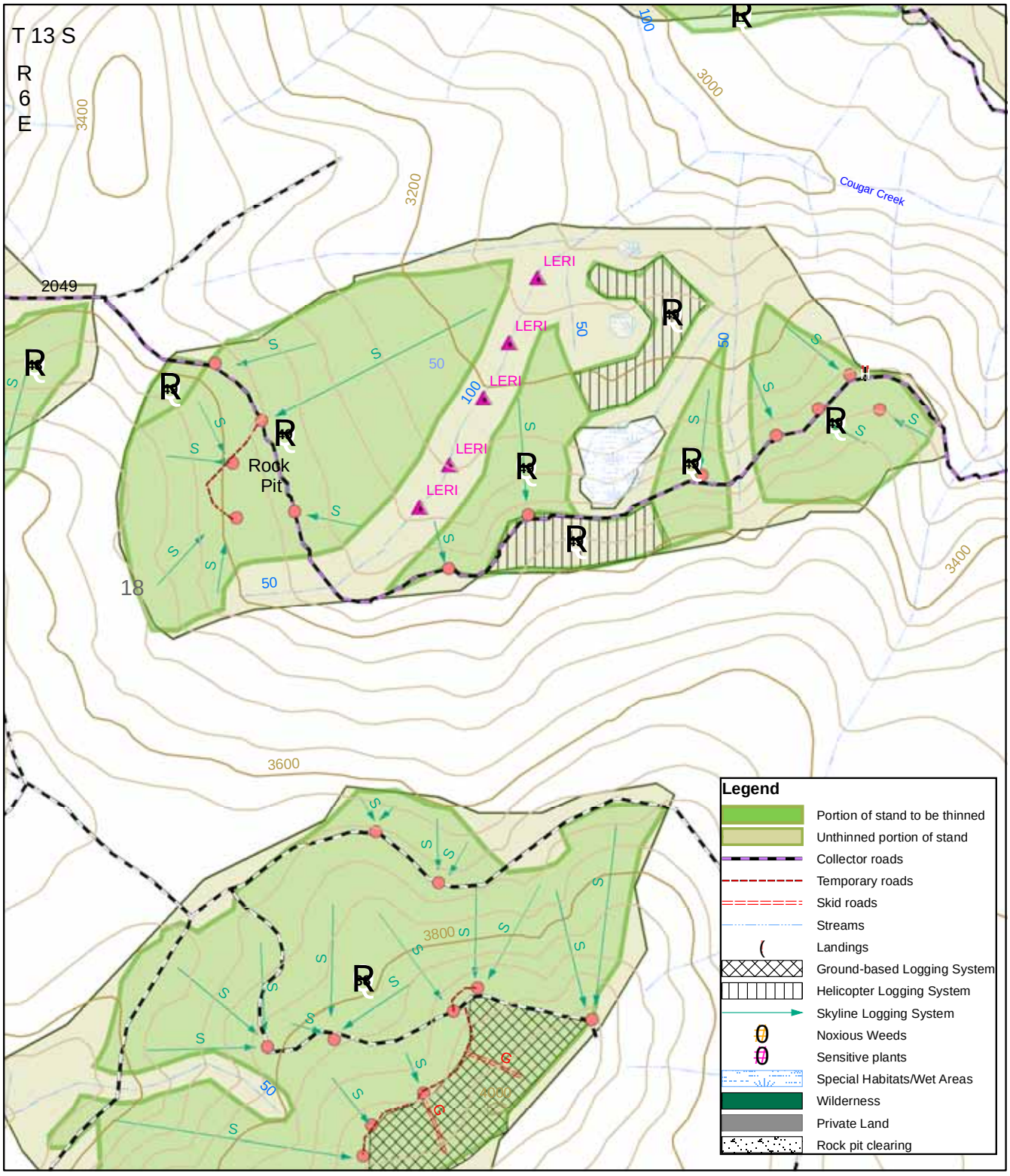
0 125 250 500 750 1,000 Feet

1 inch equals 500 feet

58 acres
skyline/ground

agl
11/06

Middle Santiam Thin
Unit 49



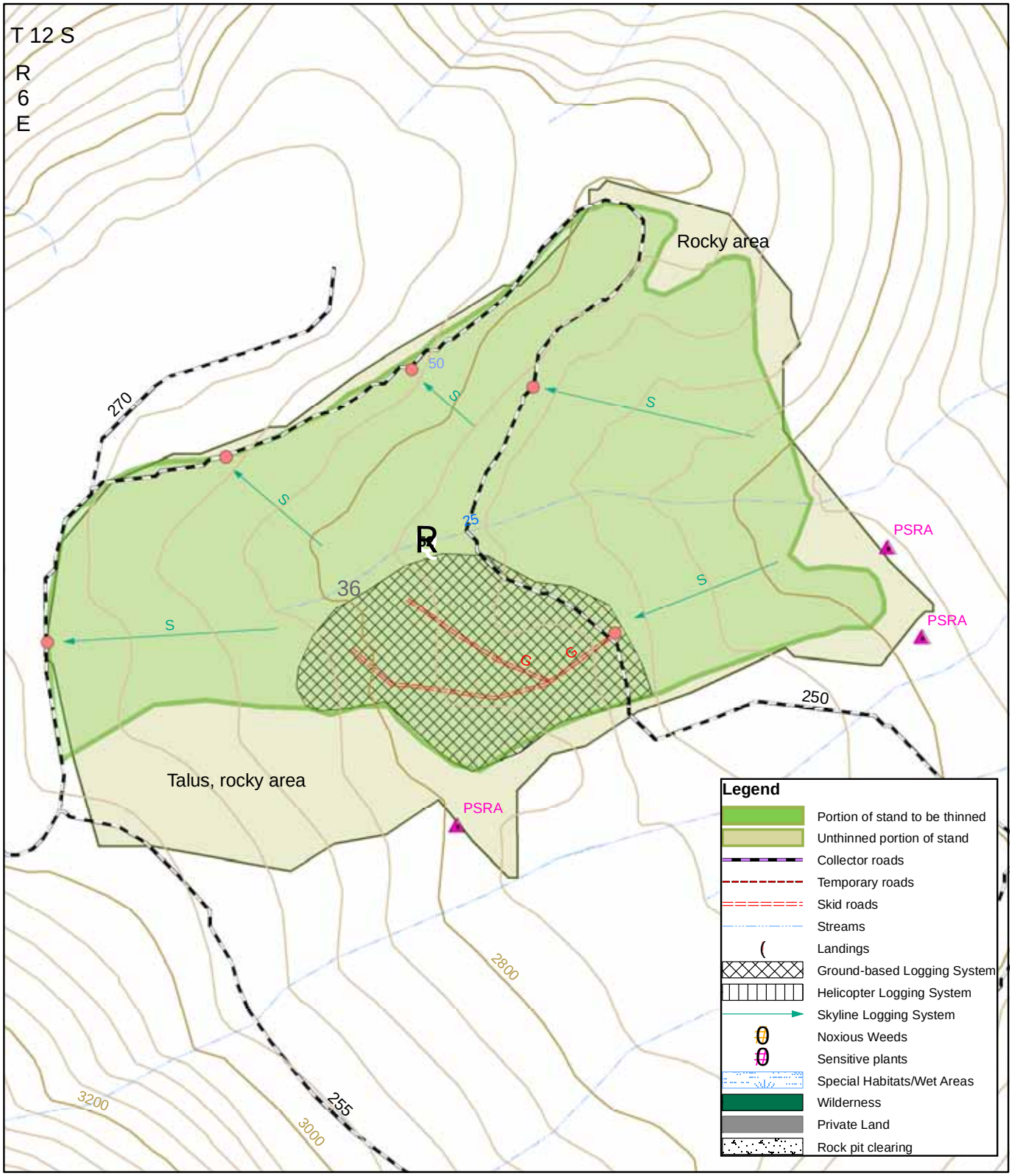
0 125 250 500 750 1,000 Feet

1 inch equals 500 feet

49 acres
skyline/ground

agl
11/06

Middle Santiam Thin
Unit 52



0 125 250 500 750 1,000 Feet

1 inch equals 330 feet

38 acres
skyline/ground

agl
11/06

Post Sale Activities

The following is a description of the post-sale activities that are planned for the Middle Santiam Thin Timber sale. The first two priority items are required mitigation for the sale and the remainder are in priority order as funding is available.

Priority 1; Subsoiling to meet Forest Plant Standards and Guidelines for Compaction.

Prior management on Units 10 and 22, that was conducted before any requirements were established to minimize soil compaction, created compaction conditions which now approach or exceed the currently accepted Regional and Willamette Standards and Guidelines of 20%. These units are proposed for subsoiling at the completion of harvest activities to reduce the amount of compacted soil. The objective is to bring these units into compliance with the current standards by reducing over all compaction below the 20% level. Based on previous experience, this effort should be successful in Unit 22. In Unit 10, the overall compaction will certainly be reduced from prethinning levels, but the 20% objective may or may not be achieved. This is in order to reduce the amount of root pruning of leave trees and to avoid excessive amounts of exposed soil. These units will be monitored closely during project implementation and will be the highest priority for post sale subsoiling dollars.

Table 1 - Units and Acres to be Subsoiled

Unit Number	Alternative Two		Alternative 3	
	Total Acres in Unit	Acres to be Subsoiled	Total Acres in Unit	Acres to be Subsoiled
10	40	5 *(40 acres x 12%)*	40	5
22	59	7 *(59 acres x 12%)*	59	7
Totals	**99**	**12**	**99**	**12**

Table 2 - Costs of Subsoiling and Seeded Subsoiled Areas

Activity	Alternative 2	Alternative 3
Subsoiling U-10 and U-22	$4,800 *(12 acres x $400/acre)*	$4,800 *(12 acres x $400/acre)*
Seed subsoiled areas with native seed $600/acre	$7,200 *(12 acres x $600/acre)*	$7,200 *(12 acres x $600/acre)*
Totals	**$12,000**	**$12,000**

Figure 1- Priority 1 Subsoiling Project (Map 1 of 2)

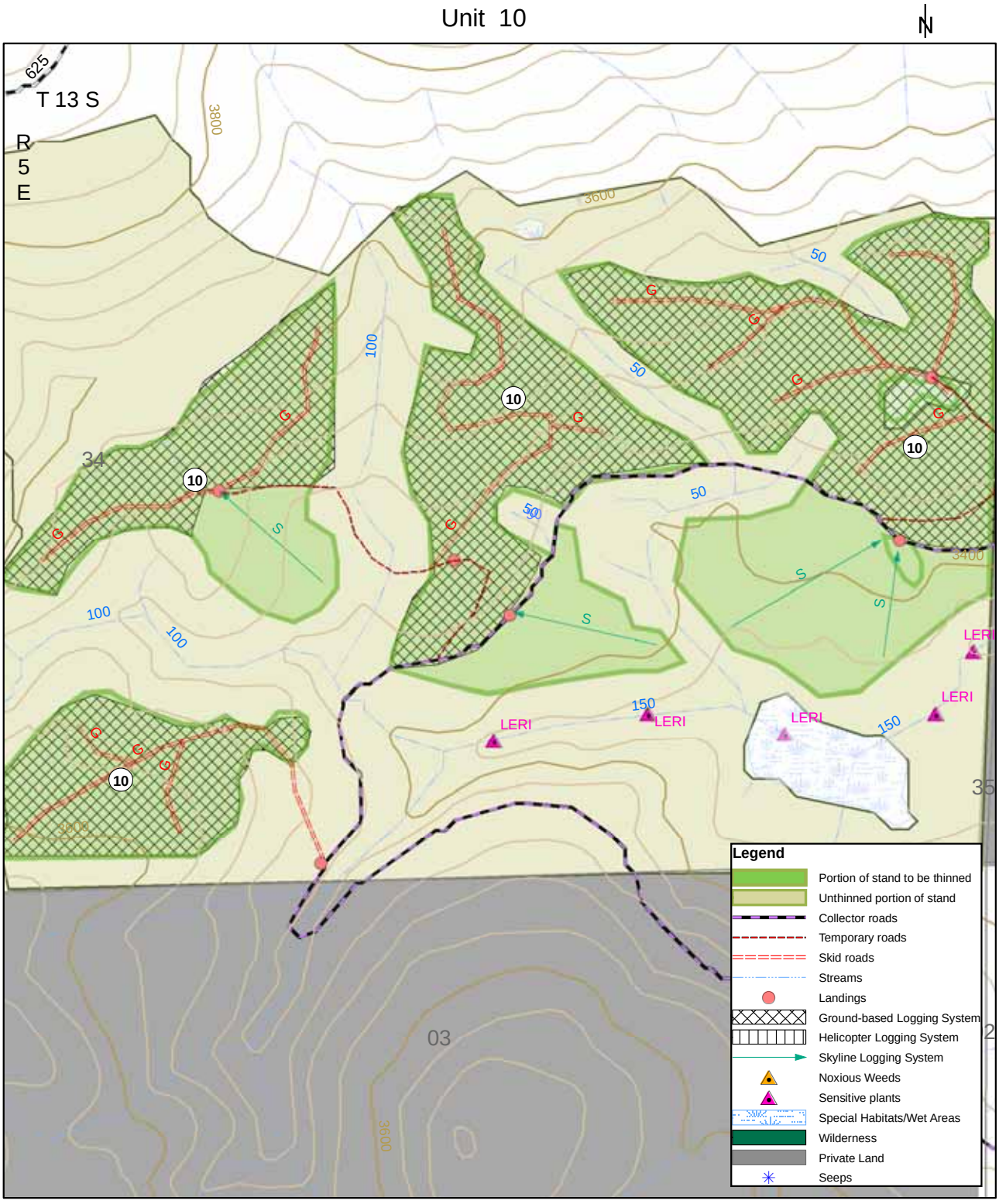
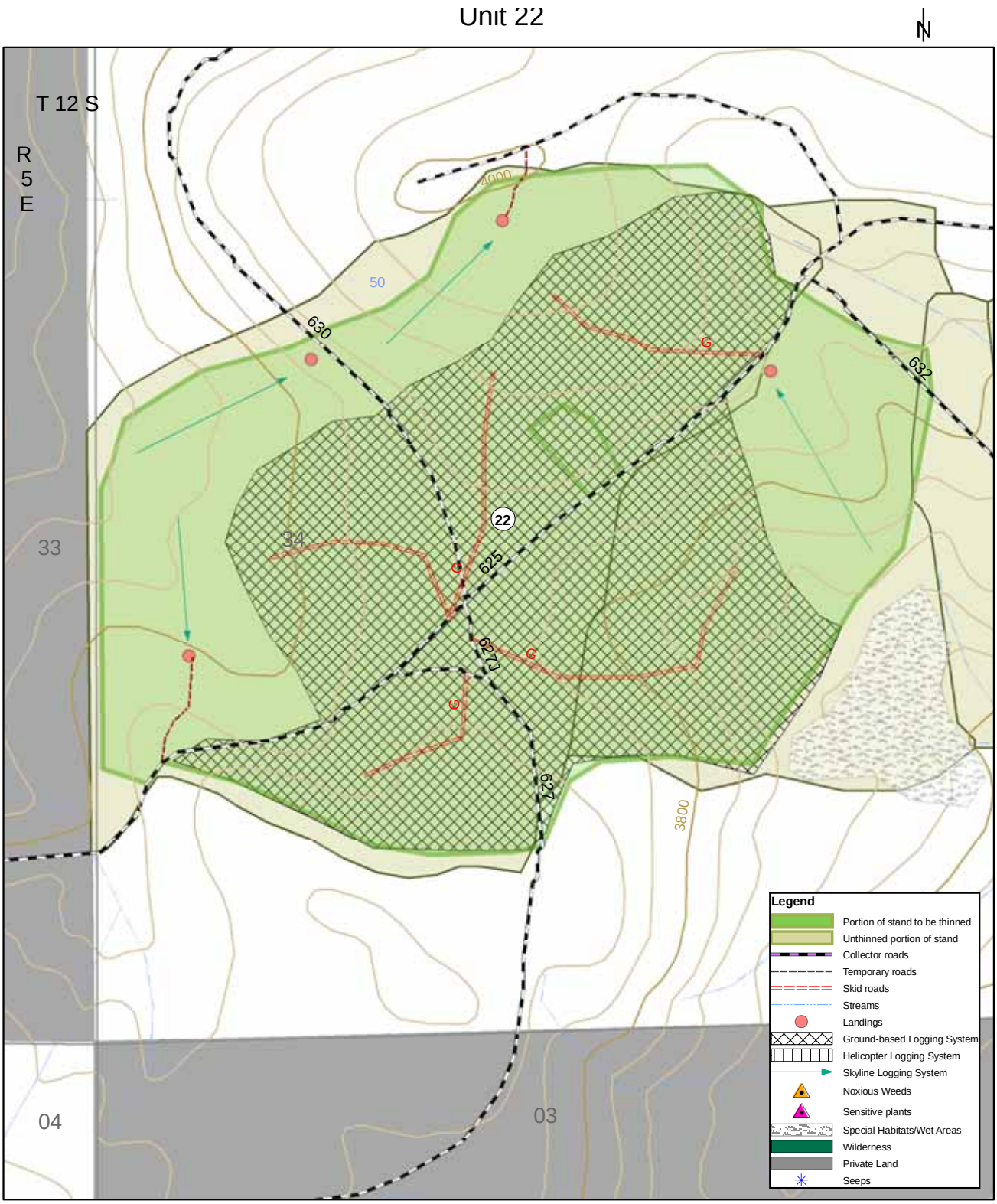


Figure 2 - Priority 1 Subsoiling Project (Map 2 of 2)



Priority 2: Invasive weed survey and treatment

Ground-disturbing activities, including commercial thinning, road reconstruction, temporary road construction, and landing sites can encourage the spread of invasive weeds by increasing light, providing a mineral soil seedbed, and spreading weed seed. Vehicles and logging equipment can inadvertently spread weed seed by carrying it into the area on tires and caked on mud.

