United States Department of the Interior

BUREAU OF LAND MANAGEMENT
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1792A

EA 12-05a

2014 Project - Second Show

March 17, 2014

Dear Citizen,

The Upper Willamette Resource Area of the Eugene District Bureau of Land Management (BLM) has completed a new Environmental Assessment (EA) for the proposed commercial regeneration and thinning harvest on an approximately 405 acres in the Mohawk 5th field watershed. The forest stands proposed for regeneration harvest in this EA were artificially and naturally regenerated 70 to 80 years ago and thinned in the 1990s. These stands are experiencing advanced rates of mortality resulting from the presence of root rot.

I understand that commercial regeneration harvest presents apprehension for some members of the public concerned with the retention of older forest habitat for dependent species and other ecological and social values these forests can provide. I have also heard from the timber industry that regeneration harvest of our forests is imperative to their sustainable management, the support of the timber industry and counties that depend upon timber revenues. The pursuit of the balance of these values in our community is a challenge that the Eugene BLM strives to achieve every day. Your involvement during our public scoping for this project, both through written comments and during our public field trip to the proposed Second Show project area, was invaluable toward identifying meaningful issues and a well-balanced range of alternatives.

The interdisciplinary team developed a range of management options and opportunities to meet the purpose and need for action using management direction provided in the 1995 Eugene Resource Management Plan (RMP), your written comments and direction, and developing scientific principles in forestry.

This EA considers in detail four alternatives, the No Action Alternative (Alternative 1), an Ecological Forestry alternative incorporating regeneration harvest levels and design under the principles of Drs. Norm Johnson and Jerry Franklin (Alternative 2), the Proposed Action alternative that incorporates regeneration harvest at RMP levels utilizing design principles of ecological forestry (Alternative 3), and a Dispersed Regeneration harvest at RMP levels (Alternative 4). Excepting the No Action Alternative, these alternatives, including the Proposed Action, meet the purpose and need to provide for a sustainable supply of timber, to increase the proportion of merchantable volume, and to manage the spread of laminated root rot pathogens (RMP, pp. 200-1).

I am providing you with this document at your request. I welcome your review of the alternatives considered, and look forward to your comments. Public notice of this proposed action will be published in the Eugene Register Guard on March 19, 2014. The EA is also available on the internet at http://www.blm.gov/or/districts/eugene/plans/index.php. The public comment period will end on April 18, 2014. Please submit comments to me at the Eugene District Office by mail at 3106 Pierce Parkway, Suite E. Springfield, OR, 97477; or by e-mail at BLM_OR_EU_Mail@blm.gov by close of business (4:30 PM) on or prior to April 18, 2014. If you have any questions concerning this proposal, please call Kristine Struck at 541-683-6287.

Please note that all comments, including names and street addresses of respondents, will be available for public review at the Eugene District Office, 3106 Pierce Parkway, Springfield, Oregon, during regular business hours (8:00 AM to 4:30 PM), Monday through Friday, except holidays, and may be published as part of the EA or other related documents. Individual respondents may request confidentiality. If you wish to withhold your name or street address from public review or from disclosure under the Freedom of Information Act, you must state this prominently at the beginning of your written comment. Such requests will be honored to the extent allowed by law. All submissions from organizations or businesses and from individuals identifying themselves as representatives or officials of organizations or businesses will be made available for public inspection in their entirety.

I would like to thank you all for your involvement in the development of this project.

Sincerely,

William O'Sullivan
Field Manager

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
EUGENE DISTRICT OFFICE

ENVIRONMENTAL ASSESSMENT
DOI-BLM-OR-E060-2012-0005a-EA

1.0 INTRODUCTION

The Upper Willamette Resource Area, Eugene District BLM proposes to implement commercial ***regeneration harvest*** and ***commercial thinning*** harvest within the approximately 405 acre project area in the Mohawk 5th field watershed. Project actions would include timber harvest, road construction, and road maintenance. The project location is: T. 15 S., R .2 W., Sec. 26, 27, 33, 34, and 35. The ***Land Use Allocations*** for these acres are Matrix, Connectivity, and Riparian Reserve.

> Terms in ***bold italics*** are defined in Appendix D - Glossary.

The ***stands*** proposed for regeneration harvest are moderately ***stocked*** and were artificially and naturally regenerated after first entry timber harvest approximately 70 to 80 years ago. The stands were commercially thinned in the late 1990's. These stands are dominated by Douglas-fir, with smaller components of western hemlock, western red-cedar, and grand fir. Hardwoods such as golden chinkapin and madrone tend to exist on ridgetops and rocky areas, while bigleaf maple, black cottonwood and red alder are generally found in riparian areas or disturbed areas within the project area. Minor amounts of Pacific yew are also present. The dominant understory vegetation consists of salal, hazel, vine maple, Oregon grape, and swordfern. Thinning would occur on Matrix and Riparian Reserve lands in stands 50-70 years old.

Stands are infected with an extensive infestation of laminated root rot (*Phellinus weirri*) or annosus root rot (*Heterobasidion annosum*), which has resulted in widespread tree mortality of the dominant species Douglas-fir. Smaller infestations of Douglas-fir beetle (*Dendroctonus psuedotsugae*), which is highly correlated with root disease, are also present. In openings created from the laminated root rot, Douglas-fir and western Hemlock have naturally seeded in. In areas where the root rot is less extensive, western redcedar occupies the understory (Chadwick, et.al., 2012).

No harvest proposed under this assessment is within ***critical habitat***. Evidence of active red tree voles (*Arborimus longicaudus*) has been found within the units. Presence of Oregon megomphix (*Megomphix hemphilli*), a terrestrial snail, was also found during surveys.

1.1 PURPOSE AND NEED

The purposes of the actions within the stands showing presence of root rot is to produce a sustainable supply of timber, to manage the spread of the pathogen into adjacent stands, and increase the economic productivity of the stand through improvement of stand health[1]. Stands with disease presence are considered to receive higher priority for timber management through regeneration harvest (RMP, p. 201). Currently stands are experiencing various stages of decline with symptomatic crowns and Douglas fir mortality widespread in some areas from pathogen presence (Chadwick, et.al. 2012).

The purposes of the action in thinning units in the Matrix are to produce a sustainable supply of timber to increase the proportion of merchantable volume, and promote development of desired understory vegetation (RMP, p. 200). The need for action in thinning units in Matrix and Riparian Reserves has been established through the results of field reviews and stand examinations. In the areas proposed for thinning, the stands are dense, overstocked and uniform in structure. This results in reduced tree growth and stand vigor. Timber management through thinning is given priority in stands that are "well-stocked or overstocked stands where density reduction is needed to maintain good diameter growth rates," (RMP, p. 201).

The purposes of the actions in Matrix would also be to provide connectivity; provide habitat for a variety of organisms associated with both late-successional and younger forests; maintenance of valuable structural

[1] For this analysis, the use of the term "stand health" is meant to refer to the health of the forested stand, including the resilience of trees to disturbance and tree growth and vigor.

components, such as down logs and ***snags***; reduce the risk of stand loss from fire, animals, insects and disease; and provide early-successional habitat (RMP, pp. 34, 84).

Additional direction for road management directs the BLM to provide and manage the road system to serve resource management needs (RMP, p. 98).

1.2 CONFORMANCE

The 2014 Project - Second Show is consistent with court orders relating to the Survey and Manage mitigation measure of the Northwest Forest Plan, as incorporated into the 1995 Eugene District Resource Management Plan. This project implements (is tiered to) the Final Environmental Impact Statements for the Eugene District Resource Management Plan (1995), as amended, as well as all documents contained in the Second Show project file. This ***Environmental Assessment*** (EA) is tiered to these documents as permitted by NEPA (40 CFR 1502.20).

On December 17, 2009, the U.S. District Court for the Western District of Washington issued an order in Conservation Northwest, et al. v. Rey, et al., No. 08-1067 (W.D. Wash.) (Coughenour, J.), granting Plaintiffs' motion for partial summary judgment and finding a variety of NEPA violations in the BLM and USFS 2007 Record of Decision eliminating the Survey and Manage mitigation measure. Judge Coughenour deferred issuing a remedy in his December 17, 2009, order until further proceedings, and did not enjoin the BLM from proceeding with projects. Plaintiffs and Defendants entered into settlement negotiations that resulted in the 2011 Survey and Manage Settlement Agreement, adopted by the District Court on July 6, 2011.

The Ninth Circuit Court of Appeals issued an opinion on April 25, 2013, that reversed the District Court for the Western District of Washington's approval of the 2011 Survey and Manage Settlement Agreement. The case is now remanded back to the District Court for further proceedings. This means that the December 17, 2009, District Court order which found National Environmental Policy (NEPA) inadequacies in the 2007 analysis and records of decision removing Survey and Manage is still valid.

Previously, in 2006, the District Court (Judge Pechman) had invalidated the agencies' 2004 RODs eliminating Survey and Manage due to NEPA violations. Following the District Court's 2006 ruling, parties to the litigation had entered into a stipulation exempting certain categories of activities from the Survey and Manage standard (hereinafter "Pechman exemptions").

Judge Pechman's Order from October 11, 2006, directs: "Defendants shall not authorize, allow, or permit to continue any logging or other ground-disturbing activities on projects to which the 2004 ROD applied unless such activities are in compliance with the 2001 ROD (as the 2001 ROD was amended or modified as of March 21, 2004), except that this order will not apply to:

A. Thinning projects in stands younger than 80 years old;
B. Replacing culverts on roads that are in use and part of the road system, and removing culverts if the road is temporary or to be decommissioned;
C. Riparian and stream improvement projects where the riparian work is riparian planting, obtaining material for placing in-stream, and road or trail decommissioning; and where the stream improvement work is the placement of large wood, channel and floodplain reconstruction, or removal of channel diversions; and
D. The portions of project involving hazardous fuel treatments where ***prescribed fire*** is applied. Any portion of a hazardous fuel treatment project involving commercial logging will remain subject to the survey and management requirements except for thinning of stands younger than 80 years old under subparagraph a. of this paragraph."

Following the District Court's December 17, 2009, ruling, the Pechman exemptions still remained in place. The 2014 Project - Second Show has been reviewed in consideration of both the December 17, 2009, partial summary judgment and Judge Pechman's October 11, 2006, order. Stands proposed for thinning under this EA are less than 80 years old. These stands meet Exemption A of the Pechman Exemptions (October 11, 2006, Order), and therefore may still proceed to be offered for sale even if the District Court sets aside or otherwise enjoins use of the 2007 Survey and Manage Record of Decision since the Pechman exemptions would remain valid in such case. Stands proposed for regeneration harvests, regardless of age, do not meet Exemptions under Pechman. Surveys were conducted in these stands in accordance to current rulings and regulations.

1.3 SCOPING

Gathering public comments about the Second Show project, including concerns about future management, began in the spring of 2012 through the introduction of the 2014 Project timber sales in the Eugene District Planning Update. A separate scoping letter for the project, describing the proposed actions and consideration of management direction to incorporate ecological forestry principles of Drs. Norm Johnson and Jerry Franklin within the area considered for the Second Show sale, was also mailed to interested and affected parties in July 2012. A field trip to the proposed Second Show sale area was held in August 2012 with more than 50 attendees representing environmental groups, timber industry, local landowners, academia, and other government agencies. The 2014 Project timber sales were scoped together and over 700 comments were received in response to scoping efforts for this project. The vast majority of these comments raised issues exclusive to regeneration harvest.

To better present the issues directed towards actions proposed for the Second Show timber sale, the analysis for the sales exclusively considering thinning management were separated and presented to the public under a separate Environmental Assessment, which was released in December 2013. This EA specifically discusses the issues, proposals, and effects of management proposed for the Second Show timber sale.

1.4 ISSUES

In the context of an environmental analysis, an issue is a point of disagreement, debate, or dispute with a proposed action based on some anticipated ***environmental impact*** or effect. An issue:

- has a cause and effect relationship with the proposed action or alternatives;
- is within the scope of the analysis;
- has not been decided by law, regulation, or previous decision; and
- is amenable to scientific analysis rather than conjecture.

1.4.1 Issues Presented in Detail

Comments received during public scoping and the project Interdisciplinary Team (IDT) brought forward the following concerns related to resources that had potential of being affected by the proposed actions. The resource concerns related to the issues are presented in Section 3.0: Affected Environment and Environmental Effects.

ISSUE 1: What are the effects of silvicultural prescriptions (retention methods, regeneration harvest levels, and planting) on management of root rot?
ISSUE 2: What are the effects of the retention methods within the regeneration harvest on listed and special status wildlife species habitat and connectivity?
ISSUE 3: What are the effects of regeneration harvest on carbon sequestration and climate change?
ISSUE 4: What are the effects of proposed actions (timber harvest, roads management, and site preparation for planting) on soil productivity and compaction?

1.4.2 Issues Considered, but Not Presented in Detail

Comments received during public scoping and the project IDT brought forward the following additional concerns related to resources that had potential of being affected by the proposed actions. Some of these issues have been raised on previous projects and analysis conducted has resulted in determinations of negligible impacts, which helped inform the IDT on the need for detailed analysis in this document. For other issues, the IDT conducted substantial analysis, including inventory and assessment, before concluding that no further analysis was needed. Summaries of analysis conducted are provided, and are tiered to the records completed for the issue considered. For reasons described below, these issues were not carried forward to be presented in detail.

Why is an EA being prepared instead of an EIS to analyze regeneration harvest?
Comments received from the public expressed that the effects of regeneration harvesting warranted the completion of analysis in an ***Environmental Impact Statement*** (EIS). Public concern regarding the preparation of an Environmental Assessment cited the perception of regeneration harvesting resulting in significant effects and the actions being controversial.

There will always be some disagreement about the nature of the effects for land management actions. However, when determining if these disagreements indicate a need for elevation of analysis to an EIS, CEQ regulations (40 CFR 1502) clearly outline the need for context and intensity to be measured in determining significance and controversy.

For context, the significance of an action must be analyzed in the context appropriate. For example, for a site-specific action, such as timber harvest, significance would usually depend upon the effects in the locale, rather than in the world as a whole. Both short-term and long-term effects are relevant. Intensity refers to the severity of the effect, which is done by looking at direct, indirect, and ***cumulative effects*** of an action (USDI/BLM 2008a). Controversy means disagreement about the nature of the effects, not expressions of opposition to the proposed action. Substantial dispute within the scientific community about the effects of the proposed action would indicate that the effects are likely to be highly controversial. There is currently no scientific dispute about the effects of regeneration timber harvesting.

EAs can also be used as a tool in the process to determine if the action would have significant effects. If so, an

EIS is then prepared. If not, a Finding of No Significant Impact (FONSI) is prepared. Determining to conduct analysis under an EA is typically a result of conducting analysis on management actions for which effects are believed to be understood. That is the case for the 2014 Project and Second Show project area, as regeneration harvest on previously entered stands experiencing decline due to root rot infestations is not uncommonly practiced on managed timber lands.

Ultimately, this EA serves to explore the CEQ requirements to determine context and intensity of effects to identify whether an EIS or FONSI should be prepared.

What are the effects of clear cutting?
Comments received during scoping expressed direct opposition to clear cutting of forest stands as part of the proposed action. ***Clear cutting*** is a timber harvest method in which all trees are removed in a single entry from a designated area, with the exception of ***wildlife trees*** or snags, to create an ***even-aged*** stand. Clear cutting is a type of silvicultural system that can be applied to forested stands for regenerative harvesting. Concerns with clear cutting were expressed both for concerns of ecological habitats and concerns for social values such as visuals.

The 2014 Project and all alternatives considered in detail under this EA for the Second Show project area does propose regenerative harvesting, but does not and never has proposed to include clear cutting as part of the project implementation. Even-aged regenerative harvesting in forestry practices typically uses one of three methods: clear cutting, ***seed tree***, or ***shelterwood***. So while all clear cuts are regeneration harvests, not all regeneration harvests are clear cuts. As no clear cutting is proposed under this project, the specific issue to not clear cut was not considered in detail.

In further consideration of regeneration harvests, the 1995 Eugene ***Resource Management Plan*** (RMP) specifically directs that silvicultural management actions will consist of 6 general types of treatments:
- regeneration harvest with partial retention;
- ***site preparation*** following harvest;
- ***reforestation*** treatment;
- management of young stands;
- commercial thinnings in mid-aged stands; and
- management of overstory trees, snags, and large woody debris.

Regeneration harvest with no retention, meaning clear cutting, is not a permissible management action under the 1995 Eugene RMP. Regeneration harvest with partial retention is described in the 1995 Eugene RMP by LUA, with 6-8 live green trees per acre (TPA) required for retention in GFMA (p. 201) and 12-18 live green TPA required for retention in Connectivity (p. 204). These trees are directed to be reserved from harvest as clumps, strips, and scattered individual trees, with no more than 40 contiguous acres having no trees present. Live ***green tree retention*** at these levels under regeneration harvesting would more accurately be described under silvicultural terms as seed tree regeneration methods. For the Second Show sale area, however, this green tree retention would primarily serve as legacy structure to the stand rather than be depended on as a seed source as species conversion would be desired to manage the presence of root rot.

Concerns from members of the public also warrant addressing of regenerative harvesting, regardless of the method applied. The planning area presented under this EA is comprised entirely of Oregon and California Railroad Act (O&C) lands. The O&C Act requires that O&C lands be managed "for permanent forest production, and the timber thereon shall be sold, cut, and removed in conformity with the principal of ***sustained yield*** for the purpose of providing a permanent source of timber supply, protecting watersheds, regulating stream flow, and contributing to the economic stability of local communities and industries, and providing recreational facilities," (43 U.S.C. 1181a). The 1995 Eugene RMP established an annual sale quantity (ASQ) to manage timber production at sustainable levels. Analysis in creating the 1995 Eugene RMP included an assumption that almost half (44%) of the acres of harvested timber on the District would be from regeneration harvest during the first decade (RMP, p. 8). Since the institution of the 1995 Eugene RMP, changes to environmental regulations and increased controversy has resulted in timber management focusing almost exclusively on thinnings in recent years to achieve ASQ.

However, regeneration harvesting is needed in some stands to meet the purpose and need "to produce a sustainable supply of timber, to manage the spread of the pathogen into adjacent stands, and increase the economic productivity of the stand through improvement of stand health", and is specifically directed to be applied in certain conditions under the 1995 Eugene RMP. The choice of silvicultural systems for management of forest stands depends on 3 general factors (p. 199):

1. Resource Management Objectives - Silvicultural systems will be designed to meet a wide range of management objectives, including the aquatic conservation strategy, development or maintenance of

particular habitat types, restoration or maintenance of ***forest health***, and production of merchantable forest products. These objectives vary by land use allocation.
2. Ecological Type and Site Conditions - Silvicultural systems will be selected to meet the ecological requirements of the communities of plants and animal species present. The silvicultural systems selected must also be compatible with soil conditions, slope, aspect, elevation, blowdown potential, and other physical characteristics of each site.
3. Forest Condition - The selection of silvicultural treatments will vary depending on the current condition of each stand. Factors considered include species mix, stand age and structure, density, vigor, previous management, damage or disturbance, and insect or disease problems.

The 1995 Eugene RMP directs that, for available forest lands, regeneration harvest treatment areas will be selected when feasible from the least productive stands first with stands that appear to have low stocking, damage, disease, generally low growth rates, or a predominance of noncommercial species resulting from past management receiving a higher priority for harvest (p. 201). The stands proposed for regeneration harvest in this analysis have infestations of laminated and annosus root rots, and are experiencing decline in stand health. Once established in a site, root disease is permanent and can never be fully eradicated. As described in detail in Chapter 3 (Issue 1), application of regeneration harvest to these stands, accompanied by reforestation efforts of disease-resistant species, is a silviculturally appropriate management application, as this harvest plan provides for the maintenance of long-term site productivity and stand health (p. 201).

What are the effects to botanical species and weeds from regeneration harvest?
Comments received expressed concerns about the impacts that regeneration harvest would have on botanical species and the spreading of weeds within the project area. This issue was considered and analyzed before determining not to present in detail in this EA for the following reasons.

There are no special status botanical species within the project area. As such, there are no effects and this issue is not presented in detail.

The weeds in Second Show occur mainly along the roads with a few places blackberries have moved into the stream system. Logging would create disturbance to the soil surface and existing plant communities, creating bare ground for weeds to colonize and increased sunlight to the soil surface. Weeds are generalists and most are pioneer or early successional species, they flourish after disturbance and are often more vigorous than native plants, so the more ground that is disturbed the more disturbance for weeds to invade. One of the major ways weeds spread is roads. Logging equipment, road graders, bulldozers, car tires, log trucks, OHVs and many other types of machinery that travel along roads pick up seeds and vegetative structures from the forest and roadsides and move them to new areas. Maintaining weed-free roadsides is one tool in reducing spread. Washing equipment and vehicles prior to entering BLM reduces the introduction of new species and reduces spread. The diversity of invasive plants almost guarantees failure to control all of them. The best control is a dominant ***cover*** with a group of species that casts a dense shade. Regardless of the overstory species present, thinning and regeneration harvest would create new opportunities for invasive plants as well as increase the growth of the conifer crops.

