U.S. Department of the Interior
Bureau of Land Management

Hole in the Road Timber Management Project

Environmental Assessment and Finding of No Significant Impact

Environmental Assessment Number: DOI-BLM-ORWA-S040-2014-0004-EA

Project Name in National NEPA Register: Hole in the Road Thinning Project

November 2016

United States Department of the Interior
Bureau of Land Management, Oregon State Office
Northwest Oregon District, Cascades Field Office
Clackamas County, Oregon
T. 7 S., R. 3 E., Sections 15, 16, 17, 21, 22, 26 and 27; W.M.

Responsible Agency:	USDI – Bureau of Land Management
Responsible Official:	John Huston, Field Manager Cascades Field Office 1717 Fabry Road SE Salem, OR 97306
For further information, contact:	Alisa Tanner Cascades Field Office 1717 Fabry Road SE Salem, OR 97306 (503) 589-6844

As the Nation's principal conservation agency, the Department of Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering economic use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interest of all people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

BLM/OR/WA/AE-17/006+1632

Introduction

The Cascades Field Office (FO), Northwest Oregon District Bureau of Land Management (BLM), proposes to thin approximately 354 acres of 42-137 year old forest stands. Connected actions include: road maintenance, renovation, culvert replacement and/or improvement; road decommissioning, stabilization and closure; and fuels treatment. Approximately 6 acres will be cleared for new road construction.

The project is located on BLM-administered lands in T. 7 S., R. 3 E., Sections 15, 16, 17, 21, 22, 26 and 27, W.M. in Clackamas County, Oregon. The Hole in the Road Environmental Assessment (EA) (#DOI-BLM-ORWA-S040-2014-0004-EA) documents the environmental analysis of the proposed timber management alternatives. The EA is attached to and incorporated by reference in this Finding of No Significant Impact (FONSI) determination. The EA and unsigned FONSI will be made available for public review and comment from November 30th, 2016 to December 29th, 2016 (*EA Section 5.3*).

The analysis in this EA is site-specific and supplements analyses found in the *Salem District Proposed Resource Management Plan/Final Environmental Impact Statement*, September 1994 (RMP/FEIS). The proposed timber management activities have been designed to conform to the *Salem District Record of Decision and Resource Management Plan*, May 1995 (RMP) and related documents which direct and provide the legal framework for management of BLM lands within the Northwest Oregon District (*EA Section 1.3*).

Northwestern and Coastal Oregon Resource Management Plan Transition

The BLM signed a Record of Decision approving the Northwestern and Coastal Oregon Resource Management Plan (2016 ROD/RMP) on August 5, 2016.

Revision of an RMP necessarily involves a transition from the application of the old RMP to the application of the new RMP. The planning and analysis of future projects such as timber sales requires several years of preparation before the BLM can design a site-specific project and reach a decision. Allowing for a transition from the old RMP to the new RMP avoids disrupting the management of BLM-administered lands and allows the BLM to utilize work already begun on the planning and analysis of projects.

The 2016 ROD/RMP (*p. 10*) allows the BLM to implement projects consistent with the management direction of either the 1995 RMP or the approved RMP, at the discretion of the decision maker, if—

- The BLM had not signed a project-specific decision prior to the effective date of the ROD;
- The BLM began preparation of NEPA documentation prior to the effective date of the ROD; and
- The BLM signs a project-specific decision on the project within two years of the effective date of the ROD.

The Cascades FO began preparation of NEPA documentation prior to the effective date of the 2016 ROD/RMP, as the FO initiated planning and NEPA documentation for this project on October 16, 2015. This project was designed to conform to and be consistent with the Salem District's 1995 Record of Decision and Resource Management Plan (1995 ROD/RMP).

This project meets the criteria described in the 2016 ROD/RMP that allows the BLM to implement projects that conform and are consistent with the 1995 ROD/RMP, with the exception of five categories of prohibited carry-over actions (*2016 ROD, p. 10*). The Hole in the Road project does not include any actions that are excepted and therefore precluded from the 2-year transition period under the 2016 ROD/RMP.

1. Regeneration harvest (construction of roads or landings does not constitute regeneration harvest) within the Late-Successional Reserve allocated by this ROD that is inconsistent with the management direction for the Late-Successional Reserve contained within the approved RMP.

   The Hole in the Road Project does not propose any regeneration harvest on any land use allocation. Commercial thinning is the only harvest method proposed for the units identified for this project.

2. Issuance of right-of-way grants within the Late-Successional Reserve allocated by this ROD that are inconsistent with the management direction for the Late-Successional Reserve contained within the approved RMP.