The spread of invasive weeds will be minimized through preventative measures taken prior to, during, and after thinning operations. These include buffers around known weed sites, logging equipment washing, post-treatment survey and control, and pretreatment of existing weed sites.

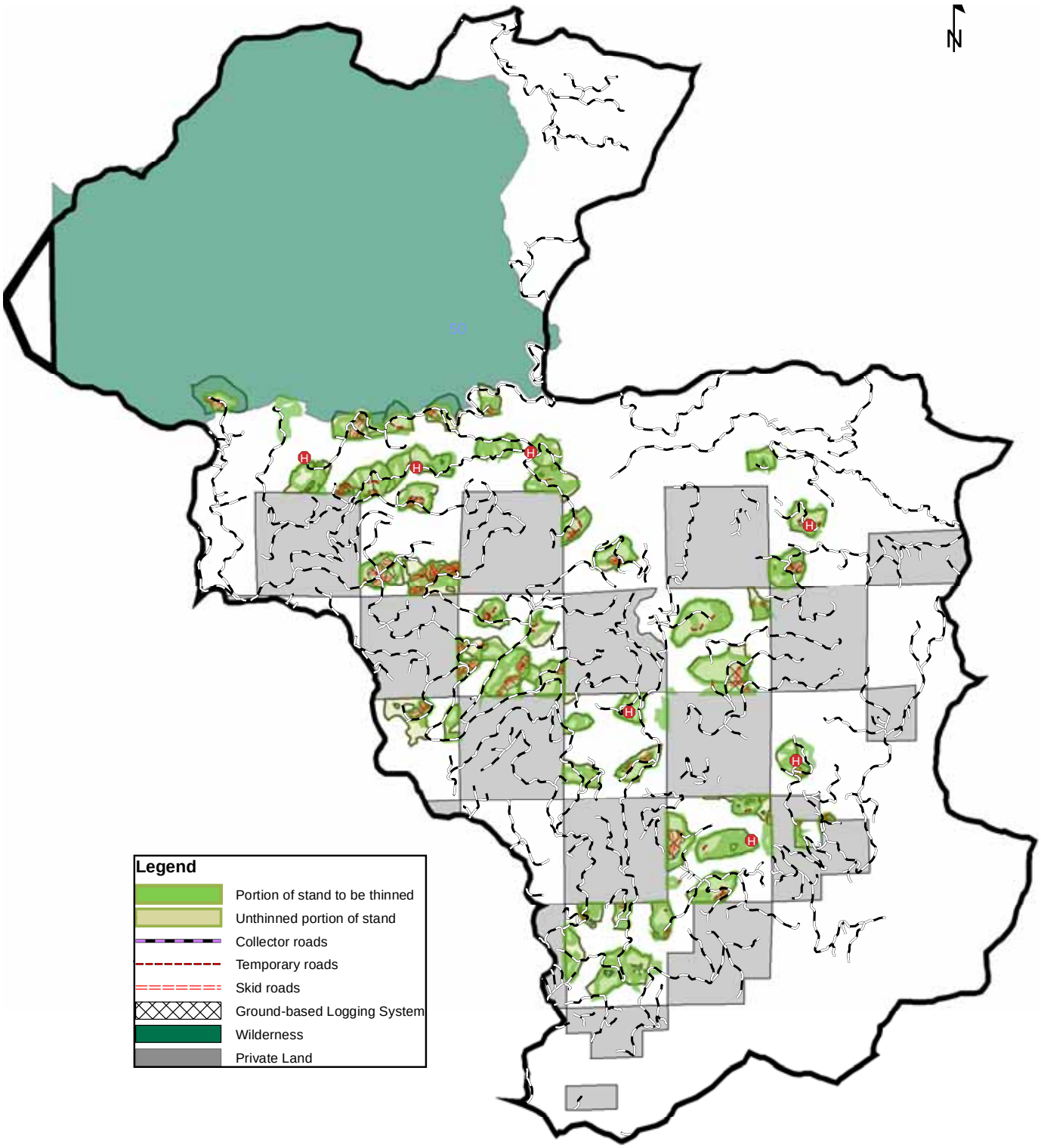
Monies will be collected from this project to survey the analysis area annually for five years for the presence of invasive weeds and to control their spread. Control methods will include manual removal and the release of insects for biological control. Herbicides will be used only as a last resort and may only be used in accordance with the current forest policies.

The following costs apply to all units, temporary roads, road reconstruction areas and landings. For Altenative 2 the harvest unit acres are 1549 acres and for Altenative 3 the harvest unit acres are 1412 acres.

Table 3 - Invasive Weed Survey and Control Costs

Activity	Alternative 2	Alternative 3
Invasive weed survey and control	$68,156 *$8/acre x (1.1 x 1549 acres/y)r x 5 yrs*	$62,128 *$8/acre x (1.1 x 1412 acres/y) x 5 yrs.*
Totals	**$68,156**	**$62,128**

Figure 3 - Priority 2 Invasive Weed Surveys (Map 1 of 1)



Priority 3: Snag and down wood creation

The wildlife prescription is to leave 5 additional trees per acre, over and above those retained in the silvicultural prescription. Snags will be created from approximately 2.1 of these retained leave trees per acre. These snags will be created using mechanical methods such as topping and/or girdling.

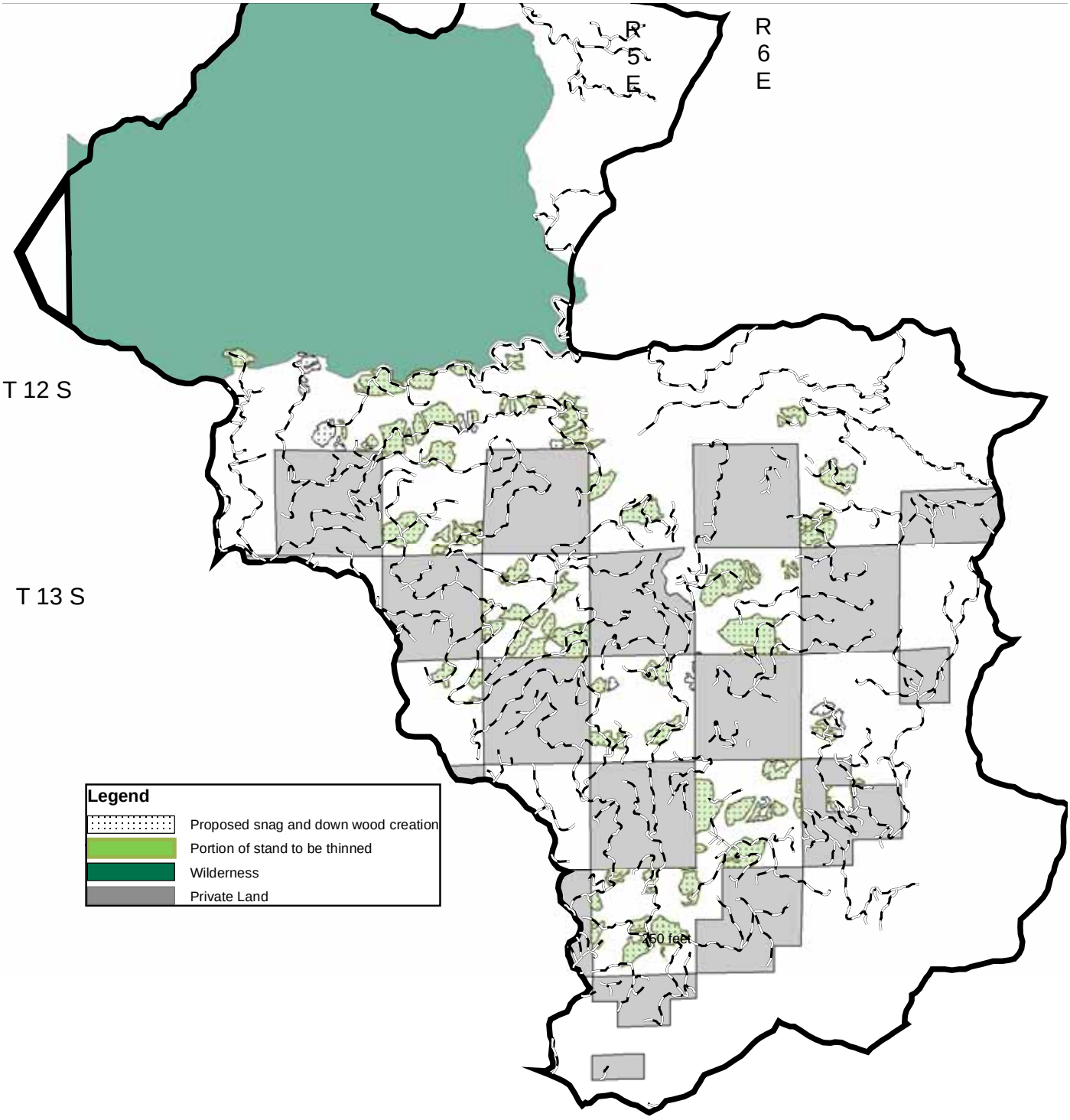
Down woody material will be created from approximately 3 of these retained trees per acre. Standing trees will be felled after harvest operatiions are complete.

The following costs apply to all units (Altenative 2 = 1549 acres and Altenative 3 = 1412 acres):

Table 4 – Snag and Down Wood Creation

Treatment	Alternative 2	Alternative 3
Tree topping/girdling	$162,465 *(2.1 trees/acre x 1549 acres x $50/tree)*	$148,260 *(2.1 trees/acre x 1412 acres x $50/tree)*
Down Wood Creation	$116,175 *(3 trees/acre x 1549 acres x $25/tree)*	$105,900 *(3 trees/acre x 1412 acres x $25/tree)*
Totals	**$278,640**	**$254,160**

Figure 4 - Priority 3 Snag and Down Wood Creation Sites (Map 1 of 1)



Priority 4: Planting DTR's and in Unit 7 adjacent to pond/wetland

In order to increase species diversity and to enccourge development of multiple canopy layers, the small openings (DTR's) created in harvest units would be planted with western redcedar.

In addition, western redcedar would be planted around a wetland in Unit 7. The planting would encompass about 2 acres in size.

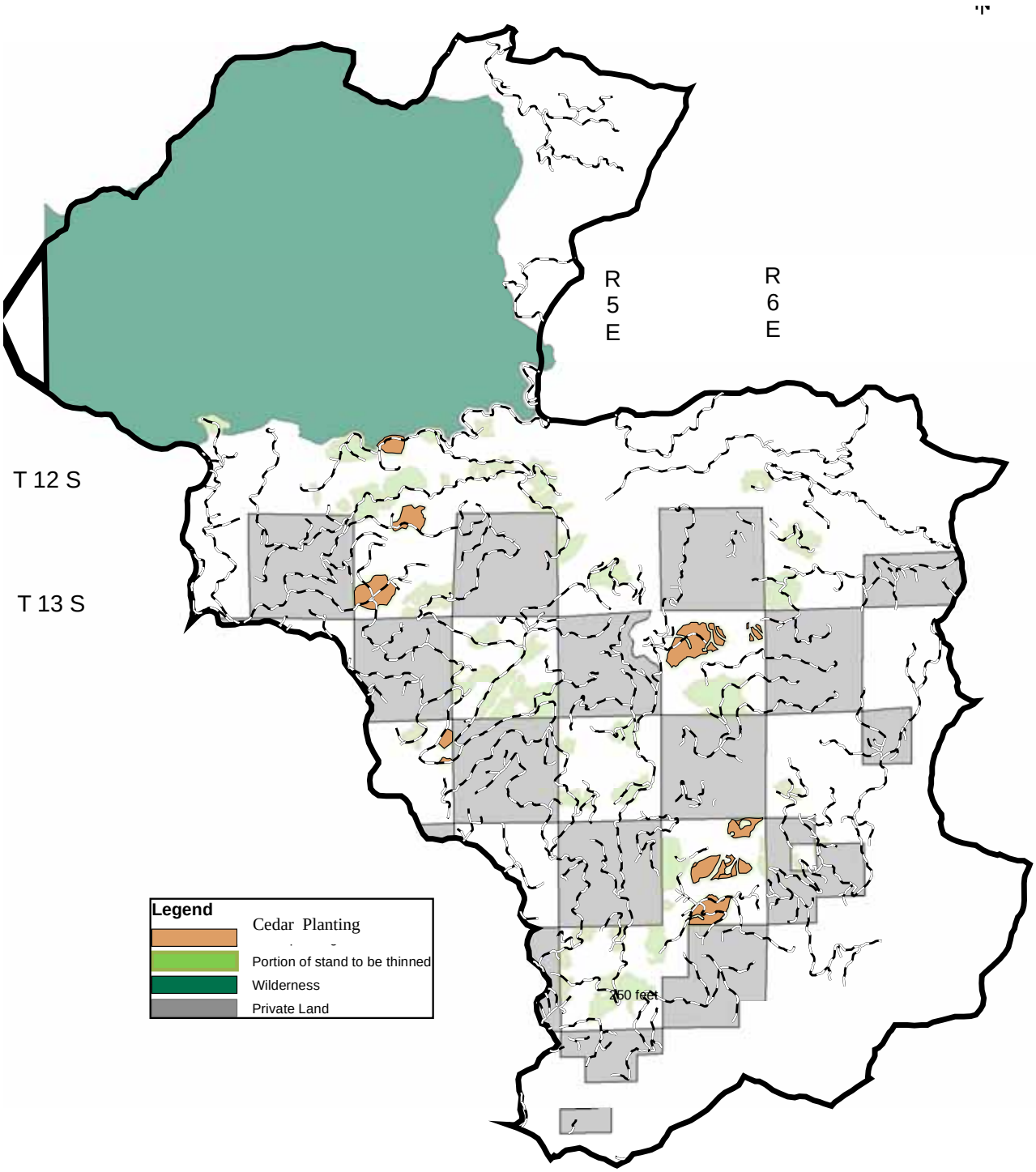
Table 5 - Units to be Planted

Unit Number	Alternative Two		Alternative 3	
	Total Acres in Unit	Acres of Small Openings (DTR's) Created Outside of Riparian Reserves	Total Acres in Unit	Acres of Small Openings (DTR's) Created Outside of Riparian Reserves
15	81	59	81	59
16	7	1	7	1
22	59	58	59	58
23	33	28	33	28
34	23	19	23	19
38	49	44	49	44
49	49	42	43	42
Totals	**301**	**251**	**295**	**251**
Unit Number	**Total Acres in Unit**	**Alternative 2 Acres to be planted**	**Total Acres in Unit**	**Alternative 3 Acres to be planted**
7	**13**	**2**	**13**	**2**
Totals	**13**	**2**	**13**	**2**

Table 6 - Planting Costs

Activity	Alternative 2	Alternative 3
Tree Planting in Small Openings (DTR's) *(10% of acres thinned outside of Riparian Reserves)*	$13,375 *($535/acre x 25 acres)*	$13,375 *($535/acre x 25 acre)*
Unit 7 planting cedar around wetland (2 acres)	$1070 *($535/acre x 2 acres)*	$1070 *($535/acre x 2 acres)*
Total	**$14,445**	**$14,445**

Figure 5 - Priority 4 Ceadar planting Areas (Map 1 of 1)



Priority 5: Gates and berms to close roads

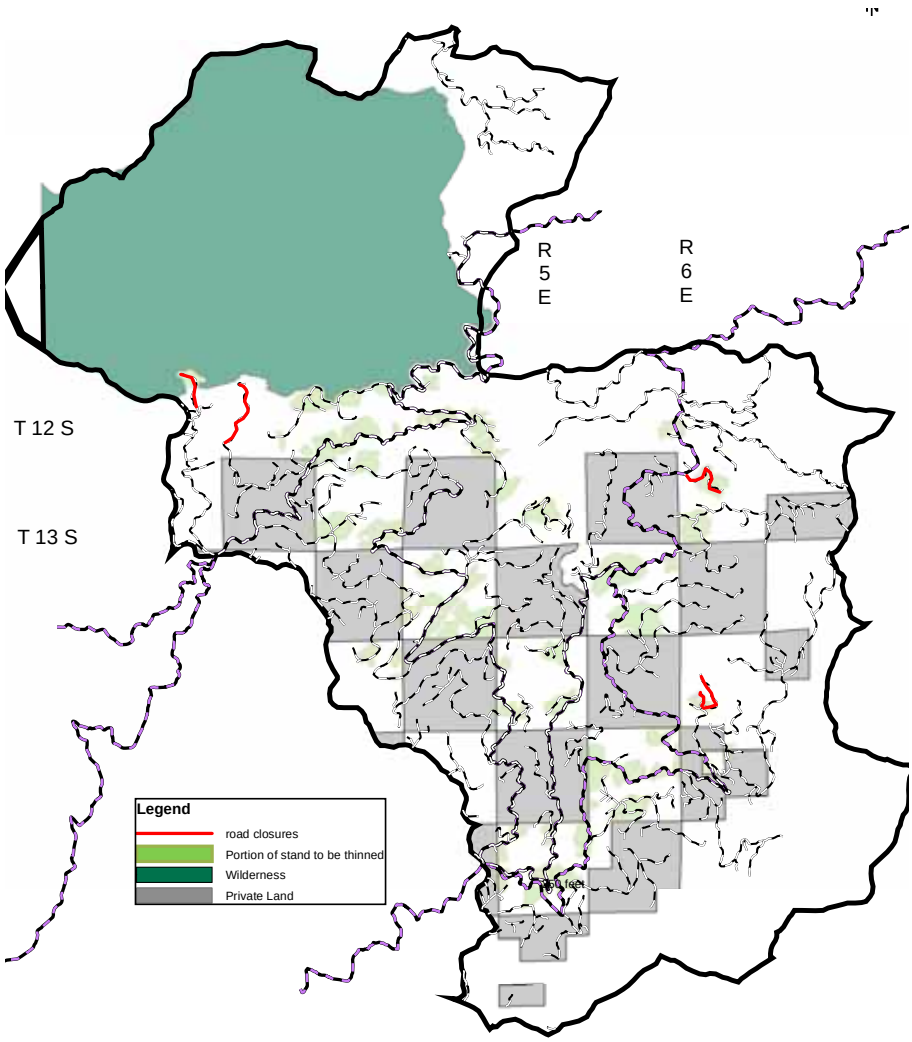
The following road closures are planned:

- **2047 846** – This road is already closed with a berm. It will be opened up with the sale and then returned to it's pre-harvest condition….bermed and stormproofed.
- **2049 640/643** – This road will be closed at the jct. with two closures one on the 640 and one on the 643. They will be closed with a berm and stormproofed.
- **2041 520** – The road will be closed with a gate just past the 526 jct.
- **2041 510** – The road will be closed with a gate just part the turnaround by trailhead.
-

Table 7 - Gate and Berm Costs

Activity	Alternative 2	Alternative 3
Install gate on 2041 520 and 2041 510	$2,000.00 *$1,000/gate x 2 gate2*	$2,000 *$1,000/gate x 2 gates*
Install berms on roads 2047 846, 2049 640, 2049 643	$1,000 *$500/berm x 2 berms*	$1000 *$500/berm x 2 berms*
Total	**$3,000**	**$3,000**

Figure 6 - Roads proposed for closure



Priority 6: Fisheries project to thin (and leave material) to improve size of future DWD in part of secondary shade zone not otherwise being treated.