What are the effects to aquatic habitats and ACS objectives from regeneration harvest?
Public comments expressed concern about the damage regeneration harvest would cause to Riparian Reserves and streams, stating that this management would not allow for attainment of ACS objectives. Aquatic Conservation Strategy (ACS) objectives established with the Northwest Forest Plan include nine specific objectives that establish criteria for management within Riparian Reserves. These nine objectives direct the maintenance and restoration of aquatic habitat characteristics through management actions.

Regeneration harvest proposed in the Second Show planning area is not proposed within Riparian Reserves; only 3 acres of Riparian Reserve thinning is proposed under this project. As no regeneration harvest is proposed within Riparian Reserves, there are no management actions of regeneration harvest to consider in analysis of ACS objective attainment. All streams adjacent to regeneration harvest stands include full-width no-cut buffers (200 or 400 feet on non-fish bearing and fish bearing streams respectively). Fisheries and hydrology analysis conducted for this project determined some short-term direct and indirect impacts to individual fish, aquatic resources, or habitat resulting in displacement of individuals due to pulse increases in sediment and turbidity from road work operations (road maintenance and haul). However, the scale considered for analysis for both resources includes a larger scope to understand the context and intensity of effects from management, and was considered at the watershed scale. At this scale, with the no-cut buffers and project design features (PDFs), there would be no effects to watershed health, fish species populations, or habitat. As no effect was determined, this issue was considered, but is not presented in detail in this EA.

2.0 ALTERNATIVES

The section describes the alternatives analyzed and considered through this project.

2.1 Alternative 1: No Action

The no action alternative is the only alternative that must be analyzed that does not respond to the purpose and need for action. This alternative also provides a useful ***baseline*** for comparison of environmental effects and demonstrates the results of not meeting the purpose and need for action. Under this alternative, proposed project activities such as timber harvest and road maintenance would not occur. Management to address stand decline resulting from root rot infestation would not occur and trees would continue to experience advanced mortality.

2.2 Alternative 2: Ecological Forestry

This alternative is designed to apply timber management to the forested stands by regeneration harvest and thinning to meet the purpose and need. Regeneration harvest under this alternative was designed to incorporate the ecological forestry principles as described by Drs. Norm Johnson and Jerry Franklin, which largely influence retention levels and methods, and reforestation practices. Regeneration harvest would be implemented by providing a mosaic of retention on at least a third of the stand, primarily clumped in aggregates. Post-harvest site preparation and reforestation work would be conducted in a manner to allow for the promotion of ***early-seral*** habitat, while also providing for timber management consistent the 1995 Eugene RMP.

Tree Retention

Green tree retention in regeneration harvest management serves to provide structural variability to forest stands. Retention under this alternative would be done using retention aggregates, which were designed to cover approximately a third of the stands considered for harvest. Retention aggregates under this alternative comprise approximately 136 acres of retention aggregates, or 37% of regeneration harvest units. No silvicultural treatments would occur in these areas. Retention aggregates were designed from a combination of upland (106 acres) and riparian (30 acres) lands. Aggregates location and size were designed to minimize the size of contiguous regeneration harvest openings and provide connectivity between untreated riparian reserves and protecting legacy features such as trees with large crowns, hardwood patches, and pockets of existing snags. Harvest openings range in size from 4 acres to 35 acres, with an average size of about 18 acres.

Aggregate location, size, and boundaries would be likely to change slightly during implementation to allow for capture of desired features on the ground not captured through in-office designing or modification to remove acres captured in-office that do not meet the desired feature components, but would not greatly alter total acres or percent of stand retained in aggregates across the project area. In designing aggregate size and location, consideration was given to the creation of ***biological corridors*** in locations where reserve aggregates would be minimally impacted from logging systems (i.e., cable corridors or ***skid trails***); however, there are some aggregates that would have some impacts from harvest actions due to cable corridors for access and potential for fire creep during post-harvest site-preparation for planting.

In addition to the retention aggregates, approximately 2 green trees per acre would be retained within regeneration harvest openings. The 2 green trees per acre retained would be from the dominant or co-dominant ***forest canopy*** class, and would be selected for retention based on visibility of tree health. Additional retention within harvest units would also occur through retention of trees with valued wildlife characteristics (e.g., trees with large, deformed limbs or broken tops), where present. Snags within harvest units would also be retained. Approximately 6 snags per acre and 300 linear feet per acre (lf/ac) of CWD ≥ 20 inches in diameter and 20 feet in length would be retained or created across both the retention aggregates and within the regeneration harvest openings where snags/CWD do not provide these levels on the sale area landscape post-harvest. This may require that additional trees dispersed throughout harvest openings are reserved during marking.

Regeneration Harvest

Regeneration harvest under this alternative would occur on approximately 231 acres of both upland Matrix (151 acres) and Connectivity (80 acres) lands. Regeneration harvest would remove all merchantable conifers (greater than 8 inches in ***diameter at breast height*** (DBH)) within harvest openings, excepting approximately 2 green trees per acre, reserved wildlife trees, and any snags. No regeneration harvest would occur within riparian reserves.

Site Preparation & Planting

Site preparation for planting would occur through use of prescribed fire, machine piling, hand piling, and whole-tree ***yarding*** (Map 4). Determining which site preparation method most safely and best achieves the goals for reforestation was determined by terrain, slope, harvest system proposed, and knowing the windows for burning in the project area. Reforestation would only occur within regeneration harvest units.

Prescribed burning has been identified to occur on approximately 24% of the project area during the spring approximately one year after harvest actions would be completed within the unit. It would likely be accomplished at around 20 acres per year for up to 5 years depending on the number of burnable days each year. Burning would not result in complete consumption across the landscape, but would provide a mosaic burn that would leave some areas untouched by fire. Fuel breaks would be constructed (approximately 3 foot wide scrape of about 6 inches in depth of duff clearance to bare soil) around burn unit boundaries to prevent spread into adjacent stands, retention aggregates, and riparian reserves to reduce likelihood of fire spread into these areas. Any unburned units would receive site-preparation for planting through machine or hand piling where feasible. Machine and hand piling would occur on approximately 59% harvest units. Piles would be covered and allowed to dry out for a season to be burned in the fall.

Whole-tree yarding would be permitted on all regeneration harvest units, and would be the only site-preparation actions on highly steepened grounds (slopes 45% and greater) where the lands are inaccessible to machines for piling and where hand piling would be infeasible.

The 1995 Eugene RMP (p. 200) directs that selection of tree species, planting density, and stock types for reforestation would depend on site characteristics, the composition of the original stand, and projected future management of each stand. It also directs that areas having identified root disease would be planted with species resistant or immune to the disease or the areas would be treated in a manner that would reduce the likelihood of spreading the disease. Post-harvest planting would occur within 1-5 years after post-harvest site treatment (i.e., ***slash*** removal, pile and ***broadcast burning***) with locally cultivated disease-resistant species. Planting site zones were located based on microclimate and plant associations (Map 5), and include ponderosa mix (70% Valley ponderosa pine, 20% Douglas-fir, and 10% incense cedar), western red cedar mix (70% western red cedar, 30% hemlock), and of alder species mix (100% alder species). Planting would be done at a variable spacing averaging about 15 by 15 feet to provide for early-seral vegetation growth, around 200 trees per acre (TPA).

Thinning Harvest

Thinning would occur on approximately 32 acres of Matrix lands and 3 acres of Riparian Reserve lands. No thinning would occur within Connectivity lands. Stands are late-50s to late-70s years old.

Thinning would produce residual ***basal areas*** averaging of 140-160 ft^2. Stands would be thinned from below. Trees selected for harvest would mostly be intermediate and co-dominant conifers that are suppressed and of poor form. Larger trees of greater growth potential and wildlife value would be marked and retained. This prescription would result in a stand with variable spacing between remaining conifers and hardwoods. Minor conifers (e.g., incense cedar, western red cedar, grand fir) and hardwood (e.g., madrone, chinquapin, cottonwood, big leaf maple, alder, oak, ash) species would be retained; except where necessary to accommodate logging systems, safety, or harvest objectives to enhance larger dominant conifers (primarily Douglas fir and western hemlock).

Logging Systems

Timber harvest would be accomplished with a combination of cable and ground-based logging systems. Table 2-1 shows the approximate range of acres per logging system. Details on logging methods are shown in maps in Appendix C.

Table 2-1: Acres by Logging System for Alternative 2.

Harvest Method	Cable (ac)	Cable (% units)	Ground-Based (ac)	Ground-Based (% units)	Total (ac)
Regeneration	189	71%	42	16%	**231**
Thinning	23	9%	12	5%	**35**
Total	**212**	**80%**	**54**	**20%**	**266**

Roads

Road system management and road improvements would occur to support timber harvest activities as described below and detailed in Appendix B (Tables B-1 through B-4) and Appendix C maps.

<u>Construction, Renovation, and Improvements</u>*:* Approximately 21 miles of existing BLM controlled roads would be utilized as part of the project. Of that, approximately 20.9 miles of road would need renovation including, but not limited to, adding crushed rock and culvert replacements. No construction of temporary road would be needed for harvest access, and only approximately 0.1 mile of proposed permanent road construction. Approximately 2.1 miles of private controlled road would be used for timber and rock haul.

<u>Culvert Replacements & New Installations</u>*:* Between 5-14 in-stream (non-fish) culverts have been identified for replacement. In addition, between 10-22 cross drain culverts have been identified for replacement. One to two

culverts would be needed on the newly constructed road segment. All culverts ranked as high priority for replacement due to concerns for fish, hydrology or road safety would be replaced if affected by the selected action.

Road Decommissioning: Approximately 0.24 miles of road would be decommissioned (long-term/blocked). Actions may include entrances barricaded, slopes water-barred, stream and cross drains removed, stream channels restored, and drain dips constructed. Other actions may include slash or brush placement, and mulching and planting of native species in disturbed areas. No roads would be fully decommissioned (permanent/tilled).

2.3 Alternative 3: Grouped Retention

This alternative is designed to apply timber management to the forested stands by regeneration harvest and thinning to meet the purpose and need. Regeneration harvest under this alternative was designed to achieve requirements under the 1995 Eugene RMP for regeneration harvest retentions using aggregated retention while incorporating design to provide for early-seral habitat under the principles of ecological forestry. Aggregates were placed on the landscape to connect riparian reserves, preserve some ecologically sensitive areas, and provide breaks to contiguity of harvest openings. Post-harvest site preparation and reforestation work would be conducted in a manner to allow for the promotion of early-seral habitat, while also providing for timber management consistent with the 1995 Eugene RMP of reforesting (planting) within one year of cutting or site-preparation completion (p. 200).

Tree Retention

Green tree retention in regeneration harvest management serves to provide structural variability to forest stands. Retention under this alternative would be done using retention aggregates which were placed on the landscape to connect riparian reserves, preserve some ecologically sensitive areas, and provide breaks to contiguity of harvest openings. Retention aggregates under this alternative comprise approximately 110 acres of retention aggregates, or 30% of the regeneration harvest units. No silvicultural treatments would occur in these areas. Aggregates location and size were designed to provide connectivity between untreated riparian reserves and protecting legacy features such as trees with large crowns, hardwood patches, and pockets of existing snags. Retention aggregates were designed from a combination of upland (80 acres) and riparian (30 acres) lands. Harvest openings range in size from 13 acres to 35 acres, with an average size of about 20 acres.

Aggregate location, size, and boundaries would be likely to change slightly during implementation to allow for capture of desired features on the ground not captured through in-office designing or modification to remove acres captured in-office that do not meet the desired feature components, but would not greatly alter total acres or percent of stand retained in aggregates across the sale. Aggregates were designed to be minimally impacted from logging systems (i.e., cable corridors or skid trails); however, some aggregates may be impacted from harvest actions due to cable corridors for access and potential for fire creep during post-harvest site-preparation for planting.

Under this alternative, green tree retention required under the 1995 Eugene RMP would be attained through retention aggregates and, as such, no target number of green trees per acre within regeneration harvest openings is prescribed. Green trees would be left in openings where marked to preserve because of biological values (e.g., wildlife tree), as would snags and CWD. Under Alternative 3, RMP goals of 3-4 snags per acre and 240 lf/ac of CWD ≥ 20 inches in diameter and 20 feet in length would be retained or created across both the retention aggregates and within the regeneration harvest openings where snags/CWD do not provide these levels on the sale area landscape post-harvest. This may require that additional trees dispersed throughout harvest openings are reserved during marking.

Regeneration Harvest

Regeneration harvest under this alternative would occur on approximately 259 acres of both Matrix (169 acres) and Connectivity (90 acres) lands. Regeneration harvest would remove all merchantable conifers (greater than 8 inches DBH) within harvest openings, excepting reserved wildlife trees and any snags. No regeneration harvest would occur within riparian reserves.

Site Preparation & Planting

Site preparation and planting that would occur post-harvest under Alternative 3 would be the same as described under Alternative 2. Use of prescribed burning, piling, and whole tree yarding, and identification of reforestation species and spacing would be identified for application under the same terms described in Alternative 2, but total acres would vary due to changes in total treated acres from changes to retention aggregates (Maps 4 & 6).

Thinning Harvest
Thinning harvest under Alternative 3 would be the same as described under Alternative 2. Acres harvested would not change as the difference between acres for the alternatives is driven by retention aggregates which are not within thinning units.

Logging Systems
Timber harvest would be accomplished with a combination of cable and ground-based logging systems. Table 2-2 shows the approximate range of acres per logging system. Details on logging methods are shown on maps in Appendix C.

Table 2-2: Acres by Logging System for Alternative 3.

Harvest Method	Cable (ac)	Cable (% units)	Ground-Based (ac)	Ground-Based (% units)	Total (ac)
Regeneration	208	71%	51	17%	**259**
Thinning	23	8%	12	4%	**35**
Total	**231**	**79%**	**63**	**21%**	**294**

Roads
Road system management and road improvements needed to support Alternative 3 would be the same as those described for Alternative 2.

2.4 ALTERNATIVE 4: DISPERSED RETENTION

This alternative is designed to treat the forested stands by regeneration harvest and thinning to meet the purpose and need. Regeneration harvest methods were designed using dispersed retention following guidance set forth in the 1995 Eugene RMP.

Tree Retention
No retention aggregates would be incorporated in this alternative; however, some no-cut areas are included within the planning area. Instead, dispersed retention to meet the requirements of the 1995 Eugene RMP would be applied. Trees identified for retention would prioritize healthy trees so as to meet the purpose and need to manage the stand to reduce the effects of root rot infestation.

Green trees would be left in harvest units in conformance with RMP direction at 6-8 green conifer trees per acre on GFMA lands and at 12-18 green trees per acre on Connectivity lands. Additional green trees and snags would be marked to preserve biological values (e.g., wildlife tree) and to retain or create 3-4 snags per acre and CWD. Under Alternative 4, RMP goals of 3-4 snags per acre and 240 lf/ac of CWD ≥20 inches in diameter and 20 feet in length would be retained or created where these levels are not met on the sale area landscape post-harvest. This may require that additional trees dispersed throughout harvest areas are reserved during marking.

Regeneration Harvest
Regeneration harvest under this alternative would occur on approximately 303 acres of both Matrix (182 acres) and Connectivity (121 acres) lands. No regeneration harvest would occur within riparian reserves.

Regeneration harvest would remove all merchantable conifers within harvest units (greater than 8 inches DBH), excepting trees identified in “Tree Retention” above or for retention by PDFs (Appendix A).

Site-Preparation & Planting
Site preparation and planting would occur posst-harvest under Alternative 4 would be the same as described under Alternative 2. Use of prescribed burning, piling, and whole tree yarding, and identification of reforestation species would be identified for application under the same terms described in Alternative 2, but total acres would vary due to changes in total treated acres from changes to retention aggregates (Maps 4 & 7). However, reforestation would differ under this alternative in spacing and density, with planting occurring at levels described in the RMP (about 435 TPA at 10 by 10 feet).

Thinning Harvest
Thinning harvest under Alternative 4 would be the same as described under Alternative 2. Acres harvested would not change as the difference between acres for the alternatives is driven by retention aggregates which are not within thinning units.

Logging Systems
Timber harvest would be accomplished with a combination of cable and ground-based logging systems. Table 2-3 shows the approximate range of acres per logging system. Details on logging methods are shown on maps in Appendix C.

Table 2-3: Acres by Logging System for Alternative 4.

Harvest Method	Cable (ac)	Cable (% units)	Ground-Based (ac)	Ground-Based (% units)	Total (ac)
Regeneration	243	72%	60	18%	**303**
Thinning	23	7%	12	3%	**35**
Total	**266**	**79%**	**72**	**21%**	**338**

Roads

Road system management and road improvements needed to support Alternative 4 would be the same as those described for Alternative 2.

2.5 Alternatives Considered, but Not Analyzed in Detail

The following alternatives were considered by the IDT, but not analyzed in detail.

Maximum Regeneration Harvest Opening of 10 acres

Ecological forestry principles outlined by Drs. Norm Johnson and Jerry Franklin recommend modeling openings and aggregates to mimic natural stand disturbances. Under scenarios with potential for occurrence in the root rot infested stands in the project area, agent-caused mortality would be likely (wind, disease, insects). This type of disturbance regime creates spatially aggregated legacies, and typically kills dominant trees. The Second Show regeneration harvest units were reviewed with an intent to create harvest openings of no more than 10 contiguous acres in attempts to model a disturbance regime of smaller ‘kill pockets’ that might be created by agent-caused mortality. It was discovered during the exercise that the existing topography and road system would not allow for certain areas to be made 10 acres or less in size without either constructing new roads or removing several acres from harvest consideration for no ecological reason other than to make the opening less than 10 acres. Specifically, ridgetop roads provide cable harvest accesses on either side of the road. These opposite road side units might average about 10 acres each, forming a contiguous 20 acre opening that crosses the road. To reduce this opening size, three options were reviewed:

1) A retention aggregate would need to be placed along the majority of the roads within the planning area. This option was removed from consideration because roadside retention aggregates would either prohibit logging systems operations from effectively occurring or would experience substantial ***habitat fragmentation*** by corridors throughout the entire length and would not achieve the purposes of establishing an aggregated reserve of trees for ecological retention. While not every aggregate under the alternatives presented in detail in this EA were able to be designed so as to eliminate the need for corridor placement through aggregates, this was minimized to the extent possible in balancing actions to meet the purpose and need.
2) A retention aggregate would need to be placed halfway down each unit to split the acres into 5-10-5 acre segments. This option was removed from consideration because to access the lower 5 acre parcels would require the construction of rocked road around the retention aggregates to access the lower portions of the unit.
3) The regeneration harvest unit boundaries would be brought in to only allow management on the upper portions of the treatment unit. This was removed from consideration because areas that would be removed from management would not receive the treatment to address the root rot infestations and, therefore, would not meet the purpose and need.

Thinning, not Regeneration Harvest

While not directed by the Secretary of Interior to propose for analysis “Secretarial Pilot Projects” using ecological forestry project under the principles of Drs. Norm Johnson and Jerry Franklin, the Responsible Official for this project directed development of a sale for the 2014 sale program to explore management under ecological forestry principles and in collaboration with the Drs.

As previously stated, a variety of general silvicultural systems are proposed for the major land use allocations under the 1995 Eugene RMP. The choice of silvicultural systems for management of forest stands would depend on three general factors: Resource Management Objectives, Ecological Type and Site Conditions, and Forest Condition. Stands presented for regeneration harvest within the Second Show project area were reviewed against these three factors to determine their ecological and economic viability for regeneration harvest timber management as opposed to thinning management.

Economically, thinning these stands proposed for regeneration harvest would be a viable alternative. However, economic contributions are not the only purpose and need for this project area, and considerations for ecosystem health must also be considered. For example, an alternative that thinned these stands and met early-serial objectives by embedding “gaps” within thinning prescriptions would not have addressed the laminated and annosus root rot infestations and the accelerated mortality the stand is experiencing.

The Second Show project includes a purpose and need to harvest timber, but also to address stand health. As an alternative that would consider thinning the stands proposed for regeneration harvest within the Second Show planning area would only partially meet the purpose and need, it was eliminated from detailed analysis, as Council on Environmental Quality (CEQ) regulations require that alternatives to be considered in detail must meet the purpose and need.

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL EFFECTS

3.1 ISSUE 1: WHAT ARE THE EFFECTS OF SILVICULTURAL PRESCRIPTIONS (RETENTION METHODS, REGENERATION HARVEST LEVELS, AND PLANTING) ON MANAGEMENT OF ROOT ROT?

3.1.1 Affected Environment

The project consists of stands in 5 sections in the Coburg Hills north-east of Springfield, Oregon. The stands proposed for treatment are moderately stocked and were artificially and naturally regenerated after first entry timber harvest approximately 70 to 80 years ago. The stands were commercially thinned in the late 1990's.

All sections are dominated by Douglas-fir, with smaller components of western hemlock, western red-cedar, and grand fir. Hardwoods such as golden chinkapin and madrone tend to exist on ridgetops and rocky areas, while bigleaf maple, black cottonwood and red alder are generally found in riparian areas or disturbed areas within the project area. Minor amounts of Pacific yew are also present. The dominant understory vegetation consists of salal, hazel, vine maple, Oregon grape, and swordfern.