Thin selected trees and leave them on-site within a portion of the Riparian Reserves on fish-bearing streams to stimulate tree growth for future down wood recruitment into stream.

Table 8 - Fisheries Thinning Project Costs

Activity	Alternative 2	Alternative 3
Unit 8 *(1500 ft long x 50 ft. wide) /43,560 ft^2/acre)*	$2,000 *(2 acres x $40 trees/acre cut x $25/tree)*	$2,000 *(2 acres x $40 trees/acre cut x $25/tree)*
Unit 10 *(2000 ft long x 72 ft wide) /43,560 ft^2/acre*	$3,000 *(3 acres x $40 trees/acre cut x $25/tree)*	$3,000 *(3 acres x $40 trees/acre cut x $25/tree)*
Unit 11 *(900 ft long x 50 ft wide)/43560 ft^2/acre*	$1,000 *(1 acres x $40 trees/acre cut x $25/tree)*	$1,000 *(1 acres x $40 trees/acre cut x $25/tree)*
Total	**$6,000**	**$6,000**

Figure 7 - Priority 6 Fisheries Project (Map 1 of 3)

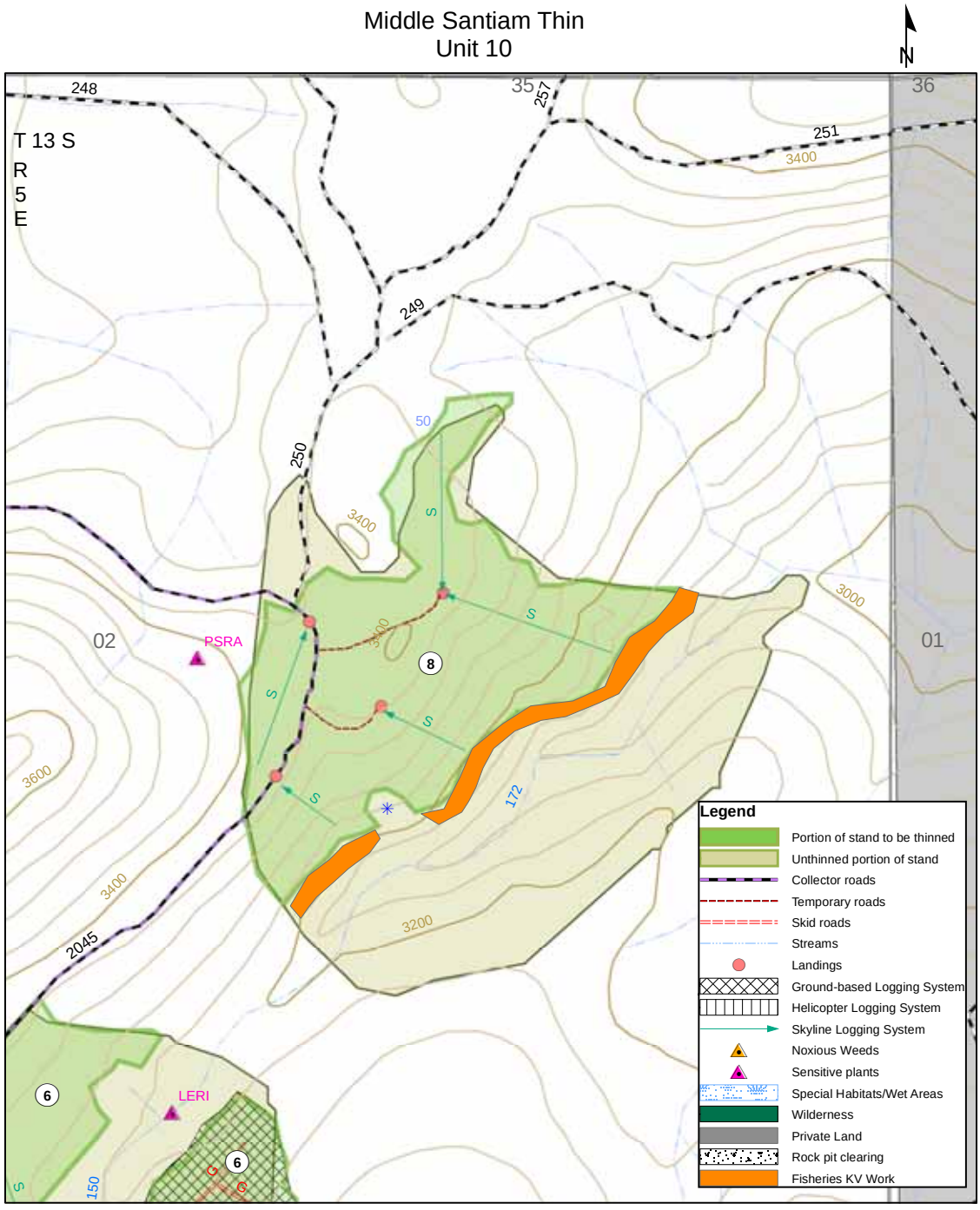


Figure 8 - Priority 6 Fisheries Project (Map 2 of 3)

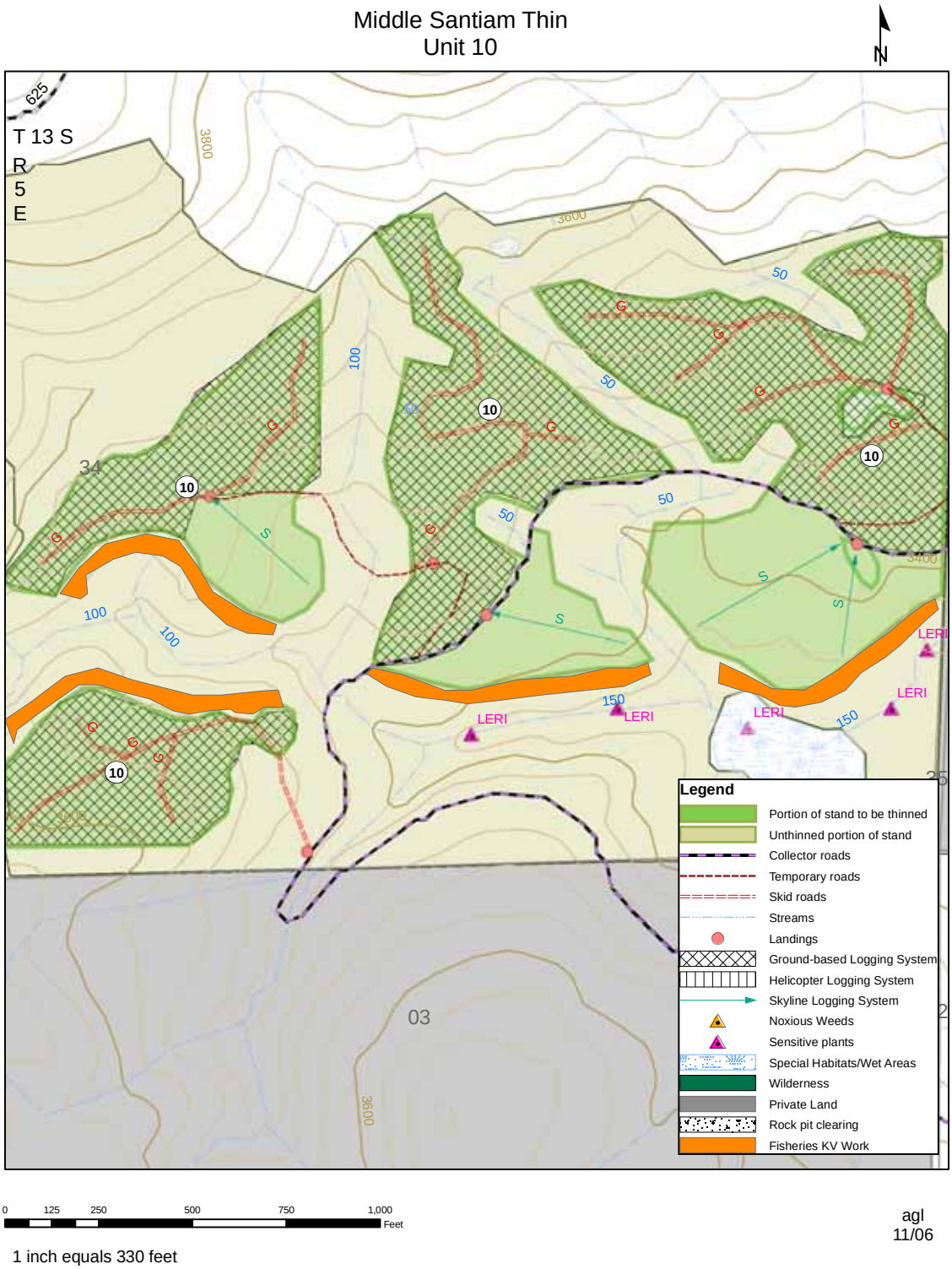
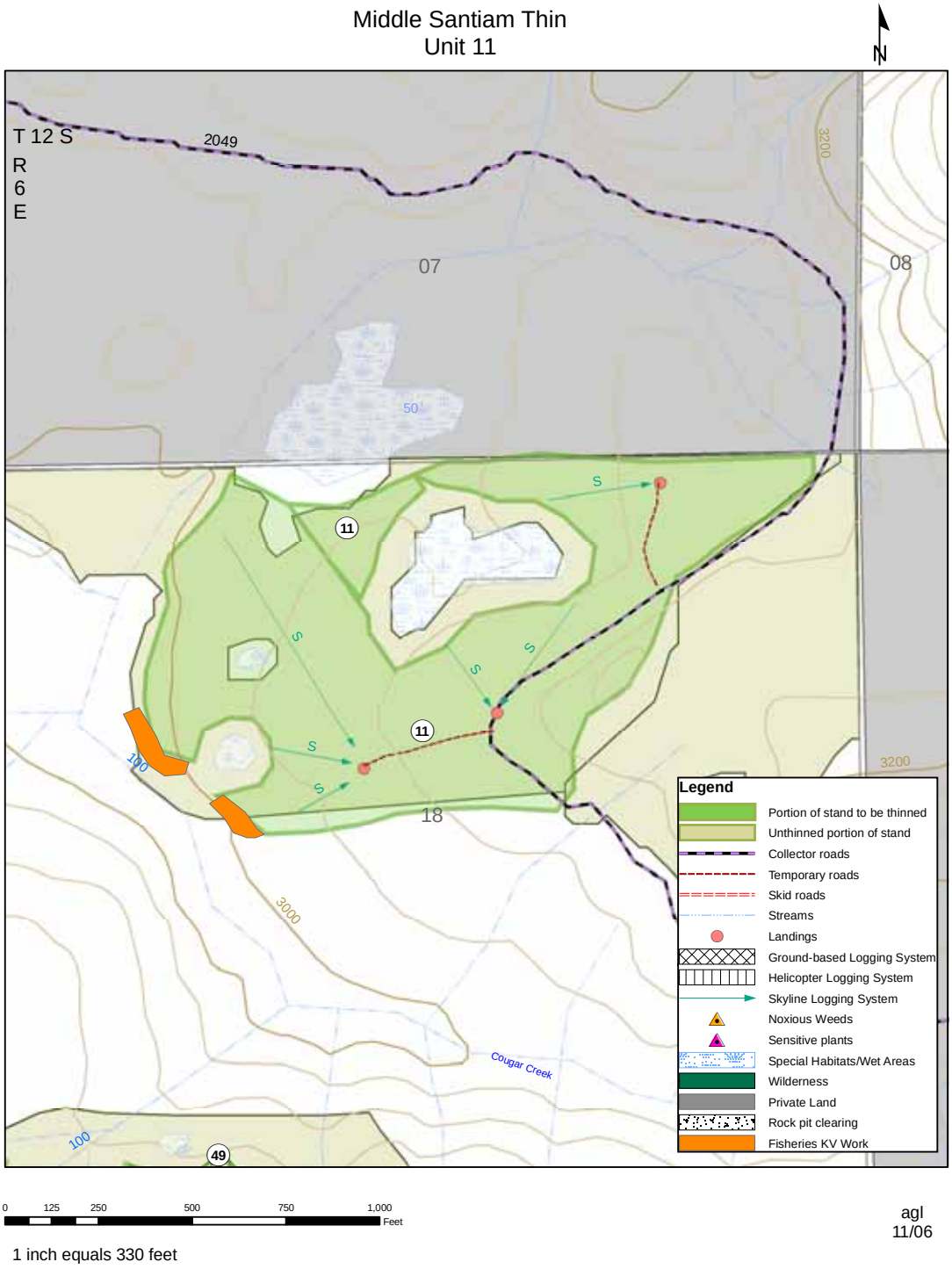


Figure 9 - Priority 6 Fisheries Project (Map 3 of 3)



Priority 7: TSI – precommercial thinning

Precommercial thinning is prescribed to enhance species diversity, prolong early seral stage stand structure, increase growth rate of dominant trees, and reduce stand densities to Regional and Forest guidelines. See table and map that follows for managed stand information and location of precommercial thinning opportunities.

Table 9 - Proposed Precommercial Thinning Stands and Acres

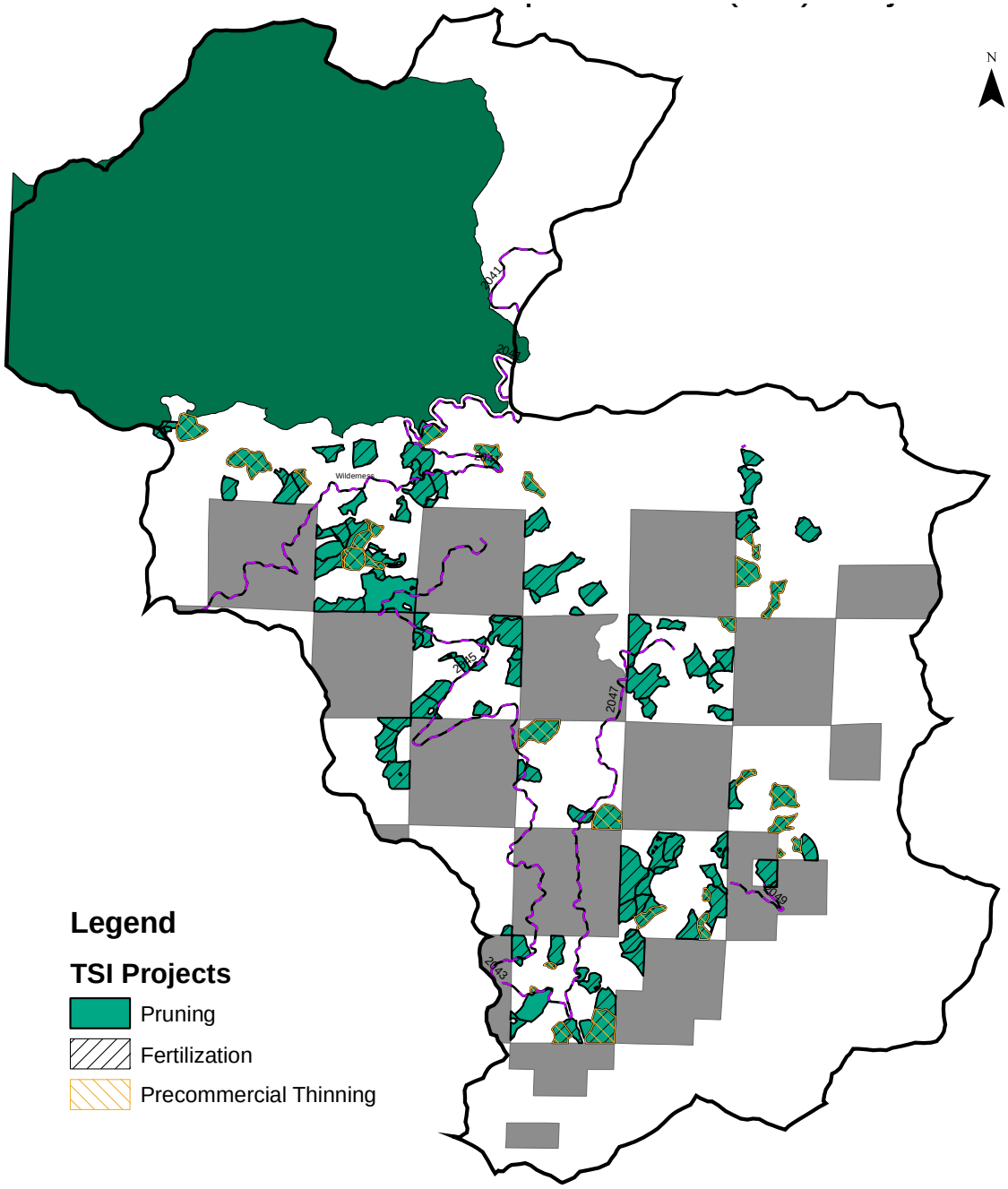
Middle Santiam Thin Unit Number (Alts. 2 and 3)	Stands within ¼ mile of Middle Santiam harvest units	Proposed Acres of Precommercial Thinning
Unit 1	3002060	5
Unit 2	3002104	1
Unit 4	3001583	37
Unit 12	3001317	17
Unit 15	3001382	13
Unit 17	3001729	31
Unit 19	3001278	7
Unit 19	3001240	22
Unit 19	3001291	27
Unit 22	3004395	2
Unit 22	3004170	20
Unit 22	3001300	5
Unit 23	3004171	5
Unit 23	3001264	12
Unit 27	3001124	17
Unit 28	3001159	12
Unit 30	3001175	5
Unit 31	3001143	34
Unit 32	3001097	32
Unit 33	3001081	17
Unit 38	3001938	17
Unit 38	3001971	7
Unit 38	3001962	3
Unit 43	3001797	3
Unit 43	3004116	1
Unit 44	3001684	25
Unit 44	3001737	12
Unit 44	3001654	6
Unit 46	3002131	46

Middle Santiam Thin Unit Number (Alts. 2 and 3)	Stands within ¼ mile of Middle Santiam harvest units	Proposed Acres of Precommercial Thinning
Unit 46	3002166	19
Unit 49	3001911	3
	Totals	**463**

Table 10 - Precommercial Thinning Costs

Activity	Alternative 2	Alternative 3
TSI precommercial thinning	$94,915 *($205/acre x 463 acres)*	$94,915 *($205/acre x 463 acres)*
Total	**$94,915**	**$94,915**

Figure 10 - Priority 7 TSI Precommercial Thinning Areas (Map 1 of 1)



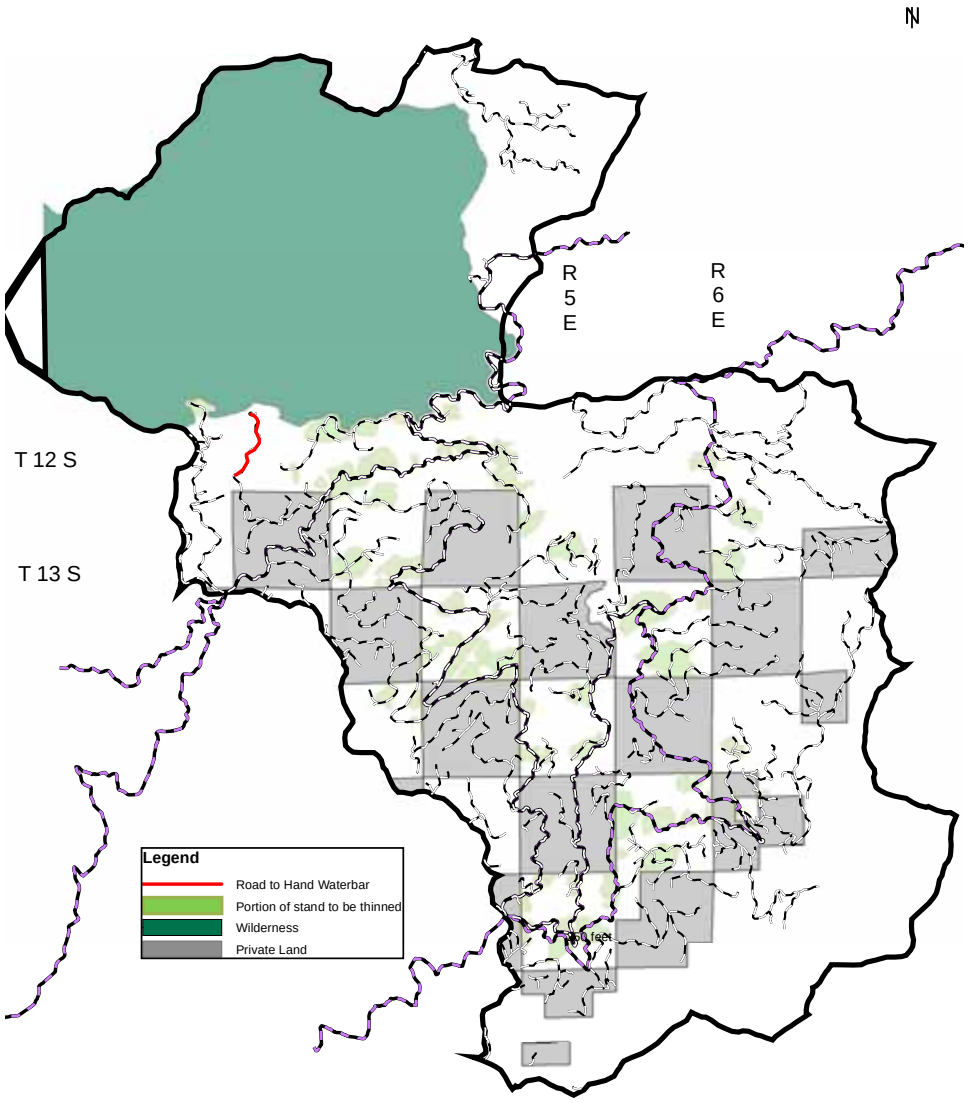
Priority 8: Waterbar 2041 515 road by hand

Road 2041 515 is already closed by a slide and is not passable to equipment to decommission the road. Collect money from the sale to hand dig waterbars/put in cross drains to storm proof the road.

Table 11 - Road waterbarring costs

Activity	Alternative 2	Alternative 3
Hand waterbar/stormproof road 2041 515 within ¼ mile of Unit 31	$12,000 *(10-person crew @$2,000/day x 6 days to make about 40 waterbars in 0.8 miles of road)*	$0
Total	**$12,000**	**$0**

Figure 11 - Priority 8 Road 515 Hand Waterbar Project (Map 1 of 1)



Priority 9: Dispersed Recreation Site Development

There are road closures planned to reduce road density. Road closures will reduce the number of dispersed campsites available so will be evaluated for new dispersed recreation site opportunities near the closure in front of planned berms and gates. Two dispersed site locations will be collected for at $500 per site in both action alternatives. See road closure map above.

Table 12 – Dispersed recreation site development costs

Activity	Alternative 2	Alternative 3
Dispersed recreational sites At closure on 2047 846 road and 2049 640 and 643 jct.	$1,000 *($500/site x 2 sites)*	$1,000 *($500/site x 2 sites)*
Total	**$1,000**	**$1,000**

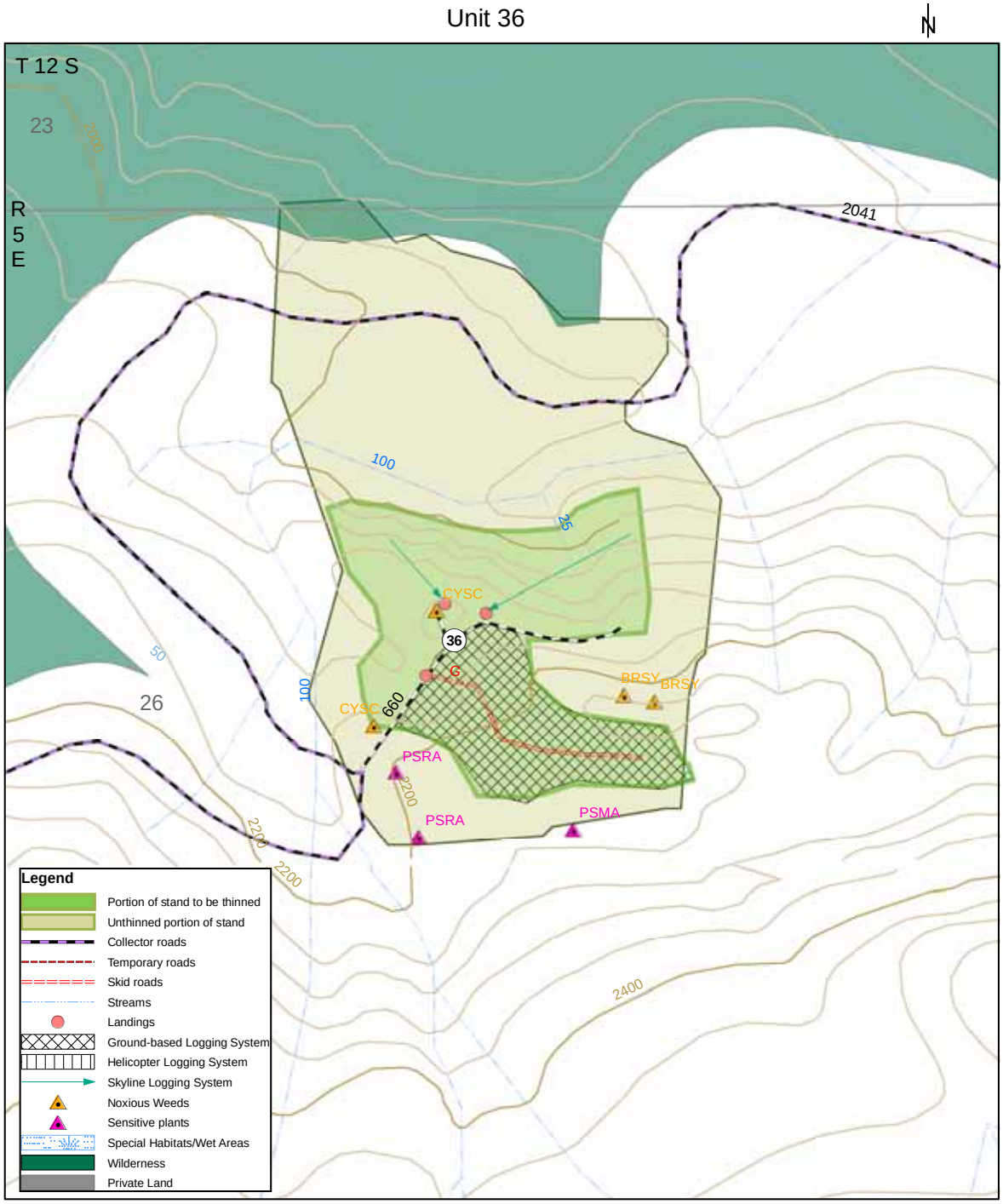
Priority 10: The trailheads at the end of Forest Roads 2041 and 2041-646 should be moved across the creek after harvest operations in unit Unit 36 are completed in Alternative 3 (only)..

Under Alternative 3, the portion of the road that is washed out would be reconstructed. The trailhead needs to be moved on the other side of the creek if this alternative is selected. The current trailhead is very small and with through traffic on the road, it would be best to move the trailhead.

Table 13 - Trailhead Reconstruction Costs

Activity	Alternative 2	Alternative 3
Trailhead reconstruction	$0	$3,000 *(2 days with cat and operator @ $1500 per day)*
Total	**$0**	**$3,000**

Figure 12 - Priority 10 Trailhead Relocation



Priority 11: Subsoiling in ground-based units where S and G's are not exceeded

Portions of units that were logged with ground-based yarding systems will be subsoiled to minimize soil compaction. It is estimated that compaction in these units will not exceed standards and guidelines of 20% so this work in not mitigation for the timber sale as in Priority 1 above.

In addition to ground-based harvest units, portions of some skyline and helicopter landings would be subsoiled in Alternative 2. The same ground-based units would be subsoiled in Alternative 3, but there are fewer skyline landings and no helicopter landings in this alternative.

A collection will be made for 10% of the acres where ground-based logging systems are used and for a portion of landings not on rocked roads, etc.

Subsoiled areas will be seeded with native seed to minimize erosion and risk of invasive weed establishment on disturbed ground.

Table 14 - Units and Acres to be Subsoiled (non-mitigation)

Alternative Two			Alternative 3		
Unit Number	**Acres of ground-based harvest**	**Acres to be Subsoiled**	**Unit Number**	**Acres of ground-based harvest**	**Acres to be Subsoiled**
1	2		1	2	
5	4		5	4	
6*	24		6*	24	
9	3		9	3	
10	30		10	30	
12	11		12	11	
14*	33		14*	33	
16	2		16	2	
17	14		17	14	
21	2		21	2	
22	38		22	38	
23	7		23	7	
25	5		25	5	
29	8		29	8	
32	9		32	9	

Alternative Two			Alternative 3		
Unit Number	**Acres of ground-based harvest**	**Acres to be Subsoiled**	**Unit Number**	**Acres of ground-based harvest**	**Acres to be Subsoiled**
33	7		33	7	
35*	21		35*	21	
			36	4	
37	3		37	3	
38	6		38	6	
41	22		41	22	
42	14		42	14	
43	3		43	3	
44	4		44	4	
47	3		47	3	
48*	22		48*	22	
52	6		52	6	
99	**307**		**99**	**311**	

**highest priority units.*

Table 15 - Subsoiling and Seeding Costs

Activity	Alternative 2	Alternative 3
Subsoil 43 acres *(about 10% of ground-based thinning acres, plus landings not on rocked roads, plus helicopter landings)*	$17,200 *($400/acre x 43 acres)*	$16,400 *($400/acre x41 acres)*
Seeding subsoiled areas with native seed	$25,800 *($600/acre x 43 acres)*	$24,600 *($600/acre x 41 acres)*
Total	**$43,000**	**$41,000**

Priority 12: TSI Fertilization

Aerial fertilization is prescribed at a rate of approximately 440 lbs. per acre, according to Regional and Forest guidelines. Fertilization will increase tree growth and improve forage conditions for wildlife. See table and map under Priority 7 for managed stand information and location of aerial fertilization opportunities.

Table 16 - Fertilization Costs

Activity	Alternative 2	Alternative 3
TSI fertilization	$193,380 *($110/acre x 1758 acres)*	$193,380 *($110/acre x1758 acres)*
Total	**$193,380**	**$193,380**

Priority 13: TSI Pruning

Pruning is prescribed for 1873 acres of managed second growth stands within ¼ mile of proposed Middle Santiam Thinning unit. *See map and table under priority 7.*

Table 17 - Pruning Costs

Activity	Alternative 2	Alternative 3
TSI pruning	$445,774 *$238/acre x 1873 acres*	$ 445,774 *$238/acre x 1873 acres*
Total	**$445,774**	**$445,774**

The following timber stand improvement treatments are prescribed for the units listed below in accordance with the Forest Plan.

Table 18 - Fertilization and Pruning Units

Middle Santiam Thin Unit Number	Numbers of Stands within ¼ mile of harvest units	Proposed Activity	
		Pruning Acres	Fertilization Acres
Unit 1	3002015	19	19
	3002060	5	5
Unit 2	3002104		1
	3002105	30	
	3002140	16	16
Unit 3	3001145	26	26
Unit 4	3001583	37	37
	3001648		
Unit 5	3001469	10	10
	3001560	11	11
Unit 6	3001477	8	8
	3001540	27	27
Unit 7	3001622	15	15
	3001660	30	30
Unit 8	3001393	5	5
	3001401	45	45
	3001431	3	3
	3001456	7	7
Unit 9	3001396	22	22
	3001427	4	4
Unit 10	3001329	16	
	3001321	8	8
Unit 11	3001791	14	14
	3001802	22	22
	3001828	1	1
Unit 12	3001317	17	17
Unit 14	3001534	14	14
	3001488	4	4
	3001539	12	12
Unit 15	3001426	29	29
	3001382	13	13
	3001389	32	32

Middle Santiam Thin Unit Number	Numbers of Stands within ¼ mile of harvest units	Proposed Activity	
		Pruning Acres	Fertilization Acres
Unit 16	3001437	23	23
	3001385	6	6
	3001461	4	4
Unit 17	3001733	15	15
	3001729	31	31
Unit 19	3001228	21	21
	3001278	7	7
	3001240	22	22
	3001291	27	27
Unit 20	3001088	28	28
	3001141	1	1
Unit 21	3002010	21	21
Unit 22	3001361	30	30
	3001304	22	22
	3004395	2	2
	3004170	20	20
	3001349	2	
	3001300	5	5
	3001289	36	36
Unit 23	3004171	5	5
	3001264	12	12
	3001261	30	30
	3001271	12	12
	3001280	38	
	3001276	2	2
	3001230	16	16
Unit 25	3001221	12	
Unit 26	3001151	4	4
	3001170	20	20
	3001168	28	28
Unit 27	3001124	17	17
Unit 28	3001159	12	12
Unit 29	3001239	22	22
Unit 30	3001201	21	21
	3001173	16	16

Middle Santiam Thin Unit Number	Numbers of Stands within ¼ mile of harvest units	Proposed Activity	
		Pruning Acres	Fertilization Acres
Unit 30	3001190	23	23
	3001185	13	13
	3001175	5	5
Unit 31	3001143	34	34
Unit 32	3001102	4	4
	3001080	4	4
	3001097	32	32
	3001104	17	17
Unit 33	3001081	17	17
	3001077	2	
Unit 34	3001115	24	24
Unit 35	3001129	15	15
Unit 38	3001938	17	17
	3001918	8	
	3001951	18	18
	3001971	7	7
	3001962	3	3
	3001908	47	47
Unit 41	3001513	18	18
	3001463	8	8
Unit 42	3001587	18	18
	3001605	16	16
Unit 43	3001774	25	25
	3001797	3	3
	3004116	1	1
	3001850	25	25
	3004117	2	2
Unit 44	3001679	12	12
	3001684	25	25

Middle Santiam Thin Unit Number	Numbers of Stands within ¼ mile of harvest units	Proposed Activity	
		Pruning Acres	Fertilization Acres
Unit 44	3001737	12	12
	3001654	6	6
Unit 46	3002070	5	5
	3002079	14	14
	3002097	21	21
	3002131	46	46
	3002155	8	
	3002152	9	9
	3002166	19	19
Unit 47	3001989	2	2
	3001987	16	16
	3002018	18	18
Unit 48	3001884	17	17
	3004229	21	21
	3001923	13	13
Unit 49	3001867	16	16
	3001911	3	3
	3001880	4	4
Unit 52	3001292	61	61
	3001331	22	22
	3001371	5	5
	Totals	**1873**	**1758**

Priority 14: *Firewood*

A collection will be made to provide firewood for public use after the timber sale. The estimated the cost of the collection is $4,000.