In 2011 and 2012, approximately 600 acres in the Mohawk area, including the 405 acre project area, were reviewed by pathologists and an entomologist to assess the presence of forest health issues. Within the project area, the primary disturbance agent in the area was determined to be laminated root rot caused by the native fungal pathogen *Phellinus sulphurascens* (syn. *P. weirii*). The pathogen is found throughout the project area as evidenced by the presence of diagnostic setal hyphae in stumps and at the bases of fallen and on the roots of recently killed trees. Trees throughout the area were in various stages of decline with symptomatic crowns (Chadwick, et.al. 2012). Armillaria and annosus root diseases are commonly found on sites that have laminated root rot, and annosus (*Heterobasidion annosum*) was detected within the project area. Douglas-fir beetle (*Dendroctonus pseudotsugae*) caused mortality of mature Douglas-fir was also evident.

In the southwestern portion of the project area (Section 34), laminated root rot was found throughout the stands. Douglas-fir mortality is widespread. Both Douglas-fir and western hemlock are naturally regenerating in openings. At lower elevations near the intersections of the 15-2-34 and 15-2-35.2 roads, laminated root rot was more diffuse and causing scattered mortality. In this area, western redcedar occupies the understory along with small patches of shrubs including bigleaf and vine maples. This distribution is characteristic of the fungus, with laminated root rot typically scattered in occurrence in the lower elevations and widely distributed in the higher elevations (Chadwick, et.al. 2012).

Laminated root rot should be considered a "disease of the site", meaning established mycelia are essentially permanent and can reside in infected stumps and roots in the ground for up to 50 years, long after the host tree has died (Hansen 1976, 1979a). Laminated root rot spreads via root to root contact below-ground at approximately one foot per year (Hagle 2009). It also spreads to susceptible, living trees when their roots penetrate old infected roots and stumps. It is believed that wind or water dispersion of the spores from the fungus is not a meaningful method for reproduction, as spores rarely land on suitable substrate and most mycelium that do establish on substrate perish.

Conifer species have varying levels of susceptibility to laminated root rot. Although nearly all conifers are occasionally infected, Douglas -fir, mountain hemlock, grand fir and white fir are most susceptible (Hansen and Goheen 2000). Western hemlock is intermediately susceptible; while readily infected, it typically develops butt decay rather than outright mortality. Western redcedar, valley ponderosa pine, and western white pine are considered tolerant to resistant. Hardwood species are immune to this pathogen (Chadwick, et.al. 2012).

The fungus is both an efficient parasite and saprophyte, meaning that both live and dead wood is utilized by the fungus. Once established on a root of a live tree, the fungus invades and kills the cambium of the root and the decays the dead root tissues. The mycelium may eventually travel up the root to colonize the root collar, and girdle the tree (Hagle 2009).

3.1.2 Environmental Effects

3.1.2.1 ALTERNATIVE 1: NO ACTION

Under Alternative 1, the Second Show project area would receive no timber management. No actions would be implemented to address stand health issues, mainly laminated root rot, and the suitability of the site to produce a commercial timber resource in the future. As no actions would be implemented, there would be no direct or indirect effects under this alternative.

The primary disturbance agent in the project area is laminated root rot, which is actively killing trees and predisposing others to Douglas-fir beetle attack or windthrow. Laminated root rot is a primary disturbance agent, and can influence ***forest succession***, composition, and structure by selectively killing susceptible conifers and providing openings resulting in species conversions to less susceptible and immune species. Laminated root disease impacts in managed second growth stands that are of commercial size, such as the stands within the project area, can be considerable if the disease is not recognized and treated. In some cases, more than one half the predicted harvest volume can be lost after two or three ***rotations*** of Douglas-fir in stands with diffuse laminated root rot (Chadwick, et.al. 2012).

In stands managed primarily for timber production such as the O&C lands within the project area, the amount of mortality and growth loss caused by laminated root rot would increase over time if susceptible host trees were continually managed on the site. Disturbance and pocket mortality would increase openings that would encourage natural regeneration of disease-resistant species within the project area, such as western hemlock, western redcedar, and hardwoods where seed trees are present.

Once established in a site, root disease is permanent and can never be fully eradicated. However, silvicultural management to reduce the mass or slow the spread of the fungus is possible. Alternative 1 would not implement any timber management to control infestation within the project area or provide for long-term site production on these O&C lands. As such, the laminated root rot would persist in the stands and increase stand susceptibility to other infestations, including bark beetle. The stands would continually experience decline of merchantable species, and eventually begin to convert to species of high resistance to root rot, which are not typically merchantable species in this area. There would be negative cumulative effects to stand health and to the ability of the site to produce a commercial timber resource.

3.1.2.2 Alternative 2: Ecological Forestry

Under Alternative 2, timber management would be implemented on 266 acres, including 231 acres of regeneration or final harvest and 35 acres of thinnings. Approximately 136 acres would remain untouched from timber management as retained through aggregates. All regeneration harvest acres would receive site-preparation and be planted with species mixtures containing species of low-susceptibility to root rot diseases (Map 5).

Silvicultural control methods used to manage laminated root rot should be equally effective against these other major root pathogens of Douglas-fir and true firs (Hagle 2009). Even-aged silvicultural systems are aimed at producing a replacement stand that is better suited to resist or tolerate laminated root rot. Under Alternative 2, there would be direct and indirect effects to root rot persistence in the stand through the final harvest and removal of most trees on 231 acres of regeneration harvest. However, laminated root rot can survive on established roots and stumps for decades after the trees have died and removal of the host trees would not remove the disease from the stand. The retention trees would be susceptible to infestation from root rot, if not already infected.

Further direct and indirect impacts would result from reforestation efforts, as the target replacement stand planted would be comprised of species mixes dominated by western redcedar, ponderosa pine, and alder. The increased resistance of these species to the root rot fungus would reduce the total mass of the disease within the regenerated stands.

Stands proposed for thinning typically contain laminated root rot presence in 20% or less of the stand. Thinning in these stands would improve growth and vigor of the residual stand. However, individual tree health and vigor has not been found to be a factor in determining likelihood of infection from laminated root rot pathogens (Hagle 2009), especially for Douglas-fir. Thinning stands would not improve or decrease the chances of future infestation since the disease is already present in the project area. As such, there are no anticipated direct or indirect effects of timber management in thinning units on laminated root rot infestation levels. Thinning would allow for improved growth and vigor (volume growth) of trees within the stand until the stand is determined ready for subsequent thinning or regenerative harvest.

Approximately 136 acres within the project area would remain unmanaged for timber under this alternative. These aggregates would be expected to have the same effects as discussed under Alternative 1 for non-harvested stands, but at a smaller scale. This level of retained stands with root rot within the harvest area would allow for the persistence of the disease on approximately 37% of regeneration harvest units within the project area, should the disease be present. If not currently present, stands in aggregated retention areas would be susceptible to infestation, as there would be a higher percentage of preferred host species than outside the aggregate retention areas. Because of this, it is likely that aggregates would become infested with laminated root rot over time.

Road management proposed, including maintenance and 0.1 mile of new construction, would not influence the presence or spread of laminated root rot in the project area. As previously stated, spores for laminated root rot can be spread by wind for which increased traffic levels and access can impact; however, this method of regeneration is not believed to be a meaningfully effective method for the fungus, as it requires a combination of landing on a suitable substrate and most mycelium that do establish on substrate perish before they can fully establish. As such, there would be no direct or indirect effects anticipated from road work or improved access in the project area.

Cumulatively, Alternative 2 would improve the long-term stand health from laminated root rot infestation through the final harvest and reforestation of 266 acres with disease-resistant species. The stands would continue to host the pathogen, particularly within aggregate reserves and individual in-stand retention trees, but levels would be expected to be lower than under Alternative 1. The project area would, therefore, benefit from proposed timber management to improve stand heath (volume growth and vigor) and resilience to root rot and long-term site production on O&C lands.

3.1.2.3 Alternative 3: Proposed Action

Under Alternative 3, timber management would be implemented on 295 acres, including 259 acres of regeneration or final harvest and 35 acres of thinnings. Approximately 110 acres would remain untouched from timber management as retained through aggregates. All regeneration harvest acres would receive site-preparation and be planted with species mixtures containing dominant species of low-susceptibility to root rot diseases (Map 6).

Direct and indirect effects of Alternative 3 would be the same as Alternative 2 for actions proposed, but total acres applicable would differ as described above. Additionally, trees retained in regeneration harvest openings would only occur where existing snags were reserved or wildlife trees were marked for retention, or where additional green trees would be marked to meet snag and CWD levels post-harvest. As such, fewer live trees would remain within harvest openings to serve to continue the persistence of the disease, but the root rot would remain on previously-infested stumps and roots of harvested trees for several decades. Final harvest openings would be larger than those under Alternative 2, and would result in a higher number of acres under Alternative 3 regenerated to disease-resistant species. The cumulative effects of Alternative 3 would be the same as Alternative 2, but would be slightly more beneficial than Alternative 2 as more acres would be managed to improve stand health and long-term site production on O&C lands.

3.1.2.4 Alternative 4: Dispersed Retention

Under Alternative 4, timber management would be implemented on 338 acres, including 303 acres of regeneration or final harvest and 35 acres of thinnings. Approximately 50 acres would remain untouched from timber management in no-harvest areas. All regeneration harvest acres would receive site-preparation and be planted with species mixtures containing dominant species of low-susceptibility to root rot diseases (Map 7).

Green tree retention would be dispersed throughout the area at approximately 6-8 trees per acre in designated GFMA lands, and approximately 16-18 trees per acre in Connectivity. Retention of green trees at these densities would likely result in providing a seed-source of Douglas-fir that would contribute to natural regeneration. Additionally, wildlife trees, snags, and CWD would be retained throughout the project area. Disease intensification in partially-harvested stands appears to be due to the rapid colonization of the stumps and roots after infected trees are cut. Infested stumps then serve as effective food bases for the pathogens enabling them to infect and kill other nearby trees. Utilization of stumps by laminated root rot is about the same whether the stand is clearcut or partially harvested. What makes the difference in subsequent impact is the composition of the stand on the site following harvest. Douglas-fir and grand fir left as seed or crop trees, are likely to exhibit rates of mortality around 30 to 40 percent per decade following a harvest. Western redcedar, normally considered a root disease-tolerant species, may develop a progressive decline after a partial harvest (Hagle 2009). Planting with species that are resistant would aid in diffusing the root rot, but long term persistence would likely ensue (Theis and Sturrock 1995).

Planting under Alternative 4 would be done at higher densities than under Alternatives 2 or 3, and would be planted in regeneration harvest stands where higher dispersal of reserve trees across the most acres of regeneration harvest of the action alternatives would occur. The dispersal of retention trees in regeneration harvest (when compared to aggregated retention) across the project area landscape would retain Douglas-fir throughout almost all acres. This would result in the most when compared to the other action alternatives, but would still be at density levels lower than those under Alternative 1.

As such, direct and indirect effects of regeneration harvest and reforestation actions would be expected to provide some benefits to stand health; however, they would not be expected to be at levels expected under Alternatives 2 or 3, as the higher dispersal of Douglas-fir retained across a greater number of acres in the project area would likely increase the mass of the disease in the reforested stands. Direct and indirect effects for road work and thinnings would be the same as those described under Alternative 2 for this alternative. Cumulative effects within the project area would overall be more beneficial than those expected under the no action alternative, but would be the least beneficial of the action alternatives, as the high dispersal of Douglas-fir would not improve stand health at the rates expected under Alternatives 2 or 3, and would have a low expected contribution to the long-term site production for O&C lands.

3.2 Issue 2: What are the effects of the retention methods within the regeneration harvest on wildlife listed and special species habitat and connectivity?

3.2.1 Affected Environment

The Wildlife specialist report evaluated the project area for impact considerations on all applicable federally listed species, ***Bureau Sensitive Species***, Survey and Manage species, and migratory birds. The following wildlife species could be potentially affected by the project: northern spotted owl, Oregon red tree vole, Cascades axetail slug, western bumblebee, harlequin duck, purple martin, fringed myotis, Townsend's big-eared bat, and Oregon megomphix, and the migratory birds northern goshawk, olive-sided flycatcher, purple finch, rufous hummingbird, band-tailed pigeon, and mourning dove.

Most of the stands within these units were regeneration harvested in 1930, with some areas harvested in 1945, 1960, 1968, and 1975. Most of the units were commercially thinned in the late 1990s. Overstory trees are primarily Douglas-fir with scattered western redcedar and western hemlock; density is variable, ranging from complete canopy closure to small openings due to root rot. Hardwoods are mainly big-leaf maple, madrone, and chinkapin, which occur both scattered throughout the units and as small clumps in open areas. The understory is of varying densities that are dominated by typical shrubs like hazel, oceanspray, and vine maple. Conifer advance regeneration is also variable, but present throughout the units as western hemlock, western redcedar, and Douglas-fir.

Coarse Woody Debris (CWD) is an important habitat feature for many wildlife species. CWD provides refugia, foraging sites, and travel corridors for species with low mobility and small ***home ranges*** (e.g., invertebrates, small mammals, and amphibians). Additionally, CWD provides important basic ecological function like moisture retention, nutrient cycling, and microclimate buffering. Amounts of CWD and snags are low compared to typical unmanaged stands of similar age; due to previous harvest, site preparation, thinning, and lack of subsequent tree mortality the CWD present is generally either large-diameter/high decay class (***decomposition class***) residue from the initial harvest or small diameter/low decay class suppression mortality. Small-diameter snags occur in the project primarily in patches of root rot and large-diameter snags are uncommon. Field review of the proposed units indicates that CWD is more regularly distributed in Riparian Reserves and irregularly distributed in upland areas; with the greatest amounts present in Riparian Reserves.

The proposed units contain an average of 646 lf/ac of CWD at least 4" DBH. As is typical in managed stands of this age, the CWD is composed primarily of recent, lower decay class, smaller diameter suppression mortality; older, higher decay class, large diameter pieces comprise the remainder.

CWD of decay class 3-4 that is ≥20" diameter provides the best currently available wildlife habitat features. Proposed harvest areas contain an average of 56 lf/ac of such CWD, generally as residue from the previous harvest.

Hard CWD provides much less function for wildlife and generally represents potential future wildlife habitat after further decay. Most of the low decay class CWD has been recruited in the past few decades and is of smaller diameter. Proposed harvest areas contain approximately 41 lf/ac of decay class 1-2 CWD that is ≥20 inches DBH.

Snags are especially important to primary and secondary cavity nesting birds (songbirds, woodpeckers, owls) and roosting bats. Stand exam data show an average of 0.5 snags per acre in the proposed units. However, more than 80% of these snags are in small diameters (4-19 inches DBH) that do not provide for the variety of wildlife life history needs that larger snags do, because of their small size and/or short lifespan. Large, moderately decayed snags are most important to wildlife. Stand exam data show an average of only 0.1 snags per acre that are 20 inches diameter or greater.

3.2.2 Environmental Effects

3.2.2.1 Alternative 1: No Action

There would be no direct effects to wildlife or habitat on BLM-managed lands if the proposed units were not harvested. Normal successional processes would indirectly affect wildlife as natural growth and mortality processes modify habitat conditions and the suitability of the habitat for various species over time. Current disease infestations would continue to cause tree mortality and would alter habitat over time. However, habitat conditions would not be expected to change abruptly unless major disturbance such as fire, wind, or ice affects the stands.

Without such disturbance, habitat conditions would be most affected by the condition of the overstory trees, which would continue to shade out suppressed trees and reduce overstory density. As the dominant trees continue to grow they would gain late-successional habitat features like large diameters, deeply fissured bark, deep crowns, large branches, broken tops, and cavities. As individual dominant trees die, they would become large snags or down wood. As large trees or snags fall, they would knock over other trees and branches, creating growing space. This growing space would release understory conifers and hardwoods, allowing them to grow into dominant trees, and stimulate growth of shrubs and herbaceous vegetation.

The overall effect of these successional processes would create a mosaic of tree ages, species composition, and late-successional habitat features in the stands. Additionally, patches of overstory trees would continue to suffer mortality from existing root rot or other disturbance such as windthrow. This would create larger areas of growing space for surviving overstory trees, hardwoods, conifer regeneration, shrubs, and herbs to occupy. Therefore, habitat in the project area would primarily develop late-successional characteristics, with patches of early- or mid-successional habitat throughout.

Existing CWD and snags would not be physically degraded or removed, nor would their quality or function change due to alteration of surrounding microclimate. Existing CWD and snags would continue to decay and disappear from the stand. Snags and CWD would continue to be recruited, primarily through suppression mortality and the effects of root rot although sporadic disturbance events such as windthrow could also occur. These features would continue to accumulate until typical late-successional sizes and amounts were achieved.

No direct or indirect effects to wildlife species or their habitat would occur under this Alternative. Stands would not be modified and no potential for noise disturbance would exist. The project area would continue to provide for wildlife use at current levels, and habitat development would continue along current trajectories.

3.2.2.2 Alternative 2: Ecological Forestry

Thinning

The proposed thinning would remove some overstory trees and create growing space for residual trees, which would continue height and diameter growth and expand their crowns and roots to use newly available resources. Increased light would penetrate the canopy and stimulate growth of understory trees and shrubs. Thinning would thereby accelerate the development of late-successional characteristics like fissured/sloughing bark, deep crowns, large branches, multiple canopy layers, and cavities. Additionally, thinning would ensure that hardwood and minor conifer species would be retained and persist in the units.

Felling and yarding operations would physically degrade saplings, shrubs, and herbaceous vegetation which would require approximately 10-15 years to recover. Operations would also fragment stands and create completely open areas through the creation of skid trails, cable yarding corridors, and ***landings***. Portions of these areas that would suffer soil degradation and compaction may be incapable of supporting vegetation for many decades and would recover much more slowly than other treated areas (see Issue 4).

Unthinned portions of Riparian Reserves would provide areas where existing conditions and development trajectories would remain undisturbed.

PDFs would retain most existing Decay Class 3-5 CWD and snags in proposed thinning units; Decay Classes 1-2 could be removed from the units though harvest. Harvest operations would damage some down logs (particularly those in advanced decay classes), and some snags could be felled for safety reasons or be inadvertently knocked over. Therefore the proposed thinning would result in an immediate reduction of snags and CWD in the project area. Changes in microclimate due to overstory removal would also modify CWD and snag function and quality until stand canopy conditions recover in 10-15 years.

In addition to damaging or removing some existing CWD and snags, thinning would also remove trees that would soon suffer suppression mortality and become snags or down wood and existing material would disappear from the stands as decay continues. As a result, less CWD and snags would not be recruited into the stands when compared to the no action alternative, and their development would be delayed until mortality of residual trees resumes. This may be many decades in the future because residual trees would continue vigorous growth, although sporadic mortality from wind, disease, or insects would occur. Because modelling showed no marked increase in tree growth in the short-term following thinning, treatment would not be expected to provide larger snags and CWD sooner than no treatment. Therefore, thinning under all action alternatives would have negative impacts to snag and CWD dynamics. However, with the incorporation of resource protective PDFs, snag and CWD levels would be expected to be achieved post-harvest through retention or creation. Retention of unthinned riparian buffers and deferred areas in and around the proposed units would moderate this effect at the project scale.

Approximately 36 acres of spotted owl dispersal-only habitat would be affected under all action alternatives. Vertical and horizontal cover would be reduced in treated areas through overstory tree removal, with varying levels of residual tree density. Harvest would also damage existing shrub and herb layers, and may also damage or destroy some coarse woody debris and snags.

Spotted owls would be expected to continue to utilize treated areas because post-project canopy closure and horizontal cover would continue to allow spotted owls to effectively use stands. Canopy closure after treatment would be 40% or greater, meeting or exceeding the threshold for dispersal function (Thomas et.al. 1990). However, spotted owls would likely utilize thinned stands less than unthinned stands for approximately 15-20 years until canopy closure and shrub/understory layers recover and develop further. The proposed action would leave untreated riparian buffers that would provide a narrow network of denser canopy cover that could facilitate spotted owl movement through the project area.

The proposed thinning would improve the development trajectory of habitat features used by spotted owls and their prey, like deep crowns with large branches, multiple canopy layers, and herbaceous and shrub vegetation. These features would develop in varying time frames; for example response from understory vegetation would take only years, while development of suitable nesting structure could take hundreds of years. With the implementation of resource protective PDFs including retention/creation of snags and CWD, the project would be expected to meet its intended goal.

These late-successional features would be free to develop in Riparian Reserves over the required timeframes and the goal of any future treatments in these areas would be to enhance the development of suitable spotted owl habitat. Therefore, it is assumed that in Riparian Reserves, the proposed action would be a first step in contributing to the long-term conservation needs of the spotted owl.

All of the proposed thinning is in the GFMA and would be available for regeneration harvest within 30-60 years. High-quality suitable spotted owl habitat would not develop in this timeframe, and any habitat improvement realized on these acres would be short-lived. Therefore, it is likely that the thinning portion of this alternative would contribute little to the long-term conservation needs of the spotted owl if the stands are ultimately regeneration harvested.

Thinning under all Alternatives would negatively impact red tree vole habitat for approximately 10-15 years by reducing ***stand density***, thereby reducing protective cover and eliminating inter-tree movement. In the long-term, thinning would accelerate the development of suitable red tree vole habitat features like deep crowns, large branches, and vertical and horizontal structure.