Table 19 - Firewood Costs

Activity	Alternative 2	Alternative 3
Firewood program admin. costs	*$8,000* *($4,000/sale x 2 sales)*	*$8,000* *($4,000/sale x 2 sales)*
Total	**$8,000**	**$8,000**

S*ummary*

In the event that the proposed timber sale does not generate sufficient funds to cover all the recommended KV projects, the projects will be funded in the following priority:

Table 20 - Post Sale Project Priorities

Priority	Type of Project	Alternative 2 Costs	Alternative 3 Costs
1	Subsoiling and seeding to be within Forest Plan S and G's.	$12,000	$12,000
2	Invasive weed survey and treatment	$68,156	$62,128
3	Snag and down wood creation	$278,640	$254,160
4	Underplanting DTR's and in Unit 7 adjacent to pond/wetland and in Unit 10	$14,445	$14,445
5	Gates and berms to close roads	$3,000	$3,000
6	Fisheries project to thin (and leave material) to improve size of future DWD in part of secondary shade zone not otherwise being treated.	$6,000	$6,000
7	TSI – precommercial thinning	$94,915	$94,915
8	Waterbar 2041 515 road by hand	$12,000	$0
9	Landings should be cleaned up and made useable for dispersed recreational activities. Berms placed on closed roads should be placed such that area could be made useable for dispersed recreational activities.	$1,000	$1,000
10	The trailheads at the end of Forest Roads 2041 and 2041-646 should be reconstructed after harvest operations in unit Unit 36 are completed.	$0	$3,000
11	Subsoiling in ground-based units where S and G's are not exceeded	$43,000	$41,000
12	TSI - fertilization	$193,380	$193,380
13	TSI - pruning	$445,774	$445,774
14	Firewood (Sheep Creek Saddle)	$8,000	$8,000
	Totals	**$1,180,310**	**$737,802**

NET VOLUME INPUT SCREEN - CURRENT ENTRY

Version 5.2 (5/1/05) - R6

Sale/alternative **Middle Santiam Thin Alternative 2** Forest/district: **Willamette/Sweet Home** Date: **12/4/2006**

Volume type - *select*: **CCF**

Unit	Acres	Percent Fiber	Total Unit Volumes By Species - *Select*						Total Volume R/W	Total Volume
			westside doug-fir	western hemlock	noble fir					
1	11	1.0%	165	22	33					220
2	20	1.0%	180	80	140					400
3	24	1.0%	408	48	24					480
4	14	1.0%	238	14	28					280
5	52	1.0%	832	52	156					1,040
6	59	1.0%	944	118	118					1,180
7	13	1.0%	234	13	13					260
8	17	1.0%	306	17	17					340
9	21	1.0%	336	21	63					420
10	40	1.0%	680	40	80					800
11	22	1.0%	374	22	44					440
12	48	1.0%	816	48	96					960
13	7	1.0%	119	7	14					140
14	98	1.0%	1,666	98	196					1,960
15	81	1.0%	1,377	81	162					1,620
16	7	1.0%	119	7	14					140
17	34	1.0%	578	34	68					680
18	27	1.0%	459	27	54					540
19	43	1.0%	731	43	86					860
20	18	1.0%	306	18	36					360
21	11	1.0%	187	11	22					220
22	59	1.0%	1,003	59	118					1,180
23	33	1.0%	561	33	66					660
24	30	1.0%	510	30	60					600
25	51	1.0%	867	51	102					1,020
26	58	1.0%	986	58	116					1,160
27	24	1.0%	408	24	48					480
28	29	1.0%	493	29	58					580
29	28	1.0%	476	28	56					560
30	31	1.0%	527	31	62					620
31	22	1.0%	374	22	44					440
32	20	1.0%	340	20	40					400
33	13	1.0%	221	13	26					260
34	23	1.0%	391	23	46					460
35	45	1.0%	765	45	90					900
36	10	1.0%	170	10	20					200
37	15	1.0%	255	15	30					300
38	49	1.0%	833	49	98					980
41	38	1.0%	646	38	76					760
42	16	1.0%	272	16	32					320
43	3	1.0%	51	3	6					60
44	36	1.0%	612	36	72					720
46	76	1.0%	1,292	76	152					1,520
47	28	1.0%	476	28	56					560
48	58	1.0%	986	58	116					1,160
49	49	1.0%	833	49	98					980
52	38	1.0%	646	38	76					760
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Tots or avgs	1,549	1.0%	26,049	1,703	3,228	0	0	0	0	30,980

NET VOLUME INPUT SCREEN - FUTURE ENTRY

Version 5.2 - R6

Sale Name: **Middle Santiam Thin Alternative 2** Forest/district: **Willamette/Sweet Home** Date: **12/4/2006**

Volume type: **CCF**

goto current

Unit	Acres	Percent Fiber	Total Unit Volumes By Species						Total Volume R/W	Total Volume
			westside doug-fir	western hemlock	noble fir					
Totals	0	0.0%	0	0	0	0	0	0	0	0

	SPECIES PERCENTS - UNITS ONLY						FINAL UNIT VOLUMES - IN				
UNIT	205	263	22	0	0	0	205	263	22	0	0
1	0.75	0.1	0.15	0	0	0	163	22	33	0	0
2	0.45	0.2	0.35	0	0	0	178	79	139	0	0
3	0.85	0.1	0.05	0	0	0	404	48	24	0	0
4	0.85	0.05	0.1	0	0	0	236	14	28	0	0
5	0.8	0.05	0.15	0	0	0	824	51	154	0	0
6	0.8	0.1	0.1	0	0	0	935	117	117	0	0
7	0.9	0.05	0.05	0	0	0	232	13	13	0	0
8	0.9	0.05	0.05	0	0	0	303	17	17	0	0
9	0.8	0.05	0.15	0	0	0	333	21	62	0	0
10	0.85	0.05	0.1	0	0	0	673	40	79	0	0
11	0.85	0.05	0.1	0	0	0	370	22	44	0	0
12	0.85	0.05	0.1	0	0	0	808	48	95	0	0
13	0.85	0.05	0.1	0	0	0	118	7	14	0	0
14	0.85	0.05	0.1	0	0	0	1,649	97	194	0	0
15	0.85	0.05	0.1	0	0	0	1,363	80	160	0	0
16	0.85	0.05	0.1	0	0	0	118	7	14	0	0
17	0.85	0.05	0.1	0	0	0	572	34	67	0	0
18	0.85	0.05	0.1	0	0	0	454	27	53	0	0
19	0.85	0.05	0.1	0	0	0	724	43	85	0	0
20	0.85	0.05	0.1	0	0	0	303	18	36	0	0
21	0.85	0.05	0.1	0	0	0	185	11	22	0	0
22	0.85	0.05	0.1	0	0	0	993	58	117	0	0
23	0.85	0.05	0.1	0	0	0	555	33	65	0	0
24	0.85	0.05	0.1	0	0	0	505	30	59	0	0
25	0.85	0.05	0.1	0	0	0	858	50	101	0	0
26	0.85	0.05	0.1	0	0	0	976	57	115	0	0
27	0.85	0.05	0.1	0	0	0	404	24	48	0	0
28	0.85	0.05	0.1	0	0	0	488	29	57	0	0
29	0.85	0.05	0.1	0	0	0	471	28	55	0	0
30	0.85	0.05	0.1	0	0	0	522	31	61	0	0
31	0.85	0.05	0.1	0	0	0	370	22	44	0	0
32	0.85	0.05	0.1	0	0	0	337	20	40	0	0
33	0.85	0.05	0.1	0	0	0	219	13	26	0	0
34	0.85	0.05	0.1	0	0	0	387	23	46	0	0
35	0.85	0.05	0.1	0	0	0	757	45	89	0	0
36	0.85	0.05	0.1	0	0	0	168	10	20	0	0
37	0.85	0.05	0.1	0	0	0	252	15	30	0	0
38	0.85	0.05	0.1	0	0	0	825	49	97	0	0
41	0.85	0.05	0.1	0	0	0	640	38	75	0	0
42	0.85	0.05	0.1	0	0	0	269	16	32	0	0
43	0.85	0.05	0.1	0	0	0	50	3	6	0	0
44	0.85	0.05	0.1	0	0	0	606	36	71	0	0
46	0.85	0.05	0.1	0	0	0	1,279	75	150	0	0
47	0.85	0.05	0.1	0	0	0	471	28	55	0	0
48	0.85	0.05	0.1	0	0	0	976	57	115	0	0
49	0.85	0.05	0.1	0	0	0	825	49	97	0	0
52	0.85	0.05	0.1	0	0	0	640	38	75	0	0
	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
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	SPECIES PERCENTS - UNITS ONLY						FINAL UNIT VOLUMES - IN				
UNIT	westside doug-fir	western hemlock	noble fir				westside doug-fir	western hemlock	noble fir		
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
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0	0	0	0	0	0	0	0	0	0	0	0
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0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0

CLUDES	R/W	
0	**fiber**	**total**
0	2	220
0	4	400
0	4	480
0	2	280
0	11	1,040
0	11	1,180
0	2	260
0	3	340
0	4	420
0	8	800
0	4	440
0	9	960
0	1	140
0	20	1,960
0	17	1,620
0	1	140
0	7	680
0	6	540
0	8	860
0	3	360
0	2	220
0	12	1,180
0	7	660
0	6	600
0	11	1,020
0	12	1,160
0	4	480
0	6	580
0	6	560
0	6	620
0	4	440
0	3	400
0	2	260
0	4	460
0	9	900
0	2	200
0	3	300
0	9	980
0	7	760
0	3	320
0	1	60
0	7	720
0	16	1,520
0	6	560
0	12	1,160
0	9	980
0	7	760
0	0	
0	0	
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vol type
MBF
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C L U D E S R/W		
	fiber	total
0	0	
0	0	
0	0	
0	0	
0	0	
0	0	
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0	0	

Dropdown table

Sp Name	Code
fiber	2
white fir	15
grand fir	17
sub alpine	19
noble fir	22
pacific silve	25
larch	70
incense ced	81
lodgepole p	108
w. white pin	117
sugar pine	119
ponderosa	122
eastside do	204
westside do	205
w. red ceda	242
western her	263
mountain he	264
hardwoods	350

Species code layout table

1	2	3	4	5	6	7
205	263	22	0	0	0	2

NET UNIT VOLUMES BY SPECIES - CURRENT ENTRY

Version 5.2 - R6

Sale/alternative: Middle Santiam Thin Alternative 2 Forest/district: **Willamette/Sweet Home** Date: **12/4/2006**

Volume type: **CCF**

Unit	Acres	Total Unit Volumes By Species - CCF							Total Volume
		westside doug-fir	western hemlock	noble fir				fiber	
1	11	163	22	33	0	0	0	2	220
2	20	178	79	139	0	0	0	4	400
3	24	404	48	24	0	0	0	4	480
4	14	236	14	28	0	0	0	2	280
5	52	824	51	154	0	0	0	11	1,040
6	59	935	117	117	0	0	0	11	1,180
7	13	232	13	13	0	0	0	2	260
8	17	303	17	17	0	0	0	3	340
9	21	333	21	62	0	0	0	4	420
10	40	673	40	79	0	0	0	8	800
11	22	370	22	44	0	0	0	4	440
12	48	808	48	95	0	0	0	9	960
13	7	118	7	14	0	0	0	1	140
14	98	1,649	97	194	0	0	0	20	1,960
15	81	1,363	80	160	0	0	0	17	1,620
16	7	118	7	14	0	0	0	1	140
17	34	572	34	67	0	0	0	7	680
18	27	454	27	53	0	0	0	6	540
19	43	724	43	85	0	0	0	8	860
20	18	303	18	36	0	0	0	3	360
21	11	185	11	22	0	0	0	2	220
22	59	993	58	117	0	0	0	12	1,180
23	33	555	33	65	0	0	0	7	660
24	30	505	30	59	0	0	0	6	600
25	51	858	50	101	0	0	0	11	1,020
26	58	976	57	115	0	0	0	12	1,160
27	24	404	24	48	0	0	0	4	480
28	29	488	29	57	0	0	0	6	580
29	28	471	28	55	0	0	0	6	560
30	31	522	31	61	0	0	0	6	620
31	22	370	22	44	0	0	0	4	440
32	20	337	20	40	0	0	0	3	400
33	13	219	13	26	0	0	0	2	260
34	23	387	23	46	0	0	0	4	460
35	45	757	45	89	0	0	0	9	900
36	10	168	10	20	0	0	0	2	200
37	15	252	15	30	0	0	0	3	300
38	49	825	49	97	0	0	0	9	980
41	38	640	38	75	0	0	0	7	760
42	16	269	16	32	0	0	0	3	320
43	3	50	3	6	0	0	0	1	60
44	36	606	36	71	0	0	0	7	720
46	76	1,279	75	150	0	0	0	16	1,520
47	28	471	28	55	0	0	0	6	560
48	58	976	57	115	0	0	0	12	1,160
49	49	825	49	97	0	0	0	9	980
52	38	640	38	75	0	0	0	7	760

NET UNIT VOLUMES BY SPECIES - CURRENT ENTRY

Version 5.2 - R6

Sale/alternative: Middle Santiam Thin Alternative 2 Forest/district: **Willamette/Sweet Home** Date: **12/4/2006**

Volume type: **CCF**

Unit	Acres	Total Unit Volumes By Species - CCF							Total Volume
		westside doug-fir	western hemlock	noble fir				fiber	
Totals	1,549	25,788	1,693	3,196				303	30,980

TEA.COST FILE & PQA SPREADSHEET DATA INPUT
All Costs & Prices in Selected Unit of Measure (MBF or CCF)

Version 5.2 - R6

Sale/alternative: **Middle Santiam Thin Alternative 2**

Forest/district: **Willamette/Sweet Home**

Forest: **Willamette**

Vol type: **CCF**

Tea.cost file used: **Version 541 (TEA 10-05) R6 TEA Data**

Forest number *(select)*: **18**

Salvage sale *(select)*: **No**

Logging Cost Centers, Zone Averages

Cost Center	$/ccf
stump-to-truck cost	138.90
log haul cost	24.72
road maintenance cost	7.12
bd plus erosion control cost	15.00
temporary development cost	3.17

Comp factor	Appr zone	Geo area
10.0%	5	West side

Species Price, Bid, & Adjustment Data For Forest… CI BPI BPP PQA

Species name	Index name	Species #	Current index	Base p index	Base p price *	PQA adj	Minimum rates	Market adjust	Quality adjust	Sum of zone Cost Centers
fiber	fiber	2	78.00	78.00			0.50			188.91
westside doug-fir	westside doug-fir	205	209.89	209.89	100.06	**-50.00**	20.00	-5.20	-50.00	
western hemlock	hem-fir	263	165.98	165.98	44.73	**-20.00**	10.00	2.60	-20.00	
noble fir	hem-fir	22	165.98	165.98	44.73	**-20.00**	20.00	2.60	-20.00	

SALE INPUT - TIMING, RATES, & FOREST SERVICE COSTS

Current Entry

Version 5.2 - R6

Sale/alternative: **Middle Santiam Thin Alternative 2**

Timing & Rate Items	Current Entry		
	Value	Input notes	
begin logging	2.4	years from now, now = 0	
sale life, yrs	5.0	estimated sale contract length, yrs	
interest rate %	4.0%	real interest rate in percent	
essential kv, year	0.0	years from now, now = 0	
Forest Service Costs	**Value-$/ccf**	**Yrs from now**	**Discounted - $/ccf**
planning, nepa	10.00	0.3	9.88
sale prep	15.00	1.4	14.20
sale admin	5.00	2.4	4.13
trans planning	5.00	0.3	4.94

Volume type: **CCF**

FS costs last updated: **12/4/2006**

LOGGING & ASSOCIATED COSTS - CURRENT ENTRY

Version 5.2 - R6

Sale/alternative: **Middle Santiam Thin Alternative 2** Forest/district: **Willamette/Sweet Home** Date: **12/4/2006**

Volume type: **CCF**

Unit Designation	INPUT APPRAISAL RELATED COSTS FOR SALE IN $'s PER CCF							
	$/ccf Stump-to-truck	$/ccf Log Haul	$/ccf Road Maint	$/ccf BD & Erosion	$/ccf Temp Roads	$/ccf Essential KV	$/ccf Con/Recon	$/ccf Unusual
1		5.00					10.89	
2		5.00					10.89	
3		5.00			0.42		10.89	
4	50.00	5.00					10.89	
5		5.00			0.71		10.89	
6		5.00					10.89	
7		5.00					10.89	
8		5.00			2.06		10.89	
9		5.00			3.57		10.89	
10		5.00			2.50		10.89	
11	10.00	5.00			1.59		10.89	
12		5.00			0.76		10.89	
13	200.00	5.00					10.89	
14		5.00			0.34		10.89	
15		5.00			1.48		10.89	2.47
16		5.00					10.89	
17		5.00					10.89	
18		5.00					10.89	3.70
19	50.00	5.00			1.74		10.89	1.72
20		5.00					10.89	
21		5.00					10.89	
22		5.00			0.42		10.89	
23		5.00			2.12		10.89	
24		5.00					10.89	3.45
25		5.00			2.55		10.89	
26	50.00	5.00			1.03		10.89	
27		5.00					10.89	
28		5.00			1.55		10.89	
29		5.00			2.50		10.89	
30	150.00	5.00					10.89	1.89
31	200.00	5.00					10.89	
32		5.00					10.89	
33		5.00					10.89	
34		5.00			2.17		10.89	
35		5.00					10.89	
36		5.00					10.89	
37		5.00					10.89	
38		5.00			2.04		10.89	
41		5.00			1.05		10.89	
42		5.00					10.89	
43		5.00					10.89	
44	150.00	5.00					10.89	2.78
46		5.00					10.89	
47		5.00			0.71		10.89	
48		5.00			0.52		10.89	
49	50.00	5.00			1.12		10.89	2.04
52		5.00					10.89	

LOGGING & ASSOCIATED COSTS - CURRENT ENTRY

Version 5.2 - R6

Sale/alternative: **Middle Santiam Thin Alternative 2** Forest/district: **Willamette/Sweet Home** Date: **12/4/2006**

Volume type: **CCF**

Unit Designation	INPUT APPRAISAL RELATED COSTS FOR SALE IN $'s PER CCF							
	$/ccf Stump-to-truck	$/ccf Log Haul	$/ccf Road Maint	$/ccf BD & Erosion	$/ccf Temp Roads	$/ccf Essential KV	$/ccf Con/Recon	$/ccf Unusual
Total or Avgs	15.67	5.00			0.81		10.89	0.48

NON-ESSENTIAL KV COSTS

CURRENT ENTRY

Version 5.2 - R6

Sale/alternative: **Middle Santiam Thin Alter**

Project Name	Required Mitigation - *select*	Total Cost - $'s	Years From Now
Precommercial Thinning	No	95,000	4
Aerial Fertilization	No	194,000	4
Tree Topping	Yes	164,000	4
Down wood Creation	Yes	116,000	4
Road Closures	No	3,000	2
Invasive Weeds	Yes	68,000	3
Subsoiling Mitigation	Yes	12,000	3
Fish Project	No	6,000	3
	No		
Firewood	No	8,000	4
DTR tree planting	No	14,450	3
Pruning	No	446,000	4
Waterbar road 2041 215	No	12,000	3
Dispersed Recreation	No	1,000	3
Subsoiling	No	43,000	4
		1,182,450	

NON-TIMBER BENEFITS and COSTS - FUTURE ENTRY

Version 5.2 - R6

Sale Name: **Middle Santiam Thin Alte 2**

Non-Timber Project Name	Benefit Total Dollars	Cost Total Dollars	Disc Rate	Duration In Years	Start - Years From Now
	0.00	0.00			

ECONOMIC BENEFIT AND COST ANALYSIS SUMMARY

CURRENT ENTRY

Version 5.2 - R6

Sale/alternative: **Middle Santiam Thin Alternative 2** Forest/district: **Willamette/Sweet Home** Date: **12/4/2006**

Unit	Tot Vol CCF	Total Acres	Total Costs	Total Benefits	Discounted Costs	Discounted Benefits	Current Entry NPV	B/C Ratio
1	220	11	7,700	46,502	7,293	38,371	31,079	5.26
2	400	20	14,000	82,395	13,260	67,989	54,729	5.13
3	480	24	16,800	102,184	15,911	84,317	68,406	5.30
4	280	14	9,800	45,803	9,282	37,794	28,513	4.07
5	1,040	52	36,400	219,692	34,475	181,280	146,805	5.26
6	1,180	59	41,300	250,425	39,116	206,640	167,524	5.28
7	260	13	9,100	55,725	8,619	45,982	37,364	5.34
8	340	17	11,900	72,081	11,271	59,479	48,208	5.28
9	420	21	14,700	87,620	13,923	72,300	58,378	5.19
10	800	40	28,000	168,348	26,519	138,913	112,394	5.24
11	440	22	15,400	88,676	14,586	73,171	58,586	5.02
12	960	48	33,600	203,824	31,823	168,187	136,364	5.29
13	140	7	4,900	2,438	4,641	2,011	-2,630	0.43
14	1,960	98	68,600	416,602	64,972	343,762	278,790	5.29
15	1,620	81	56,700	346,388	53,701	285,825	232,123	5.32
16	140	7	4,900	29,901	4,641	24,673	20,032	5.32
17	680	34	23,800	144,751	22,541	119,443	96,901	5.30
18	540	27	18,900	116,848	17,900	96,418	78,518	5.39
19	860	43	30,100	140,246	28,508	115,725	87,217	4.06
20	360	18	12,600	76,789	11,934	63,363	51,429	5.31
21	220	11	7,700	46,888	7,293	38,690	31,397	5.31
22	1,180	59	41,300	250,730	39,116	206,891	167,776	5.29
23	660	33	23,100	139,047	21,878	114,736	92,858	5.24
24	600	30	21,000	129,835	19,889	107,134	87,245	5.39
25	1,020	51	35,700	214,418	33,812	176,929	143,117	5.23
26	1,160	58	40,600	187,726	38,453	154,903	116,450	4.03
27	480	24	16,800	102,385	15,911	84,484	68,572	5.31
28	580	29	20,300	122,561	19,226	101,132	81,906	5.26
29	560	28	19,600	117,755	18,563	97,167	78,603	5.23
30	620	31	21,700	40,242	20,552	33,206	12,654	1.62
31	440	22	15,400	7,644	14,586	6,308	-8,278	0.43
32	400	20	14,000	85,399	13,260	70,467	57,208	5.31
33	260	13	9,100	55,498	8,619	45,794	37,176	5.31
34	460	23	16,100	97,082	15,248	80,108	64,859	5.25
35	900	45	31,500	191,639	29,834	158,132	128,298	5.30
36	200	10	7,000	42,583	6,630	35,137	28,508	5.30
37	300	15	10,500	63,874	9,945	52,706	42,761	5.30
38	980	49	34,300	206,860	32,486	170,692	138,206	5.25
41	760	38	26,600	161,174	25,193	132,993	107,800	5.28
42	320	16	11,200	68,179	10,608	56,258	45,651	5.30
43	60	3	2,100	12,681	1,989	10,464	8,475	5.26
44	720	36	25,200	47,363	23,867	39,082	15,215	1.64
46	1,520	76	53,200	323,493	50,386	266,933	216,546	5.30
47	560	28	19,600	118,758	18,563	97,994	79,430	5.28
48	1,160	58	40,600	246,317	38,453	203,250	164,798	5.29
49	980	49	34,300	160,761	32,486	132,653	100,167	4.08
52	760	38	26,600	161,972	25,193	133,652	108,459	5.31

ECONOMIC BENEFIT AND COST ANALYSIS SUMMARY

CURRENT ENTRY

Version 5.2 - R6

Sale/alternative: **Middle Santiam Thin Alternative 2** Forest/district: **Willamette/Sweet Home** Date: **12/4/2006**

Unit	Tot Vol CCF	Total Acres	Total Costs	Total Benefits	Discounted Costs	Discounted Benefits	Current Entry NPV	B/C Ratio
t or a	30,980	1,549	2,266,750	6,097,694	2,041,804	5,031,555	2,989,751	2.46
			total includes sale non-ess kv, if any		total includes sale non-ess kv, if any		total or ratio includes sale wide non-essential kv, if any	

Forest Resource Enterprises

With Non-Timber Vals	
Item	Values
npv	2,989,751
b/c	2.46
disc cost/ac	$1,318
disc bene/ac	$3,248
disc npv/ac	$1,930
disc cost $/ccf	$65.91
disc bene $/ccf	$162.41
npv $/ccf	$96.51

(includes non-ess kv & non-timber values, if any)

Discount rate: **4.00%**

Volume type: **CCF**

ECONOMIC ANALYSIS UNIT SUMMARY - CURRENT ENTRY

Version 5.2 - R6

Sale/alternative: **Middle Santiam Thin Alternative 2** Disc rate: **4.00%** Forest/district: **Willamette/Sweet Home** Date: **12/4/2006**

Volume type **CCF**

Unit Designation	Tot Volume CCF	Total Acres	$/ccf Pred. High Bid	$/ccf Base Rate	$/ccf Ind. Ad Rate	$/ccf Ad Rate	Tot gross-$ Timber Val	Total-$ Ess KV	Total-$ NFF Counties	Total-$ NFF Rds & Trails	Total-$ Con/Recon	Total-$ FS Costs	Total-$ Net Value	Total Disc Net Value
1	220	11	211.37	15.90	190.24	190.24	46,502	0	0	0	2,396	7,700	38,802	31,079
2	400	20	205.99	11.05	185.39	185.39	82,395	0	0	0	4,356	14,000	68,395	54,729
3	480	24	212.88	17.86	191.59	191.59	102,184	0	0	0	5,227	16,800	85,384	68,406
4	280	14	163.58	17.41	147.22	147.22	45,803	0	0	0	3,049	9,800	36,003	28,513
5	1,040	52	211.24	16.42	190.12	190.12	219,692	0	0	0	11,326	36,400	183,292	146,805
6	1,180	59	212.22	16.89	191.00	191.00	250,425	0	0	0	12,850	41,300	209,125	167,524
7	260	13	214.33	18.38	192.90	192.90	55,725	0	0	0	2,831	9,100	46,625	37,364
8	340	17	212.00	18.35	190.80	190.80	72,081	0	0	0	3,703	11,900	60,181	48,208
9	420	21	208.62	16.44	187.76	187.76	87,620	0	0	0	4,574	14,700	72,920	58,378
10	800	40	210.43	17.38	189.39	189.39	168,348	0	0	0	8,712	28,000	140,348	112,394
11	440	22	201.54	17.37	181.38	181.38	88,676	0	0	0	4,792	15,400	73,276	58,586
12	960	48	212.32	17.39	191.09	191.09	203,824	0	0	0	10,454	33,600	170,224	136,364
13	140	7	13.58	17.41	12.22	17.41	2,438	0	0	0	1,525	4,900	-2,463	-2,630
14	1,960	98	212.55	17.38	191.30	191.30	416,602	0	0	0	21,344	68,600	348,002	278,790
15	1,620	81	213.82	17.38	192.44	192.44	346,388	0	0	0	17,642	56,700	289,688	232,123
16	140	7	213.58	17.41	192.22	192.22	29,901	0	0	0	1,525	4,900	25,001	20,032
17	680	34	212.87	17.38	191.58	191.58	144,751	0	0	0	7,405	23,800	120,951	96,901
18	540	27	216.39	17.37	194.75	194.75	116,848	0	0	0	5,881	18,900	97,948	78,518
19	860	43	163.08	17.39	146.77	146.77	140,246	0	0	0	9,365	30,100	110,146	87,217
20	360	18	213.30	17.39	191.97	191.97	76,789	0	0	0	3,920	12,600	64,189	51,429
21	220	11	213.13	17.37	191.81	191.81	46,888	0	0	0	2,396	7,700	39,188	31,397
22	1,180	59	212.48	17.38	191.23	191.23	250,730	0	0	0	12,850	41,300	209,430	167,776
23	660	33	210.68	17.37	189.61	189.61	139,047	0	0	0	7,187	23,100	115,947	92,858
24	600	30	216.39	17.39	194.75	194.75	129,835	0	0	0	6,534	21,000	108,835	87,245
25	1,020	51	210.21	17.37	189.19	189.19	214,418	0	0	0	11,108	35,700	178,718	143,117
26	1,160	58	161.83	17.37	145.65	145.65	187,726	0	0	0	12,632	40,600	147,126	116,450
27	480	24	213.30	17.39	191.97	191.97	102,385	0	0	0	5,227	16,800	85,585	68,572
28	580	29	211.31	17.38	190.18	190.18	122,561	0	0	0	6,316	20,300	102,261	81,906
29	560	28	210.28	17.38	189.25	189.25	117,755	0	0	0	6,098	19,600	98,155	78,603
30	620	31	64.91	17.39	58.42	58.42	40,242	0	0	0	6,752	21,700	18,542	12,654
31	440	22	13.13	17.37	11.81	17.37	7,644	0	0	0	4,792	15,400	-7,756	-8,278
32	400	20	213.50	17.40	192.15	192.15	85,399	0	0	0	4,356	14,000	71,399	57,208
33	260	13	213.45	17.40	192.11	192.11	55,498	0	0	0	2,831	9,100	46,398	37,176
34	460	23	211.05	17.38	189.94	189.94	97,082	0	0	0	5,009	16,100	80,982	64,859
35	900	45	212.93	17.38	191.64	191.64	191,639	0	0	0	9,801	31,500	160,139	128,298
36	200	10	212.91	17.36	191.62	191.62	42,583	0	0	0	2,178	7,000	35,583	28,508
37	300	15	212.91	17.36	191.62	191.62	63,874	0	0	0	3,267	10,500	53,374	42,761
38	980	49	211.08	17.39	189.97	189.97	206,860	0	0	0	10,672	34,300	172,560	138,206
41	760	38	212.07	17.40	190.86	190.86	161,174	0	0	0	8,276	26,600	134,574	107,800
42	320	16	213.06	17.37	191.75	191.75	68,179	0	0	0	3,485	11,200	56,979	45,651
43	60	3	211.35	17.23	190.22	190.22	12,681	0	0	0	653	2,100	10,581	8,475
44	720	36	65.78	17.39	59.20	59.20	47,363	0	0	0	7,841	25,200	22,163	15,215
46	1,520	76	212.82	17.38	191.54	191.54	323,493	0	0	0	16,553	53,200	270,293	216,546
47	560	28	212.07	17.38	190.86	190.86	118,758	0	0	0	6,098	19,600	99,158	79,430
48	1,160	58	212.34	17.37	191.11	191.11	246,317	0	0	0	12,632	40,600	205,717	164,798
49	980	49	164.04	17.39	147.64	147.64	160,761	0	0	0	10,672	34,300	126,461	100,167
52	760	38	213.12	17.40	191.81	191.81	161,972	0	0	0	8,276	26,600	135,372	108,459

ECONOMIC ANALYSIS UNIT SUMMARY - CURRENT ENTRY

Version 5.2 - R6

Sale/alternative: **Middle Santiam Thin Alternative 2** Disc rate: **4.00%** Forest/district: **Willamette/Sweet Home** Date: **12/4/2006**

Volume type **CCF**

Unit Designation	Tot Volume CCF	Total Acres	$/ccf Pred. High Bid	$/ccf Base Rate	$/ccf Ind. Ad Rate	$/ccf Ad Rate	Tot gross-$ Timber Val	Total-$ Ess KV	Total-$ NFF Counties	Total-$ NFF Rds & Trails	Total-$ Con/Recon	Total-$ FS Costs	Total-$ Net Value	Total Disc Net Value
sale tot or avg	30,980	1,549	196.83	17.25	177.14	177.14	6,097,694				337,373	1,084,300	3,830,944	2,989,751
			high bid	base rate		ad rate								

totals include sale wide non-essential KV

Evaluation Item	Value	Notes
Total timber value at predicted high bid rate	6,097,694	**sale appears viable**
Total timber value at base rate	534,440	
Additional value needed to bring sale to base rate		
Tot discounted proj val (includes non-timber values & non-ess kv)	2,989,751	**this project is above cost**

Total Discounted Net Value of Non-Timber Projects:

Total Project Discounted Net Value Including Non-Timber Values: 2,989,751

PROJECT OR SALE-AS-A-WHOLE ECONOMIC ANALYSIS SUMMARY

Version 5.2 - R6

Volume type: **CCF**

Forest/district: **Willamette/Sweet Home** Sale/alternative: **Middle Santiam Thin Alternative 2** Date: **12/4/2006**

Harvest vol current: **30,980** Harvest vol future: Total harvest volume: **30,980**

Project Type	Entry	Discounted Costs	Discounted Revenues	Net Present Value (NPV)	Benefit-Cost Ratio (B/C)	Predicted High Bid- $/ccf	Notes
Timber sale	***Current***					196.83	**sale appears viable**
Timber sale & related projects		2,041,804	5,031,555	2,989,751	2.46		**sale is above cost**
Non-timber related projects							**project is above cost**
Timber & non-timber projects		2,041,804	5,031,555	2,989,751	2.46		**project is above cost**
Timber sale	***Future (07)***						
Timber sale & related projects							
Non-timber related projects							
Timber & non-timber projects							
Timber sales & related projects	***All entries***	2,041,804	5,031,555	2,989,751	2.46		**combined sale is above cost**
Non-timber related projects							**combined project is above cost**
Timber & non-timber projects		2,041,804	5,031,555	2,989,751	2.46		**combined project is above cost**

Appraisal Zone	National Forest	TEA.COST File	Salvage Sale?
5	**Willamette**	**Version 541 (TEA 10-05) - R6 TEA Data**	**No**

The timber sale is viable if the predicted high bid is greater than the base rates (see the "Unit Summary" screen). The timber sale and related projects includes not only the value of the timber, but also the Forest Service costs (i.e. planning, sale prep, sale admin, and transportation planning) and essential and non-essential KV. It is possible for the timber sale to be viable and also below cost (with related projects). Non-timber projects are those entered in the "Non Timber" input table (if any). Dollars to counties are not included in the above tables (these are cash flow items evaluated on the "Cash Flow" screen).