In proposed thinning units, potential habitat for Cascade axetail slugs in needle/leaf litter and other detritus could be negatively impacted, but this type of habitat is likely to remain abundant in the project area post-harvest. The greatest impact from thinning would likely be a reduction in canopy cover and drier microclimate conditions for 10-20 years until canopy and shrub/herbaceous vegetation recovers. It is unknown if and how this could affect species persistence in treated areas.

The ***mid-seral*** forest proposed for thinning treatment is not suitable habitat for the western bumblebee, and the proposed thinning would not alter its suitability. Therefore, this portion of the alternative would not affect this species.

The proposed thinning would also have direct and indirect effects on migratory birds and their habitats. Partial removal of overstory trees would reduce canopy cover and volume, and operations would remove or some damage understory vegetation, snags, and existing coarse woody debris. Nests could be removed by project actions and adverse effects to nesting behavior from noise and visual disruption could also occur during felling and yarding actions. Thinning would also stimulate growth in residual trees, understory trees, shrubs, and herbaceous vegetation over the course of several decades. These effects would benefit these and other migratory bird species that use mature and late-successional habitat. However the majority of the project area is in Matrix and regeneration harvest is planned, therefore the proposed thinning would not be expected to contribute to the long-term conservation of these migratory bird species.

Thinning would also be expected, to a lesser degree than regeneration harvest, to stimulate the growth of flowering vegetation on which the rufous hummingbird forages. Thinning may indirectly benefit band-tailed pigeons by accelerating the development of suitable nesting habitat. Thinning would occur in unsuitable habitat for northern goshawk and would provide an indirect benefit by accelerating the development of suitable nesting and foraging habitat

Regeneration Harvest

Regeneration harvest would cause extreme, long-lasting changes to the habitat conditions in the project area. In the 231 acres of harvest areas this alternative would remove almost all live trees, thereby setting back the successional state of the stand to a pioneer or early-seral stage. The habitat characteristics provided by mature forest, such as a closed canopy, canopy layers, and vertical and horizontal complexity, would be completely eliminated. Project operations would also physically degrade understory shrubs, and herbaceous vegetation which would require approximately 10-15 years to recover. Alternative 2 calls for the retention of 2 standing green trees in the harvested areas, which would provide a minor structural legacy component.

Snag and CWD levels in the proposed units are extremely low compared to unmanaged stands of similar age due to the two previous harvest entries. PDFs (see Appendix A) would retain most existing Decay Class 3-5 CWD and snags in proposed units; Decay Classes 1-2 could be removed from the units during harvest. Harvest operations would damage some down logs (particularly those in advanced decay classes), and some snags could felled for safety reasons or be inadvertently knocked over. Therefore the action alternatives would result in an immediate reduction of snags and CWD in the project area.

Post-harvest snag and CWD Desired Future Conditions for each alternative are specified in Chapter 2 above and are very similar among alternatives. These levels would be met by a combination of existing material that survives harvest, new material created as a byproduct of harvest operations, and post-project snag and CWD creation from green trees reserved specifically for this purpose. After this, mortality of standing green retention trees would be the only available inputs of large wood for approximately 80-100 years. Site preparation and planting density would also influence the future recruitment of smaller diameter snag and CWD under all action alternatives depending on future stand management such as brush control and thinning. Therefore, because existing snag and CWD levels are low, most potential future inputs would be removed through harvest and post-project snag and CWD goals are low, all of the action alternatives would result in continued snag and CWD levels below those of typical unmanaged stands for many decades.

Alternative 2 would provide for continued suppression mortality and future large snag and CWD inputs localized in retention aggregates, but in harvested areas large inputs (other than the very scattered dispersed retention trees) would not develop for approximately 80-100 years.

The proposed regeneration harvest under Alternative 2 harvest would be generally similar in design but affect approximately 231 acres. Differing amounts and orientations of retention aggregates between the alternatives would cause differing effects.

Regeneration harvest would remove spotted owl foraging habitat, leaving the affected forest stands as unsuitable spotted owl habitat. Harvest would remove overstory trees, canopy layers, canopy cover and horizontal and vertical structural complexity. Harvested areas would remain unsuitable habitat for approximately 60 years, until canopies of the replacement stands close to provide sufficient cover for spotted owl dispersal. At the stand scale, spotted owl habitat development would occur more slowly under this alternative than in previous regeneration harvests conducted on the District because post-harvest conifer planting would occur at wider spacing. Dispersed retention under Alternative 2 would slightly accelerate this development of stand complexity. Under Alternative 2, once the harvested areas develop into dispersal habitat in 40-60 years, the retention aggregates would be expected to provide nesting opportunities for spotted owls.

Aggregate and Riparian Reserve retention would help to partially mitigate the effects of timber harvest by maintaining untreated forested corridors between stream drainages. This would provide spotted owls limited opportunities to continue to travel across the project area more easily than after a conventional regeneration harvest. Additionally, the largest aggregates would also provide sites that spotted owls could use for limited roosting and foraging opportunities. Alternative 2 would provide approximately 22% more (136 vs. 110 acres) aggregated retention than Alternative 3. Because Alternative 2 would feature more retention patches that are also on average larger than those under Alternative 3 it would provide superior post-harvest conditions for spotted owls through increased habitat connectivity and opportunities for roosting and foraging in the aggregates. Despite the presence of retention aggregates, the harvest areas under both of these Alternatives would be large enough to preclude spotted owl movement across them, and render the project area as a whole unsuitable spotted owl habitat.

Spotted owl prey species would also be affected by the proposed regeneration harvest. Habitat for two principal prey species, Oregon red tree vole and northern flying squirrel, would be removed in harvested areas. Habitat for these species would at a minimum take approximately 40-60 years to develop after harvest. Other spotted owl prey species such as brush rabbits and woodrats are primarily associated with early-and mid-seral forest habitat (Maser et.al. 1981, Sakai and Noon 1993, Carey et.al. 1999) and could benefit from the creation of early-seral conditions providing a greater abundance of forage. However, this potential prey would only become available to spotted owls if they move into the forested habitat that would remain in retention aggregates and Riparian Reserves (Carey, et.al. 1992; Forsman, et.al. 1984).

No direct effects to spotted owls would be expected due to habitat removal; the project area occurs at the extreme periphery of two owl sites (Parsons Creek and 56NEWITS), with no harvest proposed in either site's Nest Patch or ***Core Area***, and would not affect any known high-use areas or nest trees. Habitat removal could have indirect effects; while spotted owls can survive or remain productive in areas with varying levels of suitable habitat, at some threshold home ranges cease to be viable.

Based on previous research, 40% suitable habitat within the provincial home range (PHR) of an owl nest (1.2 miles) (Thomas et.al. 1990, Courtney et.al. 2004), along with 50% suitable habitat within core areas (0.5 miles) (Swindle et.al. 1997, Irwin et.al. 2000, Irwin et.al. 2005), is considered a conservative viability threshold for a reproductive spotted owl pair. Both of the affected home ranges are far below this standard for suitable habitat and spotted owl reproduction at either would be unlikely; however, enough dispersal habitat is present that either could support non-reproductive residents or dispersal across the landscape. Additionally, approximately 313 acres of dispersal habitat in the Parsons Creek PHR is proposed for thinning through a separate timber sale. However, the affected sites currently have little suitable habitat and do not meet the Fish and Wildlife Service take thresholds.

Delineation of the Habitat Areas (see "Retention" below) would prevent direct effects to red tree voles and known nests from the proposed harvest; the action alternatives would have varying effects on red tree vole habitat. Regeneration harvest would remove suitable red tree vole habitat and have varying effects on its redevelopment and connectivity across the project area. Within harvested areas, minimally suitable red tree vole habitat would take 40-60 years to develop and would be superior under Alternative 2 due to dispersed green tree retention.

Effects to Cascade axetail slugs are difficult to analyze due to lack of detailed knowledge on its behavior and habitat use. Regeneration harvest areas would likely become unsuitable habitat for the species due to a warmer, drier, and sunnier microclimate. Under Alternative 2, habitat in retention aggregates would remain undisturbed but become less suitable due to increased insolation and wind infiltration, leading to warmer and drier conditions.

It is unknown if western bumblebees are present in the project area, therefore only effects to habitat can be reliably assessed. Regeneration harvest areas would temporarily improve habitat conditions for this species by creating early-seral conditions. After harvest, flowering herbs and shrubs would dominate the site for approximately 20-30 years and provide nectar and pollen sources until conifers developed a closed canopy. Harvest operations would also create disturbed ground suitable for nesting.

Regeneration harvest would have both positive and negative effects on migratory bird habitat. Regeneration harvest would remove all dominant conifers and hardwoods, and remove or damage shrub and herb layers. It would also result in the loss of trees with nesting structure, and disturb and degrade down wood. This would render the harvested areas unsuitable to species dependent on mature forest habitat. Regeneration harvest would, however, create early-seral habitat with snags, shrubs, herbaceous vegetation, stump-sprouting hardwoods, and young conifers important to other species.

The creation of early-seral habitat through regeneration harvest would provide increased foraging habitat for the rufous hummingbird, as flowering shrubs and herbaceous vegetation become established in the harvested units. Because units would be managed for sustainable timber production they would be replanted to conifers, which would limit the duration of increased forage availability. Regeneration harvest would remove suitable band-tailed pigeon nesting habitat. The northern goshawk is a U.S. Fish and Wildlife Service Species of Concern (USDI/USFWS 2004a). Regeneration harvest would remove suitable habitat and reduce the current and future ability of the harvested portions of the project area to support goshawk breeding and occupancy for approximately 60-80 years.

Both Townsend's big-eared bat and the fringed myotis are known to utilize caves, mines, or rock outcrops for roosts, maternity colonies, or hibernacula. None of these potential habitats exist in the proposed regeneration harvest units. The two species are known to forage in coniferous forest stands and use large trees and snags for roosting. The trees and snags present in the proposed harvest units are marginal habitat features due to their relatively small size and lack of suitable features like deeply furrowed bark and large cavities. A lack of detailed information on bat populations in the Upper Willamette Resource Area in general, and specifically in the areas in which harvest is proposed, make potential effects difficult to quantify. Bats are capable of traveling widely and quickly, so individuals residing in the proposed harvest units would likely move to other areas. Direct mortality of individuals that may occupy the stands is a possibility, however, and displacement of bats could indirectly result in mortality due to increased competition for roost sites and foraging areas. This alternative may indirectly benefit these species through the creation of snags and early-seral habitat with diverse insect populations associated with regeneration harvest which would provide increased foraging and roosting opportunities. Both species have been observed foraging in open areas and/or riparian zones (Cross and Waldien 1995, Marshall et.al. 1996, Verts and Carraway 1998, Pierson et.al. 1999, Fellers and Pierson 2002), which the proposed regeneration harvest would create and/or protect. Retention in regeneration harvest units and untreated Riparian Reserves would continue to provide a degree of roosting opportunities after harvest;

Reforestation
After harvest, site preparation and relatively wide conifer planting would favor the maintenance of early-seral habitat conditions dominated by herbs, shrubs, and stump-sprouting hardwoods for a longer period than is typical with standard BLM reforestation practices.

Retention
In the areas identified as retention aggregates and Riparian Reserves, the existing conditions and development trajectories would be less affected. The primary impact would be from increased insolation and wind infiltration, which would cause warmer, drier microclimatic conditions in the aggregates and reduce their suitability for flora and fauna species that use shaded, cool, and moist interior forest habitat.

After field-verification, red tree vole nest locations provided to the BLM by the Northwest Ecosystem Survey Team (NEST) were used to delineate two Habitat Areas as described in the species' Management Recommendations (USDA and USDI 2000). These Habitat Areas include all 7 active nests and 10 of the 16 inactive nests identified. The Habitat Areas under Alternative 2 total approximately 56 acres and consist of retention aggregates and adjacent Riparian Reserve inclusions in the unit that would not receive treatment. The Habitat Areas would "maintain the physical integrity of habitat at active sites" and "maintain red tree vole populations at sites where they currently occur;" additionally they would be of sufficient size to allow for an increase in the number of active nests at the sites (USDA and USDI 2000). Alternative 2 would provide for greater red tree vole expansion and connectivity with Riparian Reserves due to the larger Habitat Areas. Both Habitat Areas are contiguous at both ends with the Riparian Reserve network, which would provide connectivity to a land use allocation where suitable late-successional habitat would be maintained or developed. This would improve the viability of the sites by allowing for expansion and reducing isolation. Alternative 2 would retain red tree vole habitat that would continue to improve in retention aggregates, all of which also provide connectivity to the Riparian Reserve network.

The single Oregon megomphix site found during pre-project surveys would be managed by following species-specific interagency management recommendations (Applegarth, 2000). The site would be protected by establishing retention aggregate boundaries in order to provide suitable microclimate, undisturbed substrate, and vegetation or down wood. Under Alternative 2 an approximately 20-acre habitat area (retention aggregates and contiguous Riparian Reserve inclusions) would be left. This would preserve the shading, microclimate, vegetation, down wood, and other features that allow for the species persistence at the site and provide increased opportunities compared to the other action alternatives for the species to expand into undisturbed habitat within the project area through connectivity to the Riparian Reserve network. Therefore, Alternative 2 would better provide for the population-level conservation needs for this species.

All streams in the project area that are suitable habitat for harlequin ducks would receive a minimum 200 foot no-touch buffer. Therefore, this alternative would be expected to have no effects to this species through disturbance, nesting habitat modification, or changes to in-stream conditions.

Habitat for Cascades axetail slug in the untreated portions of Riparian Reserves would remain unaffected. Because the species is known to use young and mid-seral stands, which are abundant in the affected watershed and across the District, it is unlikely that any negative habitat effects would contribute to the need to list this species under the ESA.

Purple martins typically nest in more open habitat (Brown 1997, Horvath 2003), and there are no known suitable nest trees and/or snags in the proposed harvest units. The species is known to nest in the watershed, but no observations have been recorded in or adjacent to the proposed units. Potential nest trees could occur in the previously harvested areas adjacent to units 34F, 35F, and 35H, which would be subject to noise disturbance from project activities. However, any negative effects to purple martin behavior or breeding would be insignificant at the watershed, District, and regional scale and would not contribute to the need to list the species under the ***Endangered Species*** Act. Alternative 2 would feature much fewer nesting opportunities in dispersed retention trees compared to Alternative 4. Under all action alternatives, nesting opportunities would persist for approximately 20-40 years until regenerating conifers eliminated suitable nesting space.

3.2.2.3 Alternative 3: Proposed Action

Thinning
Effects from thinning harvest under Alternative 3 would be the same as under Alternative 2.

Regeneration Harvest
Effects from regeneration harvest under this Alternative would be similar to those described for Alternative 2, but would impact a 12% larger area (259 vs. 231 acres).

The proposed regeneration harvest would be generally similar in design but affect approximately 259 acres under Alternative 3. Differing amounts and orientations of retention aggregates between the alternatives would cause differing effects to northern spotted owls. Because dispersed green tree retention would not occur under Alternative 3, the development of the structural characteristics of nesting, roosting, and foraging habitat would take approximately 80 to 100 years in the harvest openings.

Reforestation
Effects from reforestation proposals under Alternative 3 would be the same as under Alternative 2.

Retention
All effects under Alternative 3 would be the same as those presented under Alternative 2, excepting the following.

The Habitat Areas for red tree voles under Alternative 3 would total approximately 46 acres and consist of retention aggregates and adjacent Riparian Reserve inclusions in the unit that would not receive treatment. The Habitat Areas would “maintain the physical integrity of habitat at active sites” and “maintain red tree vole populations at sites where they currently occur;” additionally they would be of sufficient size to allow for an increase in the number of active nests at the sites (USDA and USDI 2000).

Under Alternatives 3 the habitat area for Oregon megomphix would be 4.5 acres and would preserve the shading, microclimate, vegetation, down wood, and other features that allow for the species persistence at the site; however the larger habitat area in Alternative 2 would provide increased opportunities for the species to expand into undisturbed habitat within the project area, and would also provide connectivity to the Riparian Reserve network.

Alternative 3 includes no dispersed retention and therefore would provide future nesting opportunities for purple martin only along the edges of retention aggregates

3.2.2.4 Alternative 4: Dispersed Retention

Thinning
Effects from thinning harvest under Alternative 4 would be the same as under Alternative 2.

Regeneration Harvest
All effects under Alternative 4 would be the same as those presented under Alternative 2, excepting the following.

Regeneration harvest with dispersed retention would cause extreme and long-lasting changes to the habitat conditions in the project area. In the 303 harvested acres most live trees would be removed, thereby setting back the successional state of the stand to a pioneer or early-seral stage with scattered overstory conifer trees. The habitat characteristics provided by mature forest, such as a closed canopy, canopy layers, and vertical and horizontal complexity, would be completely eliminated. Project operations would also physically degrade understory shrubs and herbaceous vegetation which would require approximately 5-10 years to recover. After harvest, site preparation and dense conifer planting would favor the rapid establishment of a conifer-dominated stand. Future pre-commercial and commercial thinning of planted conifers would ensure vigorous growth which, along with dispersed retention of existing trees, would provide the fastest return to pre-harvest habitat functionality among the three action alternatives.

Among the action alternatives, dispersed retention under Alternative 4 would provide the earliest opportunity for well-distributed snags and CWD (including large pieces) to develop across the project area through the mortality of retention trees and planted trees; however, this would likely take at least 50 years to begin. Alternatives 2 and

3 would provide for continued suppression mortality and future large snag and CWD inputs localized in retention aggregates, but in harvested areas large inputs (other than the very scattered dispersed retention trees) would not develop for approximately 80-100 years.

Alternative 4 would remove 303 acres of spotted owl foraging habitat, the most among the action alternatives. The direct effects to spotted owl habitat under this alternative would be similar to those described above except that the retention trees would be dispersed throughout the harvested areas rather than grouped into aggregates, which would have differing short and long term effects than Alternatives 2 and 3. In the short term, dispersed retention would provide no connectivity between unharvested Riparian Reserves or the roosting and foraging opportunities that aggregated retention would. Therefore, Alternative 4 would have greater short term negative impacts to spotted owl habitat and potential spotted owl use in the project area. The project area would remain unsuitable habitat for approximately 40 years, until canopies of the replacement stands close to provide sufficient cover and flying space for spotted owl dispersal. In the long term dispersed retention would hasten the development of suitable spotted owl habitat compared to Alternatives 2 and 3 due to the increased spatial availability of nesting opportunities and snags/CWD provided by retention trees once the replacement stand matures.

Reforestation
Effects from reforestation proposals under Alternative 4 would be the same as under Alternative 2.

Retention
All effects under Alternative 4 would be the same as those presented under Alternative 2, excepting the following.

The Habitat Areas for red tree voles under Alternative 4 total approximately 46 acres and consist of retention aggregates and adjacent Riparian Reserve inclusions in the unit that would not receive treatment. The Habitat Areas would "maintain the physical integrity of habitat at active sites" and "maintain red tree vole populations at sites where they currently occur;" additionally they would be of sufficient size to allow for an increase in the number of active nests at the sites (USDA and USDI 2000). Alternative 4 would have the greatest negative impacts to red tree vole habitat, as dispersed retention would provide no suitable habitat and would eliminate connectivity between Riparian Reserves. Under this alternative minimally suitable habitat would again take 40-60 years to develop in harvested areas; however it would be higher value than in Alternatives 2 and 3 due to greater number of mature trees retained from the previous stand.

Under Alternatives 4 the habitat area for Oregon megomphix would be 4.5 acres and would preserve the shading, microclimate, vegetation, down wood, and other features that allow for the species persistence at the site. Among the action alternatives, Alternative 4 would create the best post-harvest habitat for purple martin: open conditions with dispersed retention trees and created snags. Under Alternative 4 there would be no retention aggregates and the entire regeneration harvest area would become unsuitable habitat for Cascade axetail slugs.

3.3 Issue 3: What are the effects of regeneration harvest on carbon sequestration and climate change?

3.3.1 Affected Environment
Secretarial Order No. 3226 (2001, amended 2009) directs all Departments to "consider and analyze potential climate change impacts when undertaking long-range planning exercises." The 1994 PRMP FEIS (USDI/BLM 1994, Appendix V, pg. 217) considered climate change effects as part of long-term planning efforts at the Plan-scale (western Oregon). Although the 1994 PRMP FEIS recognized the possibilities of increased incidence of wildfire, insect outbreaks, shifting range of species including Douglas-fir, and forest species composition, it found "no scientific consensus about the extent or rate of global warming nor the probable effect on forest ecosystems in western Oregon" (p.217).

Forster et al. 2007 (pp. 129-234), incorporated here by reference, reviewed scientific information on greenhouse gas emissions and climate change, and concluded that human-caused increases in greenhouse gas emissions have likely exerted a substantial warming effect on global climate. Literature, however, has not yet defined any specifics on the nature or magnitude of any cause and effect relationship between greenhouse gases and climate change.