ECONOMIC CASH FLOW SUMMARY - CURRENT ENTRY

Version 5.2 - R6

Sale/alternative: **Middle Santiam Thin Alternative 2**

Forest/district: **Willamette/Sweet Home**

Date: **12/4/2006**

Gross Value: **6,097,694**

Voume type: **CCF**

Estimated SSSS Plan Collection:

Fund Cost Center	Desired Total Amount	Amount Covered	Amount Not Covered	Fund Priority *select below*
essential kv	0	0	0	1
counties, (NFF)	0	0	0	2
roads & trails (NFF)	0	0	0	2
ssss plan collections	0	0	0	**3**
non-essential kv (**mitigation**)	360,000	360,000	0	**4**
non-essential kv (**w/o mitigation**)	822,450	822,450	0	**5**
Totals	**1,182,450**	**1,182,450**	**0**	

Forest Resource Enterprises

Estimated excess funds generated: **4,915,244** (above desired amount)

Summary of Other Evaluation Items - Sale As A Whole

Evaluation Item	Value	Notes
Total timber value at predicted high bid rate	$6,097,694	**this sale appears viable**
Total timber value at base rate	$534,440	
Additional value needed to bring sale to base rate	$0	
Total discounted project value	$2,989,751	**this sale is above cost**
Total net present value (npv)	$2,989,751	←
Benefit - cost ratio (b/c)	2.46	
Total discounted costs per acre	$1,318	**these numbers include all non-timber & non-essential KV values if applicable**
Total discounted benefits per acre	$3,248	
Total discounted npv per acre	$1,930	
Total discounted costs per ccf	$65.91	
Total discounted benefits per ccf	$162.41	
Total discounted npv per ccf	$96.51	←

NET VOLUME INPUT SCREEN - CURRENT ENTRY

Version 5.2 (5/1/05) - R6

Sale/alternative **Middle Santiam Thin Alternative 3** Forest/district: **Willamette/Sweet Home** Date: **12/4/2006**

Volume type - *select*: **CCF**

Unit	Acres	Percent Fiber	Total Unit Volumes By Species - *Select*						Total Volume R/W	Total Volume
			westside doug-fir	western hemlock	noble fir					
1	11	1.0%	165	22	33					220
2	20	1.0%	180	80	140					400
3	24	1.0%	408	48	24					480
4	9	1.0%	153	9	18					180
5	52	1.0%	832	52	156					1,040
6	59	1.0%	944	118	118					1,180
7	13	1.0%	234	13	13					260
8	17	1.0%	306	17	17					340
9	21	1.0%	336	21	63					420
10	40	1.0%	680	40	80					800
11	21	1.0%	357	21	42					420
12	48	1.0%	816	48	96					960
13	0	1.0%	0	0	0					
14	98	1.0%	1,666	98	196					1,960
15	81	1.0%	1,377	81	162					1,620
16	7	1.0%	119	7	14					140
17	34	1.0%	578	34	68					680
18	0	1.0%	0	0	0					
19	40	1.0%	680	40	80					800
20	18	1.0%	306	18	36					360
21	11	1.0%	187	11	22					220
22	59	1.0%	1,003	59	118					1,180
23	33	1.0%	561	33	66					660
24	30	1.0%	510	30	60					600
25	51	1.0%	867	51	102					1,020
26	46	1.0%	782	46	92					920
27	24	1.0%	408	24	48					480
28	17	1.0%	289	17	34					340
29	28	1.0%	476	28	56					560
30	8	1.0%	136	8	16					160
31	0	1.0%	0	0	0					
32	20	1.0%	340	20	40					400
33	13	1.0%	221	13	26					260
34	23	1.0%	391	23	46					460
35	45	1.0%	765	45	90					900
36	10	1.0%	170	10	20					200
37	15	1.0%	255	15	30					300
38	49	1.0%	833	49	98					980
41	38	1.0%	646	38	76					760
42	16	1.0%	272	16	32					320
43	3	1.0%	51	3	6					60
44	11	1.0%	187	11	22					220
46	76	1.0%	1,292	76	152					1,520
47	28	1.0%	476	28	56					560
48	58	1.0%	986	58	116					1,160
49	49	1.0%	833	49	98					980
52	38	1.0%	646	38	76					760
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Tots or avgs	1,412	1.0%	23,720	1,566	2,954	0	0	0	0	28,240

NET VOLUME INPUT SCREEN - FUTURE ENTRY

Version 5.2 - R6

Sale Name: **Middle Santiam Thin Alternative 3** Forest/district: **Willamette/Sweet Home** Date: **12/4/2006**

Volume type: **CCF**

goto current

Unit	Acres	Percent Fiber	Total Unit Volumes By Species						Total Volume R/W	Total Volume
			westside doug-fir	western hemlock	noble fir					
Totals	0	0.0%	0	0	0	0	0	0	0	0

	SPECIES PERCENTS - UNITS ONLY						FINAL UNIT VOLUMES - IN				
UNIT	**205**	**263**	**22**	**0**	**0**	**0**	**205**	**263**	**22**	**0**	**0**
1	0.75	0.1	0.15	0	0	0	163	22	33	0	0
2	0.45	0.2	0.35	0	0	0	178	79	139	0	0
3	0.85	0.1	0.05	0	0	0	404	48	24	0	0
4	0.85	0.05	0.1	0	0	0	151	9	18	0	0
5	0.8	0.05	0.15	0	0	0	824	51	154	0	0
6	0.8	0.1	0.1	0	0	0	935	117	117	0	0
7	0.9	0.05	0.05	0	0	0	232	13	13	0	0
8	0.9	0.05	0.05	0	0	0	303	17	17	0	0
9	0.8	0.05	0.15	0	0	0	333	21	62	0	0
10	0.85	0.05	0.1	0	0	0	673	40	79	0	0
11	0.85	0.05	0.1	0	0	0	353	21	42	0	0
12	0.85	0.05	0.1	0	0	0	808	48	95	0	0
13	0	0	0	0	0	0	0	0	0	0	0
14	0.85	0.05	0.1	0	0	0	1,649	97	194	0	0
15	0.85	0.05	0.1	0	0	0	1,363	80	160	0	0
16	0.85	0.05	0.1	0	0	0	118	7	14	0	0
17	0.85	0.05	0.1	0	0	0	572	34	67	0	0
18	0	0	0	0	0	0	0	0	0	0	0
19	0.85	0.05	0.1	0	0	0	673	40	79	0	0
20	0.85	0.05	0.1	0	0	0	303	18	36	0	0
21	0.85	0.05	0.1	0	0	0	185	11	22	0	0
22	0.85	0.05	0.1	0	0	0	993	58	117	0	0
23	0.85	0.05	0.1	0	0	0	555	33	65	0	0
24	0.85	0.05	0.1	0	0	0	505	30	59	0	0
25	0.85	0.05	0.1	0	0	0	858	50	101	0	0
26	0.85	0.05	0.1	0	0	0	774	46	91	0	0
27	0.85	0.05	0.1	0	0	0	404	24	48	0	0
28	0.85	0.05	0.1	0	0	0	286	17	34	0	0
29	0.85	0.05	0.1	0	0	0	471	28	55	0	0
30	0.85	0.05	0.1	0	0	0	135	8	16	0	0
31	0	0	0	0	0	0	0	0	0	0	0
32	0.85	0.05	0.1	0	0	0	337	20	40	0	0
33	0.85	0.05	0.1	0	0	0	219	13	26	0	0
34	0.85	0.05	0.1	0	0	0	387	23	46	0	0
35	0.85	0.05	0.1	0	0	0	757	45	89	0	0
36	0.85	0.05	0.1	0	0	0	168	10	20	0	0
37	0.85	0.05	0.1	0	0	0	252	15	30	0	0
38	0.85	0.05	0.1	0	0	0	825	49	97	0	0
41	0.85	0.05	0.1	0	0	0	640	38	75	0	0
42	0.85	0.05	0.1	0	0	0	269	16	32	0	0
43	0.85	0.05	0.1	0	0	0	50	3	6	0	0
44	0.85	0.05	0.1	0	0	0	185	11	22	0	0
46	0.85	0.05	0.1	0	0	0	1,279	75	150	0	0
47	0.85	0.05	0.1	0	0	0	471	28	55	0	0
48	0.85	0.05	0.1	0	0	0	976	57	115	0	0
49	0.85	0.05	0.1	0	0	0	825	49	97	0	0
52	0.85	0.05	0.1	0	0	0	640	38	75	0	0
	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
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	SPECIES PERCENTS - UNITS ONLY						FINAL UNIT VOLUMES - IN				
UNIT	westside doug-fir	western hemlock	noble fir				westside doug-fir	western hemlock	noble fir		
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
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CLUDES R/W		
0	fiber	total
0	2	220
0	4	400
0	4	480
0	2	180
0	11	1,040
0	11	1,180
0	2	260
0	3	340
0	4	420
0	8	800
0	4	420
0	9	960
0	0	
0	20	1,960
0	17	1,620
0	1	140
0	7	680
0	0	
0	8	800
0	3	360
0	2	220
0	12	1,180
0	7	660
0	6	600
0	11	1,020
0	9	920
0	4	480
0	3	340
0	6	560
0	1	160
0	0	
0	3	400
0	2	260
0	4	460
0	9	900
0	2	200
0	3	300
0	9	980
0	7	760
0	3	320
0	1	60
0	2	220
0	16	1,520
0	6	560
0	12	1,160
0	9	980
0	7	760
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vol type
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C L U D E S R/W		
	fiber	total
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Dropdown table

Sp Name	Code
fiber	2
white fir	15
grand fir	17
sub alpine	19
noble fir	22
pacific silve	25
larch	70
incense ced	81
lodgepole p	108
w. white pin	117
sugar pine	119
ponderosa	122
eastside do	204
westside do	205
w. red ceda	242
western her	263
mountain he	264
hardwoods	350

Species code layout table

1	2	3	4	5	6	7
205	263	22	0	0	0	2

NET UNIT VOLUMES BY SPECIES - CURRENT ENTRY

Version 5.2 - R6

Sale/alternative: Middle Santiam Thin Alternative 3 Forest/district: **Willamette/Sweet Home** Date: **12/4/2006**

Volume type: **CCF**

Unit	Acres	Total Unit Volumes By Species - CCF							Total Volume
		westside doug-fir	western hemlock	noble fir				fiber	
1	11	163	22	33	0	0	0	2	220
2	20	178	79	139	0	0	0	4	400
3	24	404	48	24	0	0	0	4	480
4	9	151	9	18	0	0	0	2	180
5	52	824	51	154	0	0	0	11	1,040
6	59	935	117	117	0	0	0	11	1,180
7	13	232	13	13	0	0	0	2	260
8	17	303	17	17	0	0	0	3	340
9	21	333	21	62	0	0	0	4	420
10	40	673	40	79	0	0	0	8	800
11	21	353	21	42	0	0	0	4	420
12	48	808	48	95	0	0	0	9	960
13	0	0	0	0	0	0	0	0	0
14	98	1,649	97	194	0	0	0	20	1,960
15	81	1,363	80	160	0	0	0	17	1,620
16	7	118	7	14	0	0	0	1	140
17	34	572	34	67	0	0	0	7	680
18	0	0	0	0	0	0	0	0	0
19	40	673	40	79	0	0	0	8	800
20	18	303	18	36	0	0	0	3	360
21	11	185	11	22	0	0	0	2	220
22	59	993	58	117	0	0	0	12	1,180
23	33	555	33	65	0	0	0	7	660
24	30	505	30	59	0	0	0	6	600
25	51	858	50	101	0	0	0	11	1,020
26	46	774	46	91	0	0	0	9	920
27	24	404	24	48	0	0	0	4	480
28	17	286	17	34	0	0	0	3	340
29	28	471	28	55	0	0	0	6	560
30	8	135	8	16	0	0	0	1	160
31	0	0	0	0	0	0	0	0	0
32	20	337	20	40	0	0	0	3	400
33	13	219	13	26	0	0	0	2	260
34	23	387	23	46	0	0	0	4	460
35	45	757	45	89	0	0	0	9	900
36	10	168	10	20	0	0	0	2	200
37	15	252	15	30	0	0	0	3	300
38	49	825	49	97	0	0	0	9	980
41	38	640	38	75	0	0	0	7	760
42	16	269	16	32	0	0	0	3	320
43	3	50	3	6	0	0	0	1	60
44	11	185	11	22	0	0	0	2	220
46	76	1,279	75	150	0	0	0	16	1,520
47	28	471	28	55	0	0	0	6	560
48	58	976	57	115	0	0	0	12	1,160
49	49	825	49	97	0	0	0	9	980
52	38	640	38	75	0	0	0	7	760

NET UNIT VOLUMES BY SPECIES - CURRENT ENTRY

Version 5.2 - R6

Sale/alternative: **Middle Santiam Thin Alternative 3** Forest/district: **Willamette/Sweet Home** Date: **12/4/2006**

Volume type: **CCF**

Unit	Acres	Total Unit Volumes By Species - CCF							Total Volume
		westside doug-fir	western hemlock	noble fir				fiber	
Totals	1,412	23,481	1,557	2,926				276	28,240

TEA.COST FILE & PQA SPREADSHEET DATA INPUT
All Costs & Prices in Selected Unit of Measure (MBF or CCF)

Version 5.2 - R6

Sale/alternative: **Middle Santiam Thin Alternative 3**

Forest/district: **Willamette/Sweet Home**

Forest: **Willamette**

Vol type: **CCF**

Tea.cost file used: **Version 541 (TEA 10-05) R6 TEA Data**

Forest number *(select)*: **18**

Salvage sale *(select)*: **No**

Logging Cost Centers, Zone Averages

Cost Center	$/ccf
stump-to-truck cost	138.90
log haul cost	24.72
road maintenance cost	7.12
bd plus erosion control cost	15.00
temporary development cost	3.17

Comp factor	Appr zone	Geo area
10.0%	5	West side

Species Price, Bid, & Adjustment Data For Forest… CI BPI BPP PQA

Species name	Index name	Species #	Current index	Base p index	Base p price *	PQA adj	Minimum rates	Market adjust	Quality adjust	Sum of zone Cost Centers
fiber	fiber	2	78.00	78.00			0.50			188.91
westside doug-fir	westside doug-fir	205	209.89	209.89	100.06	**-50.00**	20.00	-5.20	-50.00	
western hemlock	hem-fir	263	165.98	165.98	44.73	**-20.00**	10.00	2.60	-20.00	
noble fir	hem-fir	22	165.98	165.98	44.73	**2.00**	20.00	2.60	2.00	

SALE INPUT - TIMING, RATES, & FOREST SERVICE COSTS

Current Entry

Version 5.2 - R6

Sale/alternative: **Middle Santiam Thin Alternative 3**

Timing & Rate Items	Current Entry		
	Value	Input notes	
begin logging	2.4	years from now, now = 0	
sale life, yrs	5.0	estimated sale contract length, yrs	
interest rate %	4.0%	real interest rate in percent	
essential kv, year	0.0	years from now, now = 0	
Forest Service Costs	**Value-$/ccf**	**Yrs from now**	**Discounted - $/ccf**
planning, nepa	10.00	0.3	9.88
sale prep	15.00	1.4	14.20
sale admin	5.00	2.4	4.13
trans planning	5.00	0.3	4.94

Volume type: **CCF**

FS costs last updated: **12/4/2006**

LOGGING & ASSOCIATED COSTS - CURRENT ENTRY

Version 5.2 - R6

Sale/alternative: Middle Santiam Thin Alternative 3 Forest/district: Willamette/Sweet Home Date: 12/4/2006

Volume type: CCF

Unit Designation	INPUT APPRAISAL RELATED COSTS FOR SALE IN $'s PER CCF							
	$/ccf Stump-to-truck	$/ccf Log Haul	$/ccf Road Maint	$/ccf BD & Erosion	$/ccf Temp Roads	$/ccf Essential KV	$/ccf Con/Recon	$/ccf Unusual
1		5.00					13.44	
2		5.00					13.44	
3		5.00			0.42		13.44	
4		5.00					13.44	
5		5.00			0.71		13.44	
6		5.00					13.44	
7		5.00					13.44	
8		5.00			2.06		13.44	
9		5.00			3.57		13.44	
10		5.00			2.50		13.44	
11		5.00			1.59		13.44	
12		5.00			0.76		13.44	
13		5.00					13.44	
14		5.00			0.34		13.44	
15		5.00			1.48		13.44	2.47
16		5.00					13.44	
17		5.00					13.44	
18		5.00					13.44	
19		5.00			1.74		13.44	
20		5.00					13.44	
21		5.00					13.44	
22		5.00			0.42		13.44	
23		5.00			2.12		13.44	
24		5.00					13.44	
25		5.00			2.55		13.44	
26		5.00			1.03		13.44	
27		5.00					13.44	
28		5.00			1.55		13.44	
29		5.00			2.50		13.44	
30		5.00					13.44	
31		5.00					13.44	
32		5.00					13.44	
33		5.00					13.44	
34		5.00			2.17		13.44	
35		5.00					13.44	
36		5.00					13.44	
37		5.00					13.44	
38		5.00			2.04		13.44	
41		5.00			1.05		13.44	
42		5.00					13.44	
43		5.00					13.44	
44		5.00					13.44	
46		5.00					13.44	
47		5.00			0.71		13.44	
48		5.00			0.52		13.44	
49		5.00			1.12		13.44	
52		5.00					13.44	