The U.S. Geological Survey, in a May 14, 2008, memorandum (USDI/USGS 2008) to the U.S. Fish and Wildlife Service, summarized the latest science on greenhouse gas emissions and concluded that it is currently beyond the scope of existing science to identify a specific source of greenhouse gas emissions or sequestration and designate it as the cause of specific climate impacts at a specific location. Although it is not speculative that changes in the affected environment will occur due to climate change, it is not possible to reasonably foresee the specific nature or magnitude of the changes (USDI/BLM 2008, p. 488). Given this uncertainty, this analysis is focused on calculating gas emissions and storage, in the context of carbon release and sequestration.

Forests fix and store carbon through photosynthesis and release carbon through respiration and decay, affecting atmospheric concentrations of carbon dioxide which thereby affect global climate. Values in this analysis, in terms of carbon stored and released, are generally expressed as tonnes, the unit of measure most commonly used in scientific literature to express carbon storage and release. One tonne of carbon is equivalent to 3.67 tons of carbon dioxide (U.S. EPA 2005).

The 2008 FEIS (pp. 488-490), incorporated by reference, described current information on predicted changes in regional climate, concluding that the regional climate has become warmer and wetter with reduced snowpack, and that continued change is likely.

Even though a causal link between the Second show project and specific climate change effects cannot be assigned, the amount of carbon released or stored under the alternatives analyzed can be estimated. Site specific data from stand exams was input into the ORGANON Growth Model (Hann 2009). The outputs from the model were then used to calculate amounts of carbon that would be released or sequestered, and the resulting net carbon balance that would result under the alternatives.

Modeling was conducted for intervals extending out 50 years. The net carbon balance for this project was analyzed by calculating: the amount of carbon held in live trees and other components of the forest stands (snags, down wood, soil carbon, etc.), the amount of carbon held in wood products and logging slash that gradually release carbon over time, and the amount of carbon released by the burning of fossil fuels and slash under the proposed action alternatives.

The action alternatives would result in a cumulative 50 year flux of greenhouse gasses (GHGs) to the affected environment on the average order of 5 thousand metric tons (megagrams (MG)) of CO_2 by 2064: at the scale of western Oregon, carbon stores are predicted to increase by 169 million MG under the NWFP by 2106 (USDI/BLM 2008). Action area carbon flux estimates are quantified and described fully below. However, it is not possible with current science to estimate the effects of these GHG fluxes on the local affected environment. The USGS summarized science regarding the effects of local actions on climate change and concluded "Difficulties remain in simulating and attributing observed temperature changes at smaller than continental scales…It is currently beyond the scope of existing science to identify a specific source of CO_2 emissions and designate it as the cause of specific climate impacts at an exact location" (USDI/BLM 2008). This memorandum (No. 2008435-DO) is incorporated by reference.

Greenhouse Gasses: Carbon Stores and Carbon Flux

As an aid to decision-making, this analysis estimates carbon flux to the analysis area associated with the action alternatives. Carbon flux is the rate of exchange of carbon between pools, the net difference between carbon removal and carbon addition to a system. For the atmosphere, this refers to carbon removed by plant growth, mineralization, dissolving in the ocean and other processes, balanced by carbon added through plant respiration, harvest/volatilization, concrete production, fossil fuel burning, volcanic activity and other processes. Forest harvest may lead to flux of GHGs in addition to CO_2, principally N_2O and CH_4 (Jassal et al., 2008, Sonne 2006). Due to lack of scientific information and lack of adequate models on the effects of forest activities in the Pacific Northwest on non-carbon GHGs, and the (presumably) minor contribution of these other gases to GHG flux associated with the action alternatives in relation to total flux estimation error, they are not addressed here. The indirect effects of carbon flux following timber harvest have been addressed below. Indirect effects of this carbon flux on climate change and the affected environment is also addressed below.

Carbon Flux of the Proposed Action

Estimates of carbon stores in the analysis area as a whole would be fraught with error, could complicate contrast between the alternatives, and would not facilitate decision-making. Instead, this analysis quantifies the net effect of the action alternatives on greenhouse gas levels by comparing changes in carbon storage that would occur under the action alternatives to the carbon storage that would occur under the no action alternative, as suggested in IM-2010-012 (USDI 2010). Specifically, this analysis estimates the carbon flux associated with implementation of the action alternatives roughly fifty years from the present, incorporating: a) differences in carbon storage in live, dead, and organic soil carbon pools; b) the intermediary flux from wood products produced by the Proposed Action through this period; and c) "secondary" C fluxes associated with logging and hauling systems.

Analysis of carbon flux associated with changes in live and dead pools attributable to the Proposed Action ("a", above) used relatively simple tree-/stand-scale models available with ORGANON. This method considers changes due to succession and forest management in all major live and dead carbon pools within the action area (treated units). This ORGANON model does not directly incorporate microclimatic effects, dynamics of herb and shrub understory layers, stable soil pools, or the C flux associated with actual harvest equipment. Herb and shrub carbon pools are relatively small compared to total stores, and are similar between young and mature stands (USDI/BLM 2008, p. App-29). Soil carbon represents 9-20% of total site carbon but is the most stable C store and the least likely to respond to disturbance. For example, 60-year old forests and 450- year old forests have similar soil carbon storage (Harmon, et al. 1990). Flux of carbon from merchantable wood products ("b", in previous paragraph) produced from the action alternatives during the 50 year analysis window was estimated following synthesis in USDI/BLM (2008, p. App-30). GHG emissions from forestry activities necessary to harvest these units ("secondary emissions", "c" in previous paragraph) were estimated following (WRI 2010), and added to ORGANON estimates (see below).

3.3.2 Environmental Effects

The action alternatives would impact approximately 266-339 acres of forest, volatilizing some carbon, moving carbon from live tree pools to detritus and wood products pools, and storing some carbon in forest products while leaving some residual trees and growing replacement trees. Making a set of very broad assumptions and using the ORGANON model and assumptions similar to those developed in the 2008 RMP FEIS (USDI/BLM 2008); compared to the no action alternative, the action alternatives would result in a C flux of 2,350 MG, 3,525 MG, and 2,675 MG for Alternatives 2, 3, and 4 respectively over the 50 year time period from harvest until approximately 2064. The sum of forest treatment and harvest system flux is between 2-4 thousand metric tons. Calculations are summarized below (Tables 3-1 to 3-3).

Table 3-1. Stand level stored Carbon in metric tonnes for Alternative 2.

Present Stored Carbon	Alternative 2 in 50 Years	Wood Products derived from Proposed Action after 50 Years	No Action 2064	50 Year Flux (NA-A2+C in wood products)
25,998 (8,870 removable as wood products)	31,595	6,227	46,229	2,350

Table 3-2. Stand level stored Carbon in metric tonnes for the Proposed Action.

Present Stored Carbon	Proposed Action in 50 Years	Wood Products derived from Proposed Action after 50 Years	No Action 2064	50 Year Flux (NA-PA+C in wood products)
25,998 (13,111 removable as wood products)	24,093	9,204	46,229	3,525

Table 3-3. Stand level stored Carbon in metric tonnes for Alternative 4.

Present Stored Carbon	Proposed Action in 50 Years	Wood Products derived from Proposed Action after 50 Years	No Action 2064	50 Year Flux (NA-PA+C in wood products)
25,998 (9,893 removable as wood products)	29,368	6,945	46,229	2,675

GHG emissions from forestry activities necessary to harvest these units ("secondary emissions" including emissions from vehicles and equipment) have been estimated for all alternatives at 0.1411 MG CO_2/MBF (WRI 2010). Applying this equation to the action alternatives suggests an additional 1,067 metric tons (MG) CO_2 release attributable to the action alternatives; this is consistent with Sonne (2006) predicted a relatively small C flux associated with harvest equipment. The sum of forest treatment and harvest system flux is roughly 3-5 thousand metric tonnes.

The difference in carbon between the action and no action alternatives would continue to decrease through time because the rate of carbon storage decelerates after a stand reaches the age of culmination of mean annual increment. When analyzed over a 20 year timeframe (when modeled stand-level carbon storage appears to be at a minimum, but where the percent of carbon stored as forest products is higher), the carbon flux is approximately 7 thousand metric tons.

The total 50-year carbon flux of the Proposed Action compared to the no action would not produce measurable change in global climates considering current detection and modeling technologies. To place this carbon flux in context, the total 50-year carbon flux associated with the action alternatives would represent approximately:

- <0.01% of carbon stored on BLM-managed lands in western Oregon (USDI/BLM 2008). BLM-managed lands in western Oregon support approximately 1% of the carbon stored in the western U.S., and 0.02% of global carbon stores in vegetation, soil, and detritus (USDI/BLM 2008).
- Below the indicative threshold (25,000 metric tons) set by the EPA under a mandatory reporting rule for non-forestry regulated entities (74 FR 56373).

This EA is tiered to the 1994 PRMP FEIS that considered carbon flux and climate change at the Plan scale. The 1994 PRMP FEIS considered speculative and did not consider the indirect effects of carbon flux associated with the Plan on aspects of the affected environment including wildlife, economies, human health, and other resources (Appendix V, p. 217). The 1994 PRMP FEIS concluded that with implementation of any of the alternatives at the Plan level, “the overall impact on the global atmospheric carbon dioxide balance would be much less than 0.01 percent of the total” (p. 4-1). Based on the small estimated permanent flux of carbon that would be associated with the cumulative effects of the action alternatives following the 1994 PRMP FEIS, the high uncertainty in any such estimate of carbon flux (and other sources of GHGs), and the response of global climate to these GHG’s, conclusions in the 1994 PRMP FEIS remain valid and applicable to the cumulative effects of the action alternatives.

At the scale of western Oregon, considering the cumulative effects of both forest succession (a carbon sink) and harvest (a carbon source) under the NWFP in the Plan Area, carbon stores would be predicted to increase by 2106, from 427 to 596 million MG. This sequestration is less than under a “No Harvest” scenario, but does represent a gain in carbon storage. U.S. annual CO_2 emissions (circa 2008) were approximately 6 billion MG. The flux of approximately 5 thousand metric tons of carbon associated with the action alternatives (over 50 years) would represent far less than 0.00002% of this yearly flux. The difference in carbon storage in 50 years between alternatives would be too small to lead to a detectable change in global carbon storage, and existing climate models do not have sufficient precision to reflect the effects on climate from such a small fractional change in global carbon storage (USDI/BLM 2008, p. 543). Currently, federal thresholds for carbon flux related to individual actions have not been established. Uncertainty associated with all estimates of carbon flux in this analysis would be predicted to be quite high (circa 30%: USDI/BLM 2008, p. 538). However, estimates of the magnitude and direction in carbon response are probably accurate, and these results may be instructive for comparing the effects of the alternatives on local (watershed-scale) carbon stores.

3.4 Issue 4: What are the effects of proposed actions (timber harvest, roads management, and site preparation for planting) on soil productivity and compaction?

3.4.1 Affected Environment

Field surveys during sale planning provided verification of the Lane and Linn County Soil Surveys (NRCS, 1987). Harvest areas in T. 15 S., R. 2 W., Sections 27, 33, and 34 are in Linn County. Lane County portions are in T. 15 S., R. 2 W., Sections 26 and 35. Maps are provided in the Analysis file. Average annual precipitation ranges from 40 to 60 inches at lower elevations, and 60 to 100 inches at highest elevations.

The dominant upland soil in Second Show is Kinney cobbly loam, occupying about 47- 48% of the total acreage proposed for harvest. Kinney soils are deep (up to 60 inches) and well drained, with cobbly loam topsoil over very cobbly clay subsoils. Kinney soils in occur in old stabilized slump terrain on uplands where slopes are typically less than 30%. In some areas the soil is only moderately well drained because areas are subject to seepage and runoff from adjacent higher areas. Kinney soils are classified as high productivity and high resiliency.

Blachly, Blachly-McCully, and McCully clay loam soils either combination occupy 41-42% of the total acreage proposed for harvest. These two soils have very similar physical properties and interpretations for management. They are deep soil types with high clay content throughout, often greater than 50% in the subsoil, and few coarse fragments. Due to moderate slow permeability, these soils are generally dry less than 45 days between July and October in six out of ten years. Soil moisture content on these sites often will not draw down to recommended soil moistures (25%) that provide resistance to compaction. Gradual slopes, broad ridges, north and east aspects are particularly slow to dry.

Klickitat-Harrington soils occur together on the broad ridgetop and upper sideslopes in Section 34 on slopes less than 30%, and comprise about 11-12% of total acreage proposed for harvest. The soils are intermingled with about 50% Klickitat stony loam and 50% Harrington gravelly loam. Klickitat soils are deep and well drained with greater than 50% coarse content throughout the soil profile. The surface soil is stony loam over very cobbly clay loam subsoil. Permeability is moderate. Fractured basalt is usually at a depth of 50 inches, but shallow inclusions are fairly common. Harrington soils are moderately deep and well drained. The surface soil is gravelly loam over very gravelly clay loam. Permeability is moderately rapid. Basalt is at a depth of 34 inches. These sites are particularly dry due to the excessive coarse content. Klickitat-Harrington soils are classified as moderate productivity and moderate resiliency.

Localized long term ***soil productivity*** losses have occurred in all five sections due to compaction and displacement of surface soils. The current extent of detrimental soil conditions (severe compaction, severe displacement, and/or active erosion) varies in response to different treatment history and on site soil characteristics. In the past, harvesting was dominated by ground-based operations on variable slopes up to 50%. Many deeply excavated skid roads at close spacing, some with rock additions are still evident in steeper terrain in all five sections; gradual terrain typically has less excavation. Surface compaction on slopes greater than 30% has increased the volume and velocity of runoff, and encouraged surface erosion. Residual compaction is very persistent at these lower elevations in the project area because winter temperatures are generally mild, and soils are not subject to deep freeze thaw action. Spatial extent of detrimental soil conditions is as high as 10% in localized areas with the corresponding reductions in long term productivity and conifer growth, but across the project area is about 2%.

3.4.2 Environmental Effects

3.4.2.1 Alternative 1: No Action

There would be no direct effects on any soils in the project area, as there would be no ***soil displacement*** or compaction associated with road and landing construction, cable yarding or ground-based yarding.

Compacted soils on the old skid trails and skid roads would recover slowly, especially at depths below 6 inches (Amaranthus, et.al. 1996; Powers, et.al. 2005).

There would be no changes to current slope stability or risk of slope failure. The potential for periodic slope failures would still remain in association with areas exhibiting an historic disposition to soil movement, particularly in the event of a major storm.

Much of the nitrogen and other nutrients in forest ecosystems come from decomposition and recycling of organic matter, including decayed leaves or needles, branches, fallen trees, coarse woody debris, and roots. Organic matter helps improve water retention in soils, maintains good soil structure, aids in water filtration into the soil, stores carbon, and promotes the growth of soil organisms (Rapp, ed. 2000).

Under this alternative, no timber would be harvested, and no activity fuels would be generated which would require disposal by prescribed burning. As a consequence, no changes in the current levels of soil organic matter and nutrients would occur.

Duff and soil organic matter would continue to slowly increase with the accumulation and decomposition of needles, twigs and small branches, and larger woody material, absent a wildland fire of sufficient intensity to consume the material.

3.4.2.2 Alternatives 2, 3, & 4: Action Alternatives

All action alternatives propose management actions that would result in similar effects to soils resources. Variations in effects would result from total acres proposed for management under each alternative, and are displayed in Tables 2-1, 2-2, and 2-3 for harvest and on Maps in Appendix C for harvest and fuels management.

Ground Based Harvest

Units identified for ground based harvest systems are predominantly on slopes less than 35% and would employ BMP's to reduce the severity and spatial extent of severe compaction. For ground-based harvest operations, BMP in the ROD/RMP (p. 158) specify that landings, main skid trails and large slash piles should cumulatively affect no more than ten percent of the ground-based harvest area.

Ground-based timber harvest operations on the Eugene District typically include rubber-tired skidders, tractors, and harvester/forwarder systems. Harvest with this type of equipment has shown that with the application of appropriate PDFs and BMPs, such as dry season operations and pre-designation of skid trails, the aerial extent and severity of compaction and displacement were typically constrained to be within RMP direction for severe compaction. Severe compaction results when displacement of organic matter and topsoil occurs in excess of

50% of the impacted area, and when at depths in excess of 4 inches. The extent varied with the equipment used, number of passes over individual trails, terrain, access routes, climatic conditions, and operator skill (Steinfeld 1997).

Soil displacement and compaction can reduce soil productivity, with resultant reductions in height and volume growth of conifers (Wert and Thomas 1981). Inter-mixing of the upper soil layers with subsoil layers can reduce site productivity, because subsoils are generally denser, and lower in nutrients and organic matter. Extensive displacement can also alter slope hydrology, increasing the potential for surface erosion (Page-Dumroese, et.al. 2009).

The amount of detrimental ***soil compaction*** and displacement associated with the proposed regeneration harvest would trend toward the middle or upper end of the range noted above, principally due to the higher volume of timber to be removed, requiring more equipment passes over skid trails.

To reduce compaction, native-surface landings free of logging slash, and heavily compacted skid trails would be sub-soiled, except in areas of shallow, skeletal soils with high cobble and gravel content, or rocky soils (PDF #28). This would reduce bulk soil density and provide some soil aeration, allowing for natural reseeding of trees, and contributing to growth of both natural and planted seedlings. Sub-soiling would help prevent runoff and erosion by increasing infiltration capacity.

Cable Harvest

Units identified for cable harvest systems are on slopes greater than 35% or on soils that have limitations that preclude ground based harvest management outside of dry (less than 25%) moisture levels. Cable yarding systems would have the capacity to maintain a minimum one-end log suspension to minimize surface and soil disturbance where deemed necessary. Where full log suspension is deemed necessary, contract provisions may specify the type of equipment, such as logging carriage, to be used.

Both uphill and downhill cable yarding would cause localized disturbance characterized by duff and mineral soil displacement in yarding corridors, and in some instances displacement of the subsoil where full-suspension is not achieved. Compaction and displacement in yarding corridors would be more extensive when yarding occurs when soil moisture levels are higher (above 25%).

Disturbed areas cable harvest units occur within yarding corridors, landings, and equipment areas. Application of appropriate PDFs and BMPs limits the areal extent of ground affected; however, the extent of displacement would be greater for variable retention harvest, and would be dependent on site conditions, volume of timber yarded over any given haulback road, topography, and operator/equipment factors. Greatest disturbance would occur within 100 to 150 feet of landings where individual haulback roads merge. The extent of disturbance is expected to be 3-5% percent of the cable-yarded area, but would vary across units, primarily based upon log size. Several units have average log diameters estimated at 18 inches or greater; in these units, surface disturbance would tend toward the higher end of the anticipated range. Units average log diameter would range from 11 to 12 inches, surface disturbance would be expected to be less.

Slope failures occur on a small percentage of forest lands, over a variety of forest types, whether managed or unmanaged (2008 FEIS, p. 347). Trees transpire water and intercept moisture in their canopies, and live roots increase soil strength, both of which increase slope stability (USDI/BLM 2008, p. 348). On landscapes with potential for landslides, timber harvest can increase the probability, but only if a damaging storm occurs in the vegetation re-growth period (2008 FEIS, p. 769). The Oregon Department of Forestry (Robison et.al. 1999) studied shallow, rapid slope failures in stands ranging in age from reinitiation to 100 years and older, that originated from previous clearcut harvest or stand replacement fire. They found that after the severe winter storms of 1996, forested areas between the ages of ten to 100 years old typically exhibited the lowest landslide densities and erosion. The highest risk for shallow, rapid slope failures was found on slopes of over 70%, depending on landform and geology. Through the use of LiDAR imaging in the project area, it was determined that slopes of this scale are incidental off of short benches or humps, and occur on less than 2% of the harvest area. Additionally, no soils or specific areas within the project area were identified as having a high sensitivity or probability for mass movement (landslide) within the project area. Riparian buffers have been established on all streams, which capture the more steeply incised and seasonally saturated slopes would be protected from soil disturbance. As a consequence of these factors and measures, the risk for slope failure and landslides would be considered low.

Site Preparation

Logging slash in areas subject to ground-based harvest would be machine piled and burned to reduce activity fuels. Landings and piles would be burned when soil and duff moistures are high to minimize duff consumption and nitrogen losses, thereby maintaining soil productivity to highest level possible. Burning of landings and piles would more likely create higher temperatures that can cause adverse effect to soils, compared to broadcast burning (Korb, et.al. 2004). However, these effects would be limited to areas directly under the piles (Neary, et.al. 2005). Appropriate PDFs and BMPs, including the use of low ground pressure (PSI) equipment and amelioration of severely compacted soils, would minimize the spatial extent and severity of detrimental effects to soil function and productivity. It would be expected that duff layers would be largely consumed, but high soil moistures would moderate loss of soil carbon, nitrogen, and other nutrients which would minimize detrimental alteration of soil structure. The Second Show project area does not contain any soil types with limited inherent productivity that should be considered for a “no burn” prescription.

Mineral soil exposed by prescribed burning could be subject to surface erosion, including dry ravel on the steeper slopes, for several years until the areas are revegetated. The rate would vary depending on burn severity and vegetation recovery (Neary, et.al. 2005). The erosion rates would be greater on the steeper slopes, with possible longer recovery rates. Vegetative recovery in general would be fairly rapid in disturbed areas (Rapp 2000). Watersheds that periodically experience low severity wildfires can achieve vegetative recovery in one to three years, whereas watersheds that are moderately to severely burned can take seven or more years for vegetative recovery (Neary, et.al. 2005).

Prescribed burning would be conducted in the spring under cooler conditions, when soil and duff moisture is high, and the moisture content of large fuels is high. Burning would be done by hand ignition, applied to approximately 40-50% of unit acres and focused on finer fuels less than three inches in diameter, resulting in a mosaic of burned and unburned areas. Under these circumstances, fire duration would be short and burn intensity low, resulting in limited duff consumption and exposure of mineral soil. Loss of soil nutrients would also be low.

On all units, whole tree yarding would be authorized as a harvest mechanism affecting site preparation for planting. This would result in the removal of tops, branches and limbs in conjunction with the tree bole, to eliminate the need for broadcast burning the unit or hand pile and burn residual slash in units. This would likely occur on steepened soils (55% and greater) where safety or feasibility of other site preparation methods would be of concern. Whole tree yarding would remove a large portion of organic litter and nutrients that would otherwise remain on site, but existing duff and litter would be retained by elimination of burning. This would result in a higher percentage of the harvested acres being subject to duff and soil displacement, but with less compaction, as attached branches would afford suspension of the tree bole above the ground.

4.0 LIST OF PREPARERS

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5.0 LITURATURE CITED

Amaranthus, Michael P., Debbie Page-Dumroese, Al Harvey, Efren Cazares, and Larry F. Bednar. May 1996. Soil compaction and organic matter affect conifer seedling nonmycorrhizal and ectomycorrhizal root tip abundance and diversity. Research paper PNW-RP-494. USDA/U.S Forest Service, Pacific Northwest Research Station.

Applegarth, J. S. 2000. Management Recommendaions for Terrestrial Mollusk Species: *Megomphix hemphilli*, the Oregon Megomphix. Bureau of Land Management, Portland, Oregon, USA. 41pp.

Brown, C. R. 1997. Purple Martin. *In* The Birds of North America No. 287, A. Poole and F. Gill, eds. The Birds of North America, Inc., Philadelphia, Pennsylvania, USA. 31pp.

Carey, A. B., S. P. Horton, and B. L. Biswell. 1992. Northern Spotted Owls: influence of prey base and landscape character. Ecological Monographs 62:223-250.

Carey, A. B., C. C. Maguire, B. L. Biswell, and T. M. Wilson. 1999. Distribution of Neotoma in western Oregon and Washington. Northwest Science 73: 65-80.

Chadwick, Kristen, L., Kearns, Holly S.J., and Willhite, Beth. 2012. *Forest Health in the Cash Creek Stand/Mohawk River Watershed Project Area Upper Willamette Resource Area, Eugene Bureau of Land Management.* Sandy, OR: USDA, Forest Service. Forest Health Protection Westside Forest Insect & Disease Service Center,

Courtney, S P, J A Blakesley, R E Bigley, M L Cody, J P Dumbacher, R C Fleischer, A B Franklin, J F Franklin, R J Gutiérrez, J M Marzluff, L Sztukowski. 2004. Scientific Evaluation of the Status of the Northern Spotted Owl. Sustainable Ecosystems Institute, Portland, Oregon.

Cross, S. P. and D. Waldien. 1995. Survey of bats and their habitats in the Roseburg District of the BLM in 1994. Final Report to the Bureau of Land Management, Roseburg, Oregon, USA.

Fellers G. M. and E. D. Pierson. 2002. Habitat use and foraging behavior of Townsend's Big-Eared Bat in coastal California. Journal of Mammalogy 83: 167–177

Forsman, E. D., E. C. Meslow, and H. M. Wight. 1984. Distribution and biology of the Spotted Owl in Oregon. Wildlife Monographs 87.

Forster, P. et al. 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group 1 to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Solomon, S. D., Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller, Eds. Cambridge University Press, U.K. and New York, N.Y. (pp. 129-234). @ http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter2.pdf.

Hagle, S. K. 2009. Laminated root rot ecology and management. Chapter 11.2 Forest insect and disease management guide for the northern and central Rocky Mountains. USDA Forest Service, Northern Region, State and Private Forestry. 20 pp. Online at: http://www.fs.fed.us/r1-r4/spf/fhp/mgt_guide/index.htm.

Hann, David W. 2009. ORGANON user's manual: Edition 8.4. Department of Forest Resources, Oregon State University, Corvallis, Oregon. 129 pgs

Hansen, E. M. 1976. Twenty year survival of *Phellinus (Poria) weirii* in Douglas-fir stumps. Can. J. For. Res. 6: 123-128.

Hansen, E. M. 1979a. Survival of Phellinus weirii in Douglas-fir stumps after logging. Can. J. For. Res. 9: 484-488.

Hansen, E. M. and E. M. Goheen. 2000. Phellinus weirii and other native root pathogens as determi-nants of forest structure and process in western North America. Annu. Rev. Phytophathol. 38: 515-539.

Harmon, M. E., W. K. Ferrell, and J. F. Franklin. 1990. Effects of carbon storage of conversion of Old-Growth forests to young forests. Science. 247(4943): 669-702. http://www.sciencemag.org/cgi/content/short/247/4943/699.

Horvath, E. 2003. Purple Martin. Pages 428-430 *in* D. B. Marshall, M. G. Hunter, and A L. Contreras, eds. Birds of Oregon: A General Reference. Oregon State University Press. Corvallis, Oregon, USA. 768 pp.

Irwin, L. L., D. F. Rock, and G. P. Miller. 2000. Stand structures used by northern spotted owls in managed forests. Journal of Raptor Research. 34(3): 175-186.

Irwin, L. L., D. Rock, and S. Rock. 2005. Adaptive management monitoring of spotted owls. Annual National Council for Air and Stream Improvement progress report. Unpublished.

Jassal, R. S., T. A. Black, B. Chen, R. Roy, Z. Nesic, D. L. Spittlehouse, and J. A. Trofymow. 2008. N_2O emissions and carbon sequestation in a nitrogen-fertilized Douglas fir stand. Journal of Geophysical Research 113(G04013): 10. http://www.agu.org/pubs/crossref/2008/2008JG000764.shtml

Korb, J.E., N.C. Johnson, W.W. Covington. 2004. Slash pile burning effects on soil biotic and chemical properties and plant establishment: Recommendations for amelioration. Restoration Ecology Vol. 12 No. 1, pp. 52-62.

Marshall, D. B., M. W. Chilcote, and H. Weeks. 1996. Species at Risk: sensitive, threatened, and endangered vertebrates of Oregon. 2nd Edition. Oregon Department of Fish and Wildlife, Portland, Oregon, USA.

Maser, C., B. R. Mate, J. F. Franklin, and C. T. Dyrness. 1981. Natural History of Oregon Coast Mammals. GTR-PNW-133. USDA Forest Service, Portland, Oregon, USA.

Neary, Daniel G., Kevin C. Ryan, Leonard F. DeBano, eds. 2005. (Revised 2008). Wildland fire in ecosystems: Effects of fire on soils and water. General Technical Report RMRS-GTR-42- vol.4. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 250 p.

Page-Dumroese, Deborah S., Ann M. Abbott, and Thomas M. Rice. 2009. Forest soil disturbance monitoring protocol. Volume 1: Rapid assessment. USDA/Forest Service. General Technical Report WO-82a.

Perkins, J. P. Land cover at northern spotted owl nest and non-nest sites, east-central coast ranges, Oregon. M.S. Thesis. Department of Forest Resources, Oregon State University, Corvallis, OR.

Pierson, E. D., M. C. Wackenhut, J. S. Altenbach, P. Bradley, P. Call, D. L. Genter, C. E. Harris, B. L. Keller, B. Lengus, L. Lewis, B. Luce, K. W. Navo, J. M. Perkins, S. Smith, and L. Welch. 1999. Species conservation assessment and strategy for Townsend's big-eared bat (Corynorhinus townsendii townsendii) Idaho Conservation Effort, Idaho Department of Fish and Game, Boise, Idaho, USA.

Powers, Robert F., D. Andrew Scott, Felipe G. Sanchez, Richard A. Voldseth, Deborah Page- Dumroese, John D. Elioff, Douglas M. Stone. 2005. The North American long-term soil productivity experiment. Findings from the first decade of research. Forest Ecology and Management: 220:31-50.

Rapp, Valerie, editor. 2000. First approximation report for sustainable forest management in Oregon. Oregon Department of Forestry, April 2000.

RMP. 1995. USDI/BLM. Eugene District Record of Decision and Resource Management Plan. Eugene District Office. Eugene, OR.

Robison, E.G., Keith A. Mills, Jim Paul, Liz Dent and Arne Skaugset. 1999. Oregon Department of Forestry, Storm Impacts and Landslides of 1996: Final Report. Forest Practices Technical Report Number 4. Oregon Department of Forestry, Forest Practices Monitoring Program.

Sakai, H. F. and B. R. Noon. Dusky-footed woodrat abundance in different-aged forests in northwestern California. Journal of Wildlife Management 57: 373-382.

Sonne, E. 2006. Greenhouse gas emissions from forestry operations: a lifecycle assessment. Journal of Environmental Quality 35(4): 1439-1450.

Steinfeld, David E. 1997. Soil Compaction after Yarding Small Diameter Douglas-fir. Res. Pap. PNW-RP-504. Portland, OR: U.S. Department of Agriculture.

Swindle, K. A. Old forest distribution around spotted owl nests in the central Cascade mountains, Oregon. M.S. Thesis. Department of Forest Resources, Oregon State University, Corvallis, OR..

Thies, W.G. and R.N. Sturrock. 1995. *Laminated root rot in western North America.* Gen. Tech. Rep. PNW-GTR-349. Portland, OR: USDA, Forest Service, Pacific Northwest Research Station. 32 pp. Available: http://www.fs.fed.us/pnw/publications/pnw_gtr349

Thomas, J. W., E. D. Forsman, J. B. Lint, E. C. Meslow, B. R. Noon, and J. Verner. 1990. A conservation strategy for the northern spotted owl: a report of the Interagency Scientific Committee to address the conservation of the northern spotted owl. Portland, Oregon. U.S. Department of Agriculture, Forest Service; U.S. Department of Interior, Bureau of Land Management, U.S. Fish and Wildlife Service, National Park Service. 427 pp.

U.S. EPA. 2005. Environmental Protection Agency. Emission Facts: Average Carbon Dioxide Emissions Resulting from Gasoline and Diesel Fuel. EPA420-F-05-001 February 2005 @ http://www.epa.gov/otaq/climate/420f05001.htm.

U.S. Fish and Wildlife Service. 2004. A blueprint for the future of migratory birds: Migratory Bird Program strategic plan 2004-2014. Division of Migratory Bird Management, U.S. Fish and Wildlife Service, Arlington, Virginia. 21 pp.

USDA and USDI. 2000. Management Recommendations for the Oregon Red Tree Vole, *Arborimus longicaudus*, Version 2.0. US Forest Service and Bureau of Land Management, Portland, Oregon, USA. 27pp.

USDA, Soil Conservation Service (now Natural Resource Conservation Service). 1987. Soil Survey of Lane County Area, Oregon.

USDA, Soil Conservation Service (now Natural Resource Conservation Service). 1987. Soil Survey of Linn County Area, Oregon.

USDI. 2010. Analysis of Greenhouse Gas Emissions and Consideration of Climate Change in National Environmental Policy Act Documents. Instruction Memorandum OR-2010-012, U.S. Dept. of Interior - Bureau of Land Management.

USDI/BLM. 1994. Final Environmental Impact Statement for the Resource Management Plans of the Western Oregon Bureau of Land Management. Portland, OR.

USDI/BLM. 2008. Final Environmental Impact Statement for the Revision of the Resource Management Plans of the Western Oregon Bureau of Land Management. Portland, OR.

USDI/BLM. 2008a. National Environmental Policy Act, Handbook H-1790-1. Bureau of Land Management, Release 1-1710. Washington, DC.

USDI/USGS. 2008. The Challenges of Linking Carbon Emissions, Atmospheric Greenhouse Gas Concentrations, Global Warming, and Consequential Impacts. Reston, VA. 2 pp.

Verts, B. J. and L. N. Carraway. 1998. Land Mammals of Oregon. University of California Press. Berkeley, California, USA.

Wenger, K. F. 1984. Forestry Handbook: Edited for the Society of American Foresters. Second Edition. New York.

Wert, Steve and Byron R. Thomas. 1981. Effects of skid roads on diameter, height, and volume growth in Douglas-fir. Soil Science Society of America Journal. Volume 45, no. 3: 629-632.

WRI. 2010. The Greenhouse Gas Protocol Initiative. World Resources Institute. http://www.ghgprotocol.org/calculation-tools/wood-products

APPENDIX A – PROJECT DESIGN FEATURES

Project design features include design criteria, ***mitigation measures***, and monitoring developed to provide for resource protection. PDFs are mitigations or designs to project actions developed to protect resource values and ensure conformance with regulations, laws, and policies. PDFs are presented by the primary resource discipline for which the PDF was identified as needed to protect resource values when conducting effects analyses; however, some PDFs mitigate effects to multiple resources. Site-specific waiver of PDFs during implementation would be infrequent and require review by affected resources' specialists to determine that single or aggregated extent of the site-specific waiver would not produce effects outside of those analyzed. Review results would be reported to sale Authorized Officer to implement through contracts. The following PDFs are applicable to proposed actions and associated actions. Unless otherwise stated, PDFs are applicable on all units or roads.

WILDLIFE

1. Disruption to nesting raptors would be minimized through seasonal restrictions if necessary. Project activities in Second Show section 34 within 0.25 miles of the nest for the unidentified species (including road construction/ decommissioning, timber falling, yarding, loading, hauling, and burning) would be seasonally restricted from March 1 to July 15. Other project activities, such as renovation of existing roads, would not be restricted. The above restrictions may be reduced or extended in consultation with the Area wildlife biologist based on relevant survey information regarding occupation or nesting activity.
2. Avoid yarding through aggregated retention areas, and minimize the number of yarding corridors if yarding is necessary.
3. All Decay Class 3, 4, and 5 snags and down wood, and existing rootwads would be retained undamaged when possible and/or would not be cut, except in road construction rights of way, landings, yarding corridors, and those posing a safety hazard. Where possible, cable corridors would be placed to avoid these habitat features. If such snags are felled, they would be left on site for CWD; CWD may be cut into sections and moved to facilitate operations or safety and would be counted towards any post-treatment CWD requirement.
4. Retain all wildlife trees marked with an orange-painted "W", except where necessary to accommodate safety and logging systems. Where possible, cable corridors would be placed to avoid these habitat features. If such trees are cut they would be left on site as coarse woody debris, and such CWD may be cut into sections and/or moved to facilitate operations or safety.
5. Consistent with Instruction Memorandum OR-99-036 (E-4 Special Provisions), apply seasonal restrictions, or suspension of harvest and road activities within 1/4 mile of: known nesting great blue herons, peregrine falcons, bald eagles, spotted owls, great grey owls, accipiter hawks, and other owls, hawks, or raptors if they are located at any time during project activities.
6. Protect aggregated retention areas from post-harvest broadcast burning.
7. Monitor snag and CWD levels within 3 years post-harvest; create snags and CWD if desired future conditions are not met. Retain sufficient trees during harvest to provide for anticipated snag/CWD creation while meeting silvicultural requirements (canopy closure, RD, TPA, etc.).

AQUATICS

8. Remove and dispose of all damaged culverts in conformance with Best Management Practices.
9. Right-of-way stumps shall be grubbed out only within the road prism (road surface, ditch line, and cut/fill areas) and not within other portions of the posted right-of-way unless necessary to facilitate intended function of the road (i.e., turnarounds, curve widening).
10. To protect fish species during critical life cycle functions, apply the ODFW in-water guidelines for all stream culvert placement and removal.
11. Require the following along streams during culvert replacement:
    a. Stream flow would be routed around construction activities as much as possible (i.e., temporary flow diversion structure).
    b. Sediment containment structure placed across the channel below the work section (i.e., weed free mulch) as needed.
    c. Work site would be pumped free of standing water as applicable.
    d. If present, fish and other aquatic species would be removed from the project area and block nets placed above and below the worksite by area fisheries biologist.
    e. After installation, disturbed ground would be planted with appropriate BLM-provided seed or straw/wood mulch before the first rains.
    f. Countersink culverts in fish bearing streams at least 6-8 inches below the streambed to minimize scouring.

12. Non-functional cross drains would be rendered functional and cross drains to be added would be installed before log haul could start on affected roads.
13. Prior to and during log haul, implement the following combination of methods year round to maintain drainage and minimize sedimentation from the gravel surfaced roads into stream channels:
    a. Keep ditch line, cross drains, and leadoff ditches clean and free to flow, while minimizing disturbance to existing ditch line vegetation.
    b. Sediment traps, rock armor, or other devices may be installed in ditch lines lacking vegetation and having the potential to deliver sediment to streams.
    c. Prior to and during haul operation, rock surfacing and road maintenance would be assessed for road damage, drainage, and erosion throughout the project and haul route to determine if haul may continue or if any damage has occurred that would require corrective actions (e.g., grading, crowning, adding rock) before haul may resume.
    d. If erosion and road degradation occurs during or after freeze and thaw or rainy periods, log haul operations may be discontinued.
14. Construction of roads would not occur when soils are saturated, in order to minimize soil compaction, erosion, and sedimentation outside the road bed. Blading and rocking would occur as needed.
15. Areas of exposed soil associated with road construction (typically along cut and fill slopes) would be seeded with BLM-provided native seed and/or mulch up to the closest cross drain or 200' from the stream crossing, whichever is closer.
16. Removal, notification, transport and disposal of any diesel, hydraulic fluid, or other petroleum product released into soil and/or water would be accomplished in accordance with all applicable laws and regulations.
17. Keep a Spill Contamination Kit (SCK) on-site during any operation within the project area; prior to starting work each day, all machinery would be checked for leaks and necessary repairs would be made.
18. Slash, logging debris, and stacked logs to be sorted would be removed from road ditches during the wet season if impeding drainage function to allow for proper road drainage.
19. Native surface roads would only be used in dry season (typically July 1 through October 1).
20. Waterbars, drain dips, and/or lead-off ditches may be required to create an erosion resistant condition on roads during seasonal closures. Access to such roads shall be blocked during closures.
21. Position waste from road construction, renovation, and decommissioning a minimum of 50 feet from stream or wetland.

SILVICULTURE

22. In thinning units, minor coniferous species (i.e., species other than Douglas-fir and western hemlock), hardwoods, and yew trees would be reserved, except where necessary to accommodate safety and logging systems and to meet BA targets.
23. Where operationally feasible, falling techniques would be utilized for the protection of retention trees and other reserve areas. Falling techniques include: falling to lead towards yarding corridors, skid trails and areas where residual tree damage would be minimized, and falling away from reserve areas.
24. Harvest activities during sap flow season should be minimized and monitored to ensure residual stand damage is not occurring in thinning units or on reserve trees or aggregates.
25. Cable corridors and skid trails would be placed on the landscape to minimize the amount of residual trees cut to implement logging systems and log yarding, and would be limited to 12 feet in width.
26. The regeneration harvest units would be replanted to meet a minimum of 200 trees per acre at year 20.
27. In thinnings, limit log lengths to 40' in length where necessary to minimize damage to residual trees, snags and coarse woody debris during yarding. Additional protections to trees (e.g., plastic barrelling) during sap flow would be required if damage to tree cambium is occurring.

SOILS

28. Native surface spur (temporary) roads, landings, and other compacted areas such as turnouts, truck turnarounds, and log decking areas shall be subsoiled (broken up, loosened, decompacted) with excavator attachments, log loader tongs or other effective equipment:
    a. All decompaction equipment shall be inspected and approved by AO in consult w/ soil scientist before tillage begins.
    b. Subsoiling shall be completed to a minimum depth of 18" below the ground surface and span the entire width of compacted surface.
    c. At least 80% of compacted soil profile shall be shattered, except within a five foot radius of the boles of residual trees where major roots can be cut or mangled or in areas where equipment is prohibited from operations (i.e., on slopes in excess of 35% or crossing streams).

   d. Subsoiling shall occur during the same summer season as harvest operations or completion of native surface road use and stabilized prior to fall rains (typically Oct. 1). Should fall rains come early and subsoiling does not get completed, all native surface roads would be put in an erosion resistant condition and blocked before Oct. 1 until such time as subsoiling could occur. This includes construction of waterbars, drainage dips, and barriers (root wads, large woody debris or brush piles). Waterbar spacing to be based on gradient and erosion class.
   e. Scatter limbs, slash, and logs greater than 6 inch diameter over the subsoiled surface with an excavator equipped w/ a thumb or clamp. Debris to cover at least 50% of treated road length where quantity of this material is available. Scatter landing piles, along temporary roads, on top of the road surface to remove the fuel concentrations, deter OHV use and slow erosion.
29. Except during winching (GB) or skyline lateral yarding, skidding and yarding systems must at least keep the leading ends of all logs suspended above the ground during inhaul cycle.
30. During cable harvest activities:
    a. Cable corridor width limited to 12 feet;
    b. Independent cable settings and single cable corridors to be spaced 150 feet apart on average;
    c. Lateral yarding limited to 75 feet; and
    d. Yard only to approved landings, with landing size average being 60' x 40' and not exceeding 60’ x 80’.
31. Design ground based units with skid trail pattern on up to 35% favorable skidding to downhill GB landings, and a skid trail pattern with up to +20% adverse skidding to uphill ground based landings.
32. Skid trails would not be designated on identified skeletal or shallow soils. Decompact/subsoil all severely compacted skid trails w/ excavator or other properly designed equipment. This could be waived if inspection reveals that less than 2% of the GB unit is severely compacted.
33. Ground base equipment operations may be suspended during periods of prolonged rain.
34. To minimize soil compaction, limit ground based skidding and yarding to the annual dry season (typically July 1 to Oct. 1) when soils provide the most resistance to compaction.
35. BLM shall not approve skid trails through identified areas of high water tables or where skid trails would channel water into unstable headwall areas.
36. Design drainage for all temporary native surface roads with lead off ditches or outsloping. Maintain drainage function as needed during use.
37. Mechanized harvest systems would only be approved for travel when all of the following are met:
    a. A unit has been analyzed for GB systems;
    b. On slopes less than 35%;
    c. Restrict operations to dry conditions;
    d. Confined to operating from a prepared slash mat that the machine creates of sufficient depth which results in no severe compaction; and
    e. Limit equipment movement to one pass over the same ground off of designated skid trails.
38. Trails would be approved by BLM prior to approval for timber felling. Ground base skidding area is planned for a skid trail pattern to keep within 10% of the ground base unit by restricting operations to 12' wide trails spaced at least 150' apart. GB skidding/yarding equipment to remain on designated skid trails at all times.