LOGGING & ASSOCIATED COSTS - CURRENT ENTRY

Version 5.2 - R6

Sale/alternative: **Middle Santiam Thin Alternative 3** Forest/district: **Willamette/Sweet Home** Date: **12/4/2006**

Volume type: **CCF**

Unit Designation	INPUT APPRAISAL RELATED COSTS FOR SALE IN $'s PER CCF							
	$/ccf Stump-to-truck	$/ccf Log Haul	$/ccf Road Maint	$/ccf BD & Erosion	$/ccf Temp Roads	$/ccf Essential KV	$/ccf Con/Recon	$/ccf Unusual

NON-ESSENTIAL KV COSTS

CURRENT ENTRY

Version 5.2 - R6

Sale/alternative: **Middle Santiam Thin Alter**

Project Name	Required Mitigation - *select*	Total Cost - $'s	Years From Now
Precommercial Thinning	No	95,000	4
Aerial Fertilization	No	194,000	4
Tree Topping	Yes	143,000	4
Down wood Creation	Yes	111,000	4
Road Closures	No	3,000	2
Noxious Weed Control	Yes	62,000	3
Trailhead Relocation	No	3,000	3
Firewood	Yes	8,000	4
DTR tree planting	No	14,400	3
Pruning	No	446,000	4
Subsoiling mitigation	Yes	12,000	4
Subsoiling	No	41,000	4
Fish Project	No	6,000	3
Waterbar road 2041 515	No	12,000	3
Dispersed recreation	No	1,000	4
		1,151,400	

NON-TIMBER BENEFITS and COSTS - FUTURE ENTRY

Version 5.2 - R6

Sale Name: **Middle Santiam Thin Alte 3**

Non-Timber Project Name	Benefit Total Dollars	Cost Total Dollars	Disc Rate	Duration In Years	Start - Years From Now
	0.00	0.00			

ECONOMIC BENEFIT AND COST ANALYSIS SUMMARY

CURRENT ENTRY

Version 5.2 - R6

Sale/alternative: **Middle Santiam Thin Alternative 3** Forest/district: **Willamette/Sweet Home** Date: **12/4/2006**

Unit	Tot Vol CCF	Total Acres	Total Costs	Total Benefits	Discounted Costs	Discounted Benefits	Current Entry NPV	B/C Ratio
1	220	11	7,700	46,667	7,293	38,508	31,215	5.28
2	400	20	14,000	84,433	13,260	69,671	56,411	5.25
3	480	24	16,800	101,488	15,911	83,743	67,832	5.26
4	180	9	6,300	38,215	5,967	31,533	25,566	5.28
5	1,040	52	36,400	220,428	34,475	181,887	147,413	5.28
6	1,180	59	41,300	249,990	39,116	206,281	167,165	5.27
7	260	13	9,100	55,348	8,619	45,671	37,052	5.30
8	340	17	11,900	71,588	11,271	59,072	47,801	5.24
9	420	21	14,700	87,913	13,923	72,542	58,620	5.21
10	800	40	28,000	168,046	26,519	138,664	112,145	5.23
11	420	21	14,700	88,655	13,923	73,155	59,232	5.25
12	960	48	33,600	203,466	31,823	167,892	136,069	5.28
13	0	0	0	0	0	0	0	0.00
14	1,960	98	68,600	415,872	64,972	343,160	278,188	5.28
15	1,620	81	56,700	345,777	53,701	285,320	231,619	5.31
16	140	7	4,900	29,852	4,641	24,633	19,992	5.31
17	680	34	23,800	144,491	22,541	119,228	96,687	5.29
18	0	0	0	0	0	0	0	0.00
19	800	40	28,000	168,654	26,519	139,166	112,647	5.25
20	360	18	12,600	76,663	11,934	63,259	51,325	5.30
21	220	11	7,700	46,811	7,293	38,626	31,333	5.30
22	1,180	59	41,300	250,295	39,116	206,533	167,417	5.28
23	660	33	23,100	138,794	21,878	114,527	92,649	5.23
24	600	30	21,000	127,533	19,889	105,235	85,346	5.29
25	1,020	51	35,700	214,039	33,812	176,616	142,804	5.22
26	920	46	32,200	194,652	30,497	160,619	130,122	5.27
27	480	24	16,800	102,217	15,911	84,345	68,434	5.30
28	340	17	11,900	71,838	11,271	59,278	48,007	5.26
29	560	28	19,600	117,537	18,563	96,987	78,423	5.22
30	160	8	5,600	34,150	5,304	28,179	22,876	5.31
31	0	0	0	0	0	0	0	0.00
32	400	20	14,000	85,259	13,260	70,352	57,092	5.31
33	260	13	9,100	55,407	8,619	45,719	37,100	5.30
34	460	23	16,100	96,921	15,248	79,975	64,727	5.24
35	900	45	31,500	191,302	29,834	157,854	128,020	5.29
36	200	10	7,000	42,513	6,630	35,080	28,450	5.29
37	300	15	10,500	63,769	9,945	52,619	42,675	5.29
38	980	49	34,300	206,495	32,486	170,391	137,905	5.25
41	760	38	26,600	160,886	25,193	132,756	107,563	5.27
42	320	16	11,200	68,067	10,608	56,166	45,558	5.29
43	60	3	2,100	12,660	1,989	10,447	8,458	5.25
44	220	11	7,700	46,811	7,293	38,626	31,333	5.30
46	1,520	76	53,200	322,917	50,386	266,457	216,071	5.29
47	560	28	19,600	118,540	18,563	97,814	79,250	5.27
48	1,160	58	40,600	245,889	38,453	202,897	164,444	5.28
49	980	49	34,300	207,396	32,486	171,135	138,649	5.27
52	760	38	26,600	161,684	25,193	133,414	108,221	5.30

ECONOMIC BENEFIT AND COST ANALYSIS SUMMARY

CURRENT ENTRY

Version 5.2 - R6

Sale/alternative: **Middle Santiam Thin Alternative 3** Forest/district: **Willamette/Sweet Home** Date: **12/4/2006**

Unit	Tot Vol CCF	Total Acres	Total Costs	Total Benefits	Discounted Costs	Discounted Benefits	Current Entry NPV	B/C Ratio
t or a	28,240	1,412	2,139,800	5,981,928	1,923,886	4,936,030	3,012,144	2.57
			total includes sale non-ess kv, if any		**total includes sale non-ess kv, if any**		**total or ratio includes sale wide non-essential kv, if any**	

Forest
Resource
Enterprises

With Non-Timber Vals	
Item	**Values**
npv	3,012,144
b/c	2.57
disc cost/ac	$1,363
disc bene/ac	$3,496
disc npv/ac	$2,133
disc cost $/ccf	$68.13
disc bene $/ccf	$174.79
npv $/ccf	$106.66

(includes non-ess kv & non-timber values, if any)

Discount rate: **4.00%**
Volume type: **CCF**

ECONOMIC ANALYSIS UNIT SUMMARY - CURRENT ENTRY

Version 5.2 - R6

Sale/alternative: **Middle Santiam Thin Alternative 3** Disc rate: **4.00%** Forest/district: **Willamette/Sweet Home** Date: **12/4/2006**

Volume type **CCF**

Unit Designation	Tot Volume CCF	Total Acres	$/ccf Pred. High Bid	$/ccf Base Rate	$/ccf Ind. Ad Rate	$/ccf Ad Rate	Tot gross-$ Timber Val	Total-$ Ess KV	Total-$ NFF Counties	Total-$ NFF Rds & Trails	Total-$ Con/Recon	Total-$ FS Costs	Total-$ Net Value	Total Disc Net Value
1	220	11	212.12	15.90	190.91	190.91	46,667	0	0	0	2,957	7,700	38,967	31,215
2	400	20	211.08	11.05	189.98	189.98	84,433	0	0	0	5,376	14,000	70,433	56,411
3	480	24	211.43	17.86	190.29	190.29	101,488	0	0	0	6,451	16,800	84,688	67,832
4	180	9	212.30	17.33	191.07	191.07	38,215	0	0	0	2,419	6,300	31,915	25,566
5	1,040	52	211.95	16.42	190.75	190.75	220,428	0	0	0	13,978	36,400	184,028	147,413
6	1,180	59	211.86	16.89	190.67	190.67	249,990	0	0	0	15,859	41,300	208,690	167,165
7	260	13	212.88	18.38	191.59	191.59	55,348	0	0	0	3,494	9,100	46,248	37,052
8	340	17	210.55	18.35	189.50	189.50	71,588	0	0	0	4,570	11,900	59,688	47,801
9	420	21	209.32	16.44	188.39	188.39	87,913	0	0	0	5,645	14,700	73,213	58,620
10	800	40	210.06	17.38	189.05	189.05	168,046	0	0	0	10,752	28,000	140,046	112,145
11	420	21	211.08	17.36	189.98	189.98	88,655	0	0	0	5,645	14,700	73,955	59,232
12	960	48	211.94	17.39	190.75	190.75	203,466	0	0	0	12,902	33,600	169,866	136,069
13	0	0	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0
14	1,960	98	212.18	17.38	190.96	190.96	415,872	0	0	0	26,342	68,600	347,272	278,188
15	1,620	81	213.44	17.38	192.10	192.10	345,777	0	0	0	21,773	56,700	289,077	231,619
16	140	7	213.23	17.41	191.91	191.91	29,852	0	0	0	1,882	4,900	24,952	19,992
17	680	34	212.49	17.38	191.24	191.24	144,491	0	0	0	9,139	23,800	120,691	96,687
18	0	0	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0
19	800	40	210.82	17.38	189.74	189.74	168,654	0	0	0	10,752	28,000	140,654	112,647
20	360	18	212.95	17.39	191.66	191.66	76,663	0	0	0	4,838	12,600	64,063	51,325
21	220	11	212.78	17.37	191.50	191.50	46,811	0	0	0	2,957	7,700	39,111	31,333
22	1,180	59	212.11	17.38	190.90	190.90	250,295	0	0	0	15,859	41,300	208,995	167,417
23	660	33	210.29	17.37	189.26	189.26	138,794	0	0	0	8,870	23,100	115,694	92,649
24	600	30	212.56	17.39	191.30	191.30	127,533	0	0	0	8,064	21,000	106,533	85,346
25	1,020	51	209.84	17.37	188.86	188.86	214,039	0	0	0	13,709	35,700	178,339	142,804
26	920	46	211.58	17.38	190.42	190.42	194,652	0	0	0	12,365	32,200	162,452	130,122
27	480	24	212.95	17.39	191.66	191.66	102,217	0	0	0	6,451	16,800	85,417	68,434
28	340	17	211.29	17.38	190.16	190.16	71,838	0	0	0	4,570	11,900	59,938	48,007
29	560	28	209.89	17.38	188.90	188.90	117,537	0	0	0	7,526	19,600	97,937	78,423
30	160	8	213.44	17.43	192.10	192.10	34,150	0	0	0	2,150	5,600	28,550	22,876
31	0	0	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0
32	400	20	213.15	17.40	191.83	191.83	85,259	0	0	0	5,376	14,000	71,259	57,092
33	260	13	213.10	17.40	191.79	191.79	55,407	0	0	0	3,494	9,100	46,307	37,100
34	460	23	210.70	17.38	189.63	189.63	96,921	0	0	0	6,182	16,100	80,821	64,727
35	900	45	212.56	17.38	191.30	191.30	191,302	0	0	0	12,096	31,500	159,802	128,020
36	200	10	212.56	17.36	191.31	191.31	42,513	0	0	0	2,688	7,000	35,513	28,450
37	300	15	212.56	17.36	191.31	191.31	63,769	0	0	0	4,032	10,500	53,269	42,675
38	980	49	210.71	17.39	189.64	189.64	206,495	0	0	0	13,171	34,300	172,195	137,905
41	760	38	211.69	17.40	190.52	190.52	160,886	0	0	0	10,214	26,600	134,286	107,563
42	320	16	212.71	17.37	191.44	191.44	68,067	0	0	0	4,301	11,200	56,867	45,558
43	60	3	211.00	17.23	189.90	189.90	12,660	0	0	0	806	2,100	10,560	8,458
44	220	11	212.78	17.37	191.50	191.50	46,811	0	0	0	2,957	7,700	39,111	31,333
46	1,520	76	212.45	17.38	191.20	191.20	322,917	0	0	0	20,429	53,200	269,717	216,071
47	560	28	211.68	17.38	190.51	190.51	118,540	0	0	0	7,526	19,600	98,940	79,250
48	1,160	58	211.97	17.37	190.78	190.78	245,889	0	0	0	15,590	40,600	205,289	164,444
49	980	49	211.63	17.39	190.47	190.47	207,396	0	0	0	13,171	34,300	173,096	138,649
52	760	38	212.74	17.40	191.47	191.47	161,684	0	0	0	10,214	26,600	135,084	108,221

ECONOMIC ANALYSIS UNIT SUMMARY - CURRENT ENTRY

Version 5.2 - R6

Sale/alternative: **Middle Santiam Thin Alternative 3** Disc rate: **4.00%** Forest/district: **Willamette/Sweet Home** Date: **12/4/2006**

Volume type **CCF**

Unit Designation	Tot Volume CCF	Total Acres	$/ccf Pred. High Bid	$/ccf Base Rate	$/ccf Ind. Ad Rate	$/ccf Ad Rate	Tot gross-$ Timber Val	Total-$ Ess KV	Total-$ NFF Counties	Total-$ NFF Rds & Trails	Total-$ Con/Recon	Total-$ FS Costs	Total-$ Net Value	Total Disc Net Value
sale tot or avg	28,240	1,412	211.82	17.24	190.64	190.64	5,981,928				379,546	988,400	3,842,128	3,012,144
			high bid	base rate		ad rate								

totals include sale wide non-essential KV

Evaluation Item	Value	Notes
Total timber value at predicted high bid rate	5,981,928	**sale appears viable**
Total timber value at base rate	486,791	
Additional value needed to bring sale to base rate		
Tot discounted proj val (includes non-timber values & non-ess kv)	3,012,144	**this project is above cost**

Total Discounted Net Value of Non-Timber Projects:

Total Project Discounted Net Value Including Non-Timber Values: 3,012,144

PROJECT OR SALE-AS-A-WHOLE ECONOMIC ANALYSIS SUMMARY

Version 5.2 - R6

Volume type: **CCF**

Forest/district: **Willamette/Sweet Home** Sale/alternative: **Middle Santiam Thin Alternative 3** Date: **12/4/2006**

Harvest vol current: **28,240** Harvest vol future: Total harvest volume: **28,240**

Project Type	Entry	Discounted Costs	Discounted Revenues	Net Present Value (NPV)	Benefit-Cost Ratio (B/C)	Predicted High Bid- $/ccf	Notes
Timber sale	***Current***					211.82	**sale appears viable**
Timber sale & related projects		1,923,886	4,936,030	3,012,144	2.57		**sale is above cost**
Non-timber related projects							**project is above cost**
Timber & non-timber projects		1,923,886	4,936,030	3,012,144	2.57		**project is above cost**
Timber sale	***Future (07)***						
Timber sale & related projects							
Non-timber related projects							
Timber & non-timber projects							
Timber sales & related projects	***All entries***	1,923,886	4,936,030	3,012,144	2.57		**combined sale is above cost**
Non-timber related projects							**combined project is above cost**
Timber & non-timber projects		1,923,886	4,936,030	3,012,144	2.57		**combined project is above cost**

Appraisal Zone	National Forest	TEA.COST File	Salvage Sale?
5	**Willamette**	**Version 541 (TEA 10-05) - R6 TEA Data**	**No**

The timber sale is viable if the predicted high bid is greater than the base rates (see the "Unit Summary" screen). The timber sale and related projects includes not only the value of the timber, but also the Forest Service costs (i.e. planning, sale prep, sale admin, and transportation planning) and essential and non-essential KV. It is possible for the timber sale to be viable and also below cost (with related projects). Non-timber projects are those entered in the "Non Timber" input table (if any). Dollars to counties are not included in the above tables (these are cash flow items evaluated on the "Cash Flow" screen).

ECONOMIC CASH FLOW SUMMARY - CURRENT ENTRY

Version 5.2 - R6

Sale/alternative: **Middle Santiam Thin Alternative 3**

Forest/district: **Willamette/Sweet Home**

Date: **12/4/2006**

Gross Value: **5,981,928**

Voume type: **CCF**

Estimated SSSS Plan Collection:

Fund Cost Center	Desired Total Amount	Amount Covered	Amount Not Covered	Fund Priority *select below*
essential kv	0	0	0	1
counties, (NFF)	0	0	0	2
roads & trails (NFF)	0	0	0	2
ssss plan collections	0	0	0	**3**
non-essential kv (**mitigation**)	336,000	336,000	0	**4**
non-essential kv (**w/o mitigation**)	815,400	815,400	0	**5**
Totals	**1,151,400**	**1,151,400**	**0**	

Estimated excess funds generated: **4,830,528** (above desired amount)

Summary of Other Evaluation Items - Sale As A Whole

Evaluation Item	Value	Notes
Total timber value at predicted high bid rate	$5,981,928	**this sale appears viable**
Total timber value at base rate	$486,791	
Additional value needed to bring sale to base rate	$0	
Total discounted project value	$3,012,144	**this sale is above cost**
Total net present value (npv)	$3,012,144	←
Benefit - cost ratio (b/c)	2.57	
Total discounted costs per acre	$1,363	**these numbers include all non-timber & non-essential KV values if applicable**
Total discounted benefits per acre	$3,496	
Total discounted npv per acre	$2,133	
Total discounted costs per ccf	$68.13	
Total discounted benefits per ccf	$174.79	←
Total discounted npv per ccf	$106.66	