FUELS

39. Cover and burn all landing piles along roads.
40. Pile, cover and burn slash, less than 6" in diameter and greater than 3' in length, within 25 feet of either side of designated (typically permanent) roads within harvest areas.
41. Cover all piles to be burned with plastic in compliance with the Oregon Smoke Management Plan.

OTHER

42. Prior to use, areas used for borrow and fill need to be reviewed for Special status plants by area Botanist.
43. Where a decommissioned road connects to an active road, sow with native seed first 200' of the tilled, decompacted road.
44. Gravel, fill and borrow material would need to be weed free. Gravel from pits known to be weedy would not be used.
45. All logging, tilling and road construction equipment must be washed and be free of dirt and plant debris prior to arrival on BLM lands. When moving equipment from the Mohawk/Marcola area, it needs to be washed before moving onto BLM lands outside the Mohawk/Marcola area.
46. Early detection rapid response weed species along roads or in units would be treated prior to harvesting unit. Roadside mowing to limit the spread of weeds would occur as scheduled.
47. Cultural resource surveys have been completed prior to harvest. If additional sites are found within the project area, appropriate actions would be taken to avoid or mitigate effects to the sites.

APPENDIX B – TABLES

Table B-1: Permanent Road Construction.

Road #	Length (miles)	Comments
Spur SS34A	0.1	6”-12” rock, install 1 to 2 cross drains

Table B-2: Road Renovation.

Road #	Length (miles)	Comments
15-1-31	6.1	Clean culverts, replace 2 to 10 culverts
15-1-32 west	1.9	Brush & grade, Reestablish ditch line, add 0"-9" rock, clean culverts, replace 0 to 8 culverts
15-1-32 east	0.3	Brush & grade, Reestablish ditch line and lead off ditches, add 0"-9" rock
15-2-25.1	2.6	Brush & grade, Reestablish ditch line, add 0"-9" rock, clean culverts, replace 3 to 8 culverts
15-2-26.2 Seg. A	0.4	Brush & grade, Reestablish ditch line, add 0"-9" rock, clean culverts, replace 0 to 3 culverts
15-2-28.3 west	0.9	Brush & grade, Reestablish ditch line, add 0"-9" rock, clean culverts, replace 0 to 3 culverts
15-2-28.3 east A	0.8	Brush & grade, Reestablish ditch line, add 0"-9" rock, clean culverts
15-2-28.3 east B	0.3	Extensive Renovation; Clear, Grub, Grade & Compact, install 0 to 3 temporary cross drains
15-2-33	0.4	Brush & grade, Reestablish ditch line and lead off ditches, add 0"-9" rock
15-2-34	1.4	Brush & grade, Reestablish ditch line, add 0"-9" rock, clean culverts, replace 0 to 3 culverts
15-2-34.1	0.3	Brush & grade, Reestablish ditch line and lead off ditches, add 0"-9" rock
15-2-34.3	0.2	Extensive Renovation; Clear, Grub, Grade & Compact, install 0 to 3 temporary cross drains
15-2-35.2	0.5	Brush & grade, Reestablish ditch line, add 0"-9" rock, clean culverts, replace 1 cross drains
15-2-35.3	0.2	Brush & grade, Reestablish ditch line and lead off ditches, add 0"-9" rock
15-2-35.5	0.1	Brush & grade, Reestablish ditch line and lead off ditches, add 0"-9" rock
15-2-35.6	0.2	Brush & grade, Reestablish ditch line and lead off ditches, add 0"-9" rock
15-2-35.7	0.1	Brush & grade, Reestablish ditch line and lead off ditches, add 0"-9" rock
15-2-35.8	0.9	Brush & grade, Reestablish ditch line, add 0"-9" rock, clean culverts
15-2-36	1.5	Brush & grade, Reestablish ditch line, add 0"-9" rock, clean culverts, replace 0 to 3 culverts
16-2-10.2	1.9	Brush & grade, Reestablish ditch line, add 0"-9" rock, clean culverts, replace 0 to 2 culverts
Total	**20.9**	

Table B-3: Road Improvement.

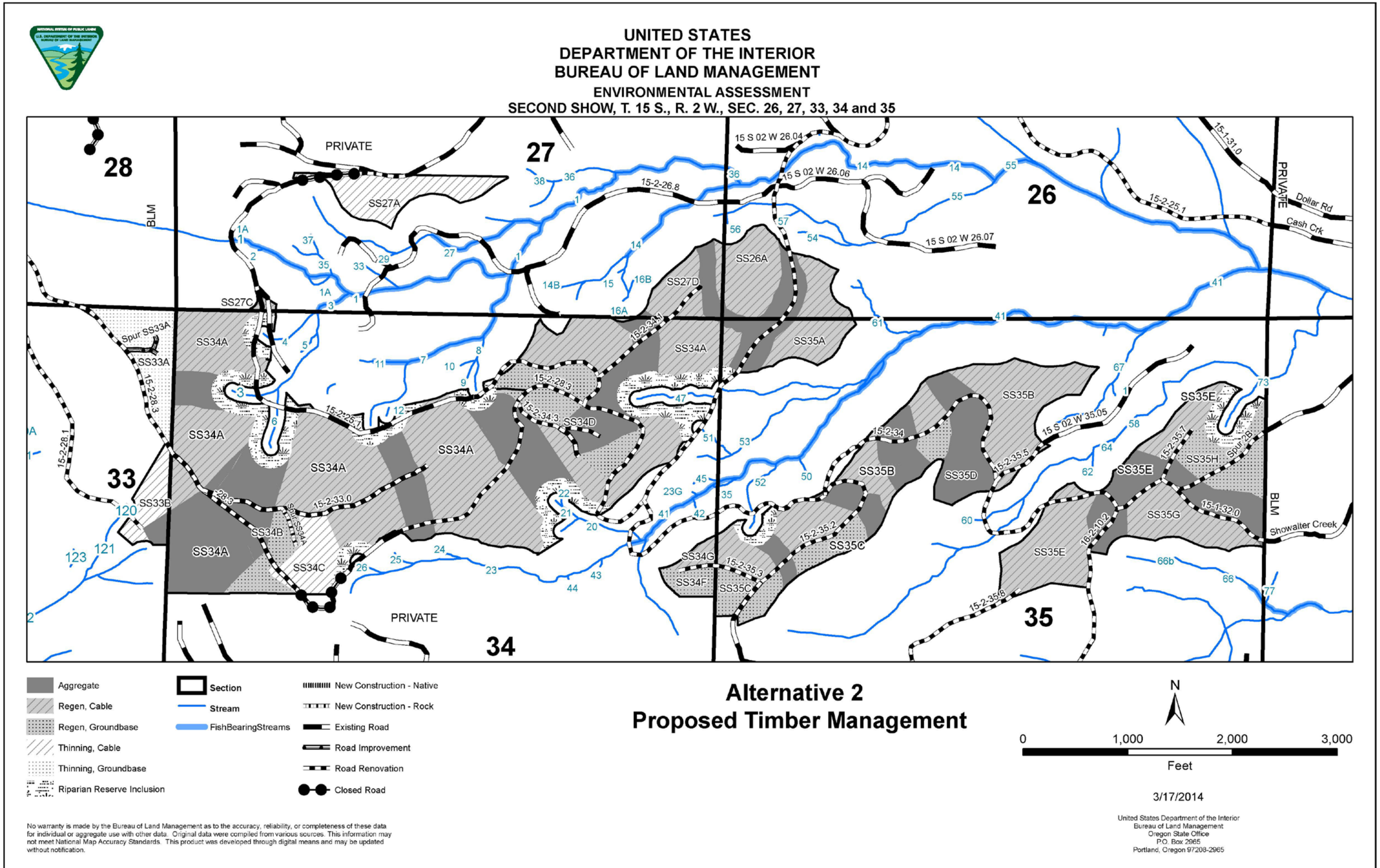
Road #	Length (miles)	Comments
Spur SS33A	0.1	Improve to rock surface with 6"-12" rock, install 0 to 2 cross drains
Spur SS33B	0.0	Improve to rock surface with 6"-12" rock, install 0 to 1 cross drains
Total	**0.1**	

Table B-4: Road Decommissioning.

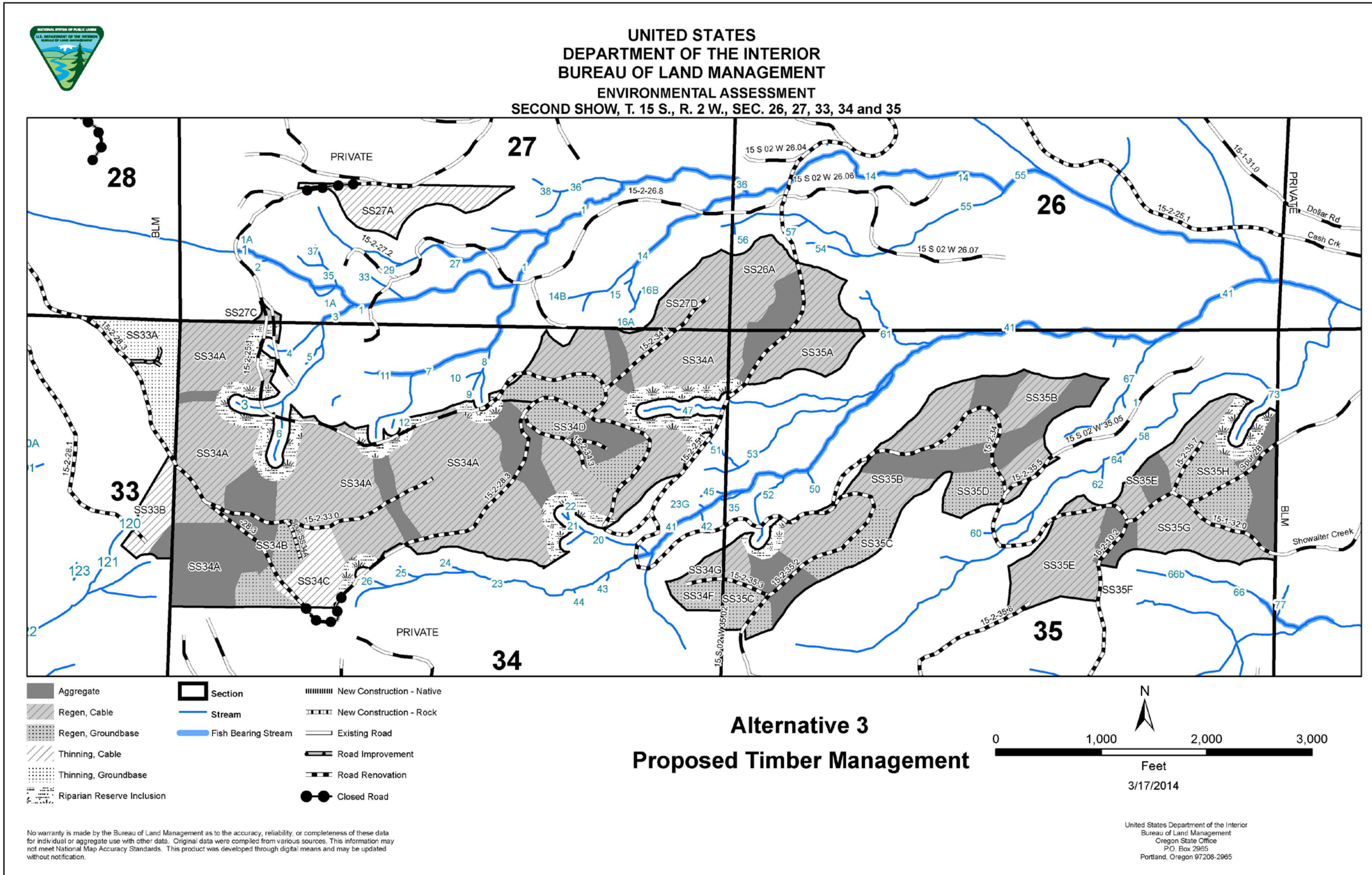
Road #	Length (miles)	Comments
15-2-28.3 east B	0.3	Barricade; pull any temporary culverts; and water bar
15-2-34.3	0.2	Barricade; pull any temporary culverts; and water bar
Total	**0.6**	

APPENDIX C – MAPS

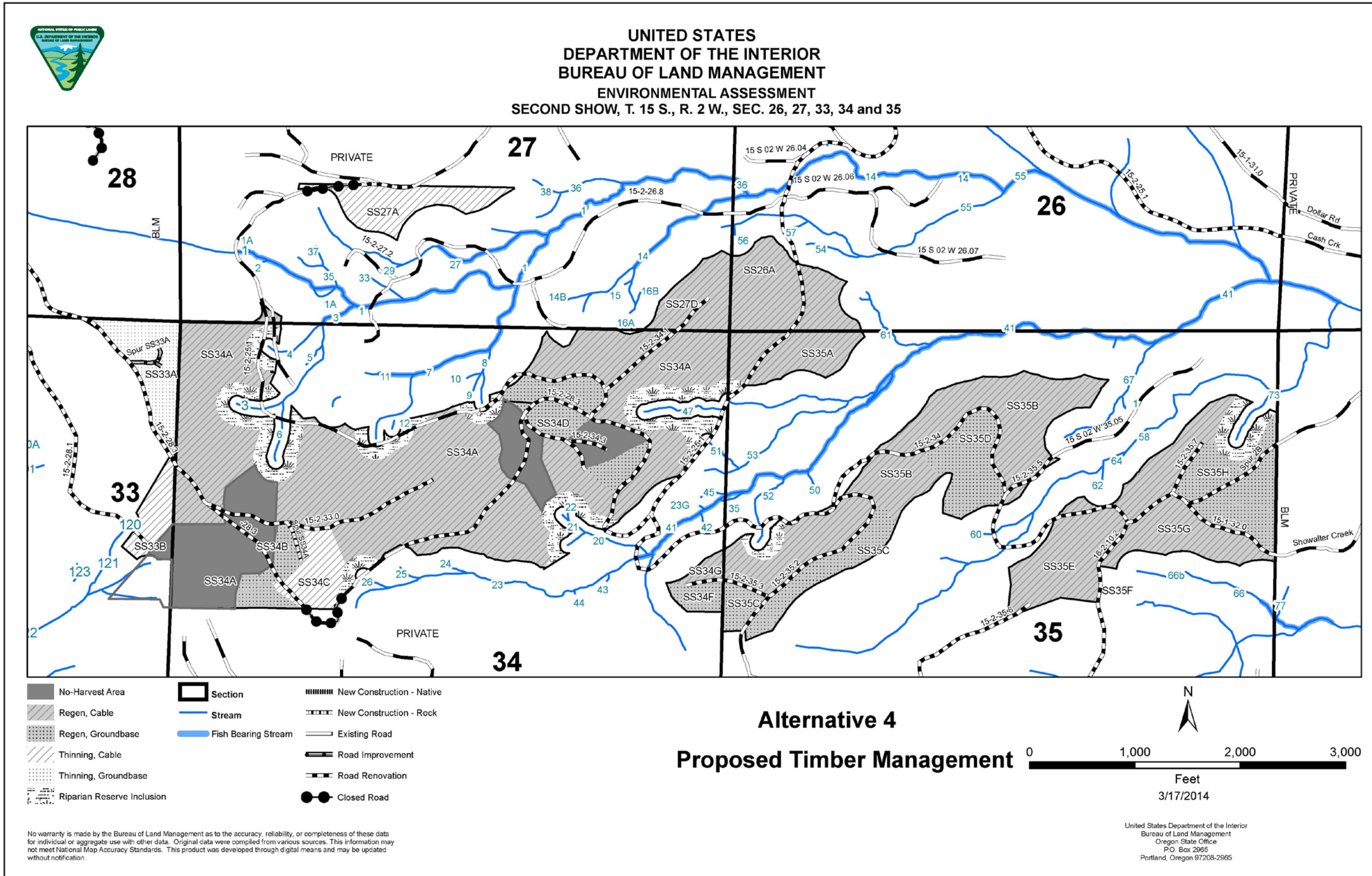
Map 1. Proposed Timber Harvest: Alternative 2



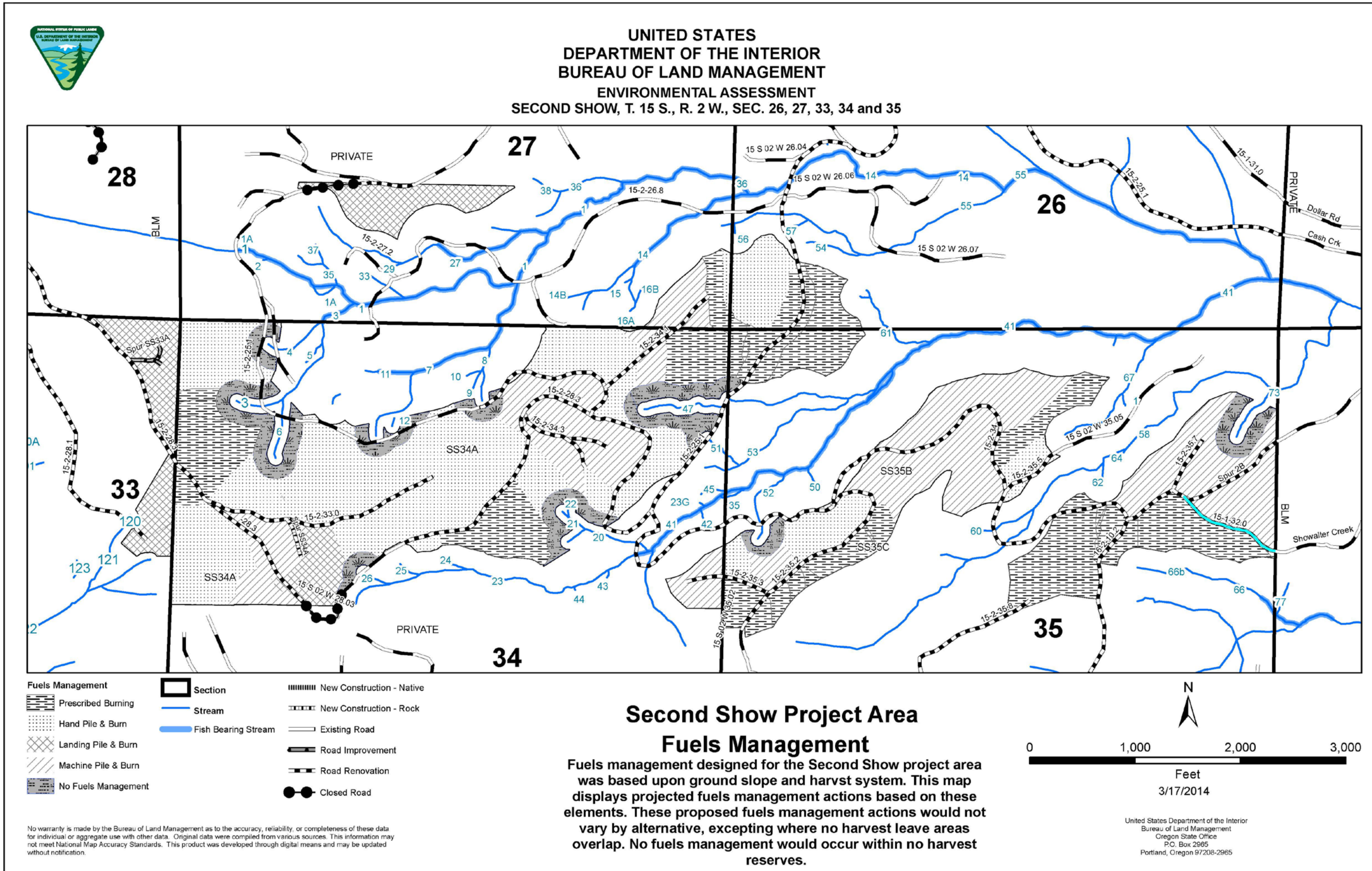
Map 2. Proposed Timber Harvest: Alternative 3



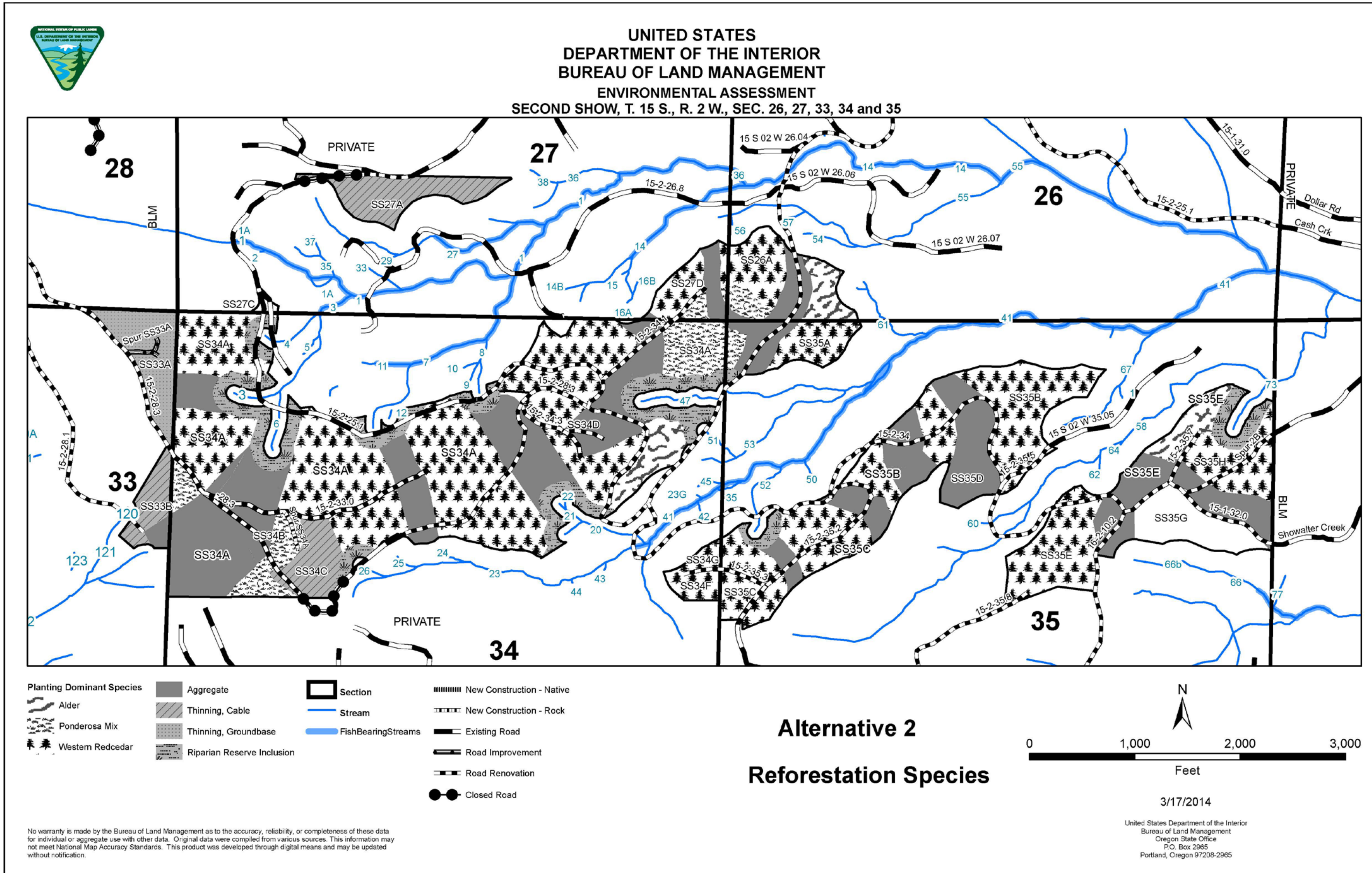
Map 3. Proposed Timber Harvest: Alternative 4



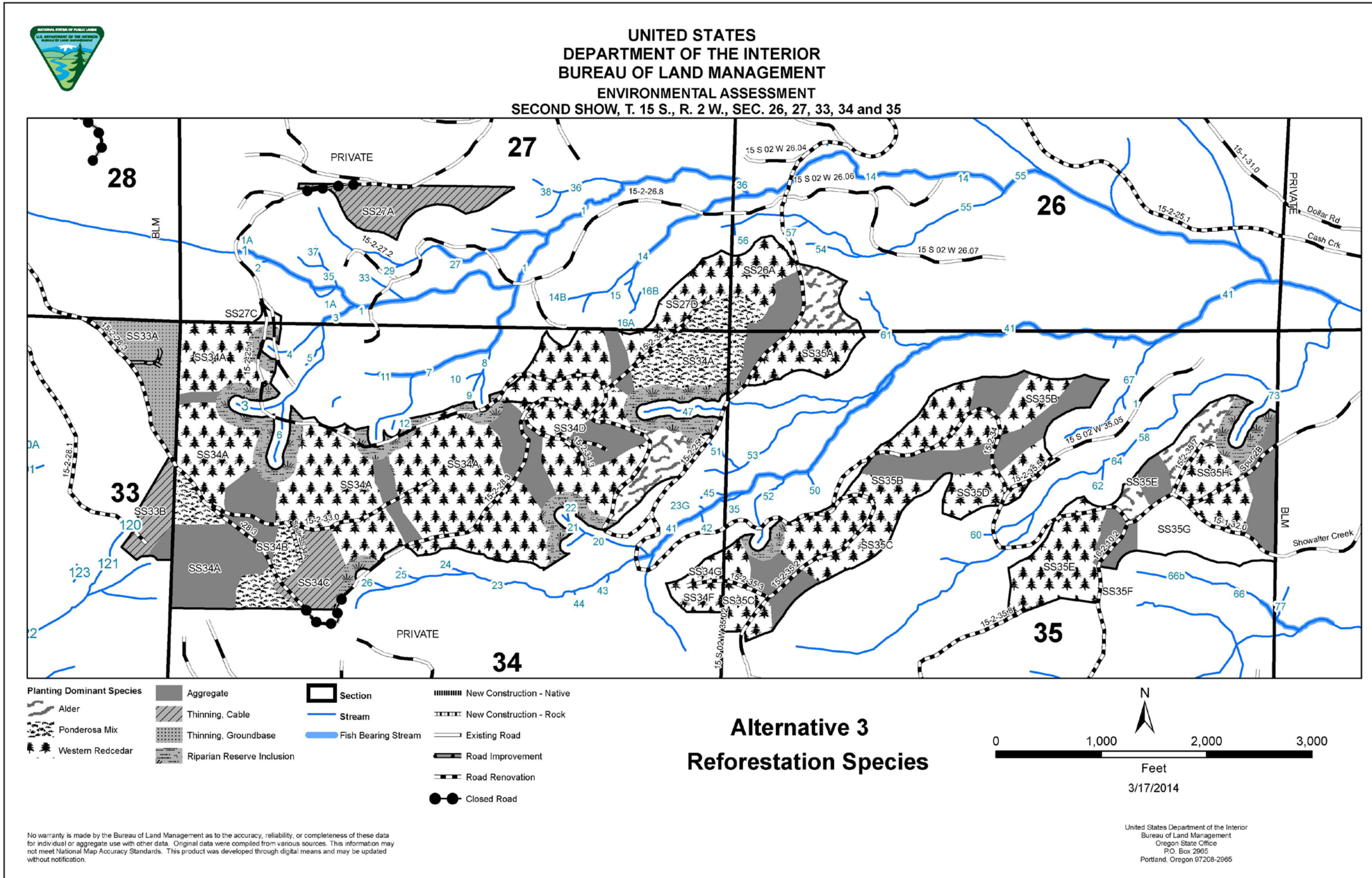
Map 4. Proposed Fuels Management



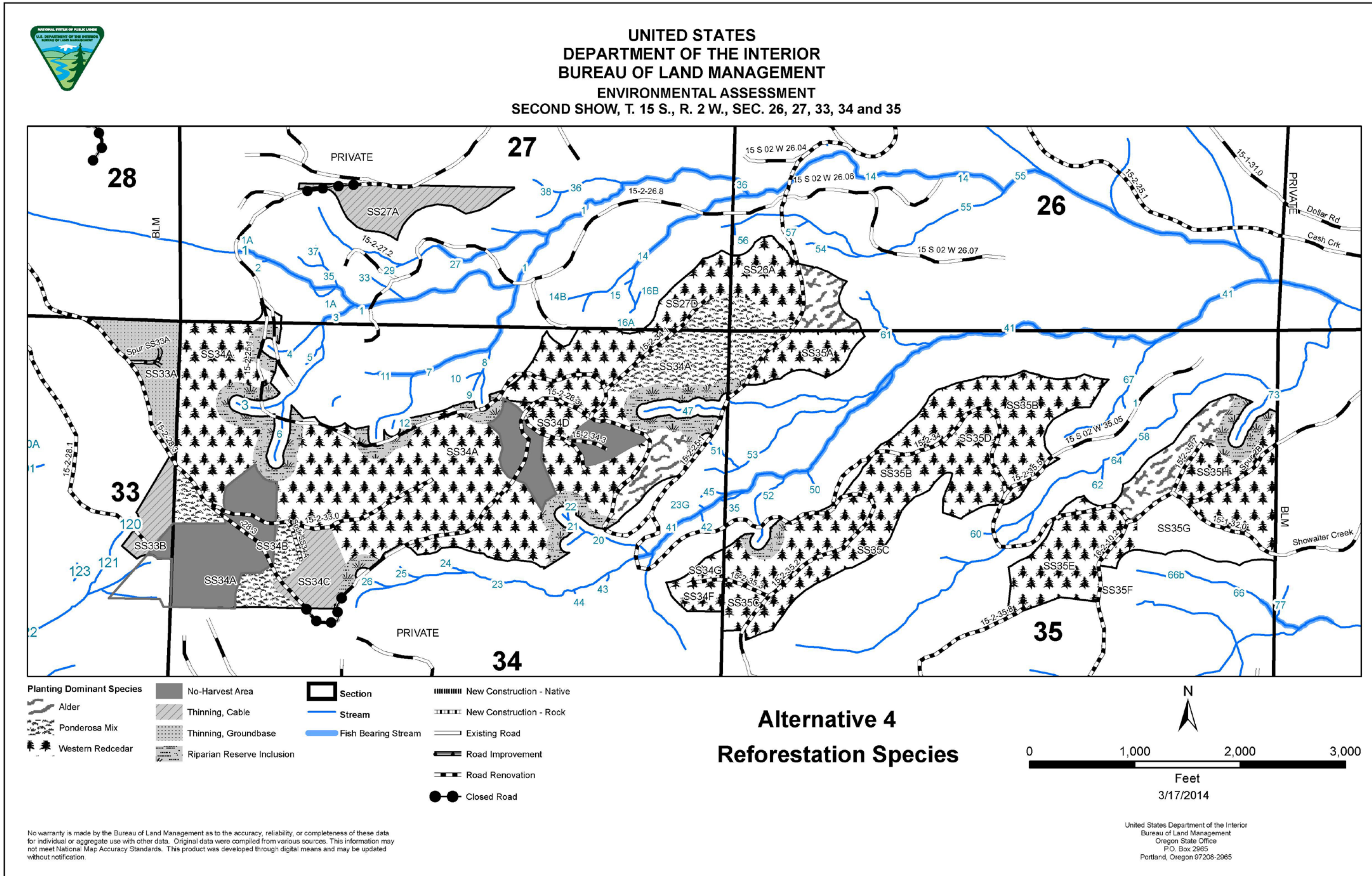
Map 5. Proposed Reforestation: Alternative 2



Map 6. Proposed Reforestation: Alternative 3



Map 7. Proposed Reforestation: Alternative 4



APPENDIX D - GLOSSARY

Unless otherwise indicated, all definitions are from the 1995 Eugene RMP.

Basal Area - The area of the cross section of a tree stem near its base, generally at breast height, 4.5 feet above the ground and inclusive of bark.

Baseline - The starting point for Analysis of Environmental Consequences; may be the conditions at a point in time (e.g., when inventory data is collected) or may be the average of a set of data collected over a specified period of years

Biological Corridor - A habitat band linking areas reserved from substantial disturbance.

Broadcast Burn - Allowing a prescribed fire to burn over a designated area within well-defined boundaries for reduction of fuel hazard or as a silvicultural treatment, or both.

Bureau Sensitive Species - Plant or animal species eligible for Federal Listed, Federal Candidate, State Listed, or State Candidate (plant) status, or on List 1 in the Oregon Natural Heritage Data Base, or approved for this category by the State Director.

Clear Cut Harvest - A timber harvest method in which all trees are removed in a single entry from a designated area, with the exception of wildlife trees or snags, to create an even-aged stand.

Commercial Thinning - The removal of merchantable trees from an even-aged stand to encourage growth of the remaining trees.

Core Area - That area of habitat essential in the breeding, nesting, and rearing of young, up to the point of dispersal of the young.

Cover - Vegetation used by wildlife for protection from predators, or to mitigate weather conditions, or to reproduce. May also refer to the protection of the soil and the shading provided to herbs and forbs by vegetation.

Critical Habitat - Under the Endangered Species Act, (1) the specific areas within the geographic area occupied by a Federally listed species on which are found physical and biological features essential to the conservation of the species, and that may require special management considerations or protection; and (2) specific areas outside the geographic area occupied by a listed species when it is determined that such areas are essential for the conservation of the species.

Cumulative Effect - The impact that results from identified actions when they are added to other past, present, and reasonably foreseeable future actions regardless of who undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.

Diameter At Breast Height (dbh) - The diameter of a tree 4.5 feet above the ground on the uphill side of the tree.

Endangered Species - Any species defined through the Endangered Species Act as being in danger of extinction throughout all or a significant portion of its range and published in the Federal Register.

Environmental Assessment (EA) - A systematic analysis of site-specific BLM activities used to determine whether such activities have a significant effect on the quality of the human environment; and whether a formal Environmental Impact Statement is required; and to aid an agency's compliance with NEPA when no EIS is necessary.

Environmental Impact - The positive or negative effect of any action upon a given area or resource.

Environmental Impact Statement (EIS) - A formal document to be filed with the Environmental Protection Agency that considers significant environmental impacts expected from implementation of a major Federal action.

Even-Aged Management - A silvicultural system that creates forest stands, which are primarily of a single age or limited range of ages.

Forest Canopy - The cover of branches and foliage formed collectively by the crowns of adjacent trees and other woody growth.

Forest Health - The ability of forest ecosystems to remain productive, resilient, and stable over time and to withstand the effects of periodic natural or human-caused stresses such as drought, insect attack, disease, climatic changes, flood, resource management practices and resource demands.

Forest Succession - The orderly process of change in a forest as one plant community or stand condition is replaced by another, evolving towards the climax type of vegetation.

Green Tree Retention - A stand management practice in which live trees as well as snags and large down wood, are left as biological legacies within harvest units to provide habitat components over the next management cycle.

> **High Level** -A regeneration harvest designed to retain the highest level of live trees possible while still providing enough disturbance to allow regeneration and growth of the naturally occurring mixture of tree species. Such harvest should allow for the regeneration of intolerant and tolerant species. Harvest design would also retain cover and structural features necessary to provide foraging and dispersal habitat for mature and old growth dependent species.

> **Low Level** - A regeneration harvest designed to retain only enough green trees and other structural components (snag, coarse woody debris, etc.) to result in the development of stands, which meet old growth definitions within 100-120 years after harvest entry, considering overstory mortality.

Habitat Fragmentation - The breaking up of habitat into discrete islands through modification or conversion of habitat by management activities.

Home Range - The area that an animal traverses in the scope of normal activities; not to be confused with territory, which is the area an animal defends.

Landing - Any place on or adjacent to the logging site where logs are assembled for further transport.

Land Use Allocations - Allocations that define allowable uses/activities, restricted uses/ activities, and prohibited uses/activities. They may be expressed in terms of area such as acres or miles, etc. Each allocation is associated with a specific management objective.

Log Decomposition Class - Any of 5 stages of deterioration of logs in the forest; stages range from essentially sound (class 1) to almost total decomposition (class 5).

Mitigating Measures - Modifications of actions that (a) avoid impacts by not taking a certain action or parts of an action; (b) minimize impacts by limiting the degree or magnitude of the action and its implementation; (c) rectify impacts by repairing, rehabilitating or restoring the affected environment; (d) reduce or eliminate impacts over time by preservation and maintenance operations during the life of the action; or (e) compensate for impacts by replacing or providing substitute resources or environments.

Prescribed Fire - A fire burning under specified conditions that will accomplish certain planned objectives.

Reforestation - The natural or artificial restocking of an area with forest trees; most commonly used in reference to artificial stocking.

Regeneration Harvest - Timber harvest conducted with the partial objective of opening a forest stand to the point where favored tree species will be reestablished.

Resource Management Plan (RMP) - A land use plan prepared by the BLM under current regulations in accordance with the Federal Land Policy and Management Act.

Rotation - The planned number of years between establishment of a forest stand and its regeneration harvest.

Seed Tree Regeneration Method - Removal of old stand in one cutting, except for a small number of trees left singly, in small groups, or narrow strips, as a source of seed for natural regeneration. Distinguished from shelterwood cutting by the fact that the seed trees do not cover enough ground to provide any significant shelter to the new trees-a matter that depends more on the width of the crowns of the seed trees than upon their number. (Wenger, 1984).

Seral Stages -The series of relatively transitory plant communities that develop during ecological succession from bare ground to the climax stage. There are five stages:

> **Early-Seral Stage** - The period from disturbance to crown closure of conifer stands usually occurring from 0-15 years. Grass, herbs, or brush are plentiful.

> **Mid-Seral Stage** - The period in the life of a forest stand from crown closure to ages 15- 40. Due to stand density, brush, grass, or herbs rapidly decrease in the stand. Hiding cover may be present.

> **Late-Seral Stage** - The period in the life of a forest stand from first merchantability to culmination of mean annual increment. This is under a regime including commercial thinning, or to 100 years of age, depending on

wildlife habitat needs. During this period, stand diversity is minimal, except that conifer mortality rates will be fairly rapid. Hiding and thermal cover may be present. Forage is minimal.

Mature-Seral Stage - The period in the life of a forest stand from Culmination of Mean Annual Increment to an old growth stage or to 200 years. This is a time of gradually increasing stand diversity. Hiding cover, thermal cover, and some forage may be present.

Old Growth - This stage constitutes the potential plant community capable of existing on a site given the frequency of natural disturbance events. For forest communities, this stage exists from approximately age 200 until when stand replacement occurs and secondary succession begins again. Depending on fire frequency and intensity, old growth forests may have different structures, species composition and age distributions. In forests with longer periods between natural disturbance, the forest structure will be more even-aged at late mature or early old growth stages.

Shelterwood Regeneration Method - Establishment of a new, essentially even-aged, stand from the release, typically in a series of cuttings, of new trees started under the old stand. The essential characteristic is that the new stand is established naturally or artificially before the last of the old one is removed. (Wenger, 1984)

Site Preparation - Any action taken in conjunction with a reforestation effort (natural or artificial) to create an environment that is favorable for survival of suitable trees during the first growing season. This environment can be created by altering ground cover, soil or microsite conditions, using biological, mechanical, or manual clearing, prescribed burns, herbicides or a combination of methods.

Skid Trail - A pathway created by dragging logs to a landing (gathering point).

Slash - The branches, bark, tops, cull logs, and broken or uprooted trees left on the ground after logging.

Snag - Any standing dead, partially-dead, or defective (cull) tree at least 10 inches in diameter at breast height (dbh) and at least 6 feet tall. A hard snag is composed primarily of sound wood, generally merchantable. A soft snag is composed primarily of wood in advanced stages of decay and deterioration, generally not merchantable.

Soil Compaction - An increase in bulk density (weight per unit volume) and a decrease in soil porosity resulting from applied loads, vibration, or pressure.

Soil Displacement - The removal and horizontal movement of soil from one place to another by mechanical forces such as a blade.

Soil Productivity - Capacity or suitability of a soil for establishment and growth of a specified crop or plant species, primarily through nutrient availability.

Stand (Tree Stand) - An aggregation of trees occupying a specific area and sufficiently uniform in composition, age, arrangement, and condition so that it is distinguishable from the forest in adjoining areas.

Stand Density - An expression of the number and size of trees on a forest site. May be expressed in terms of numbers of trees per acre, basal area, stand density index, or relative density index.

Stocked/Stocking - Related to the number and spacing of trees in a forest stand.

Sustained Yield - The yield that a forest can produce continuously at a given intensity of management.

Wildlife Tree - A live tree retained to become future snag habitat.

Yarding - The act or process of moving logs to a landing.