   No right-of-way grants are proposed to be issued within the Late-Successional Reserve Land Use Allocation, thus there are no inconsistencies between the management direction for the 1995 ROD/RMP and the 2016 ROD/RMP.

3. Commercial thinning within the inner zone of the Riparian Reserve (RR) allocated by this ROD that is inconsistent with the management direction for the RR contained within the approved RMP.

   The proposed units identified in the Hole in the Road project were designed to exclude commercial thinning within the inner zone of the RR. As such, there are no inconsistencies between the management direction for the RR under the 1995 RMP/ROD and the 2016 RMP/ROD.

4. Projects within the District-Designated Reserve – Lands Managed for their Wilderness Characteristics allocated by this ROD that are inconsistent with the management direction for the District-Designated Reserve – Lands Managed for their Wilderness Characteristics contained within the approved RMP.

   The Hole in the Road project is not proposed within a District-Designated Reserve – Lands Managed for their Wilderness Characteristics allocated by the 1995 RMP/ROD or the 2016 RMP/ROD, so there are no inconsistencies between the management directions for the two RMPs/RODs.

5. Timber harvest that would cause the incidental take of northern spotted owl territorial pairs or resident singles and does not have a signed Biological Opinion and Incidental Take Statement that predates the effective date of the Biological Opinion for the approved RMP.

   The US Fish and Wildlife Service (USFWS) was consulted with on the Hole in the Road project (*EA Section 5.1.1*). The Biological Assessment of Not Likely to Adversely Affect was submitted in June 2015 and concluded that the Hole in the Road proposal may affect and is not likely to adversely affect the northern spotted owls (*See EA Section 5.1.1 for additional information on USFWS consultation*). The proposed project would not cause the incidental take of northern spotted owls because the project will maintain suitable and dispersal habitat with in the provincial home range of known sites and impose a seasonal restriction on operations during the critical nesting period.

Finding of No Significant Impact

The FONSI is defined in 40 CFR 1508.13 as a document briefly presenting the reasons why an action will not have a significant effect on the human environment which includes the natural and physical environment and the relationship of people with that environment.

If the agency "finds" that the action has "no significant impact", the agency is not required to prepare an Environmental Impact Statement (EIS) for the project. 40 CFR 1508.27 defines the factors to consider in determining whether a project is anticipated to "significantly" impact the human environment. The following FONSI documents the BLM's evaluation of the potential impacts of the Hole in the Road Project.

Based upon review of the Hole in the Road EA and supporting documents, the proposed project is not a major federal action and would not significantly affect the quality of the human environment, individually or cumulatively with other actions in the general area. No environmental effects described in the EA meet the definition of significance in context or intensity as defined in 40 CFR 1508.27. Therefore, supplemental or additional information to the analysis in the RMP/FEIS in the form of an EIS is not needed. This finding is based on the following discussion:

***Context* [40 CFR 1508.27(a)]** refers to the suitable scale for analysis. Potential effects resulting from the implementation of the proposed project have been analyzed within the context of the project area boundaries, the Upper Molalla 5th field Watershed, and the Pine Creek Molalla 6th field Watershed. The 354 acre project would affect less than 1 percent of the 43,084 acres in the Upper Molalla 5th field Watershed.

***Intensity* [40 CFR 1508.27(b)]** refers to severity of impact. The following ten sections refer to the specific conditions/concerns addressed in §1508.27 and document the BLM's consideration of the severity of the impacts as assessed in the Hole in the Road EA.

Impacts that may be both beneficial and adverse [40 CFR 1508.27(b) (1)]: The effects of commercial thinning are unlikely to have significant (beneficial and/or adverse) impacts *(EA Chapter 3)* for the following reasons:

Project Design (EA Section 2.3): The proposed treatments described in EA Section 2.3.1 (Proposed Action, including the project design features (PDF) described in Table 5) were developed by the Interdisciplinary Team (IDT) of BLM Resource Specialists so that the risk of effects to affected resources would conform to RMP Management Direction and be within the effects described in the RMP/FEIS.

Vegetation and Forest Stand Characteristics (EA Section 3.3.1): Effects to these resources would not have significant impacts because:

A forest environment would be maintained in the project area by retaining green trees within project units (*EA Table 15*).

For thinning areas there would be no identifiable adverse impacts to suitable habitat for Special Status species in the project units or any known or undiscovered Special Status species populations from this project because the nature of the thinning would not change these habitats in a way that would preclude those species. Potential undiscovered populations include seasonal fungi species.

The project would not contribute to the need to list any BLM Special Status species.

BLM examined past timber harvest areas near the proposed project areas and found no evidence to indicate that adverse impacts from invasive/non-native species would occur as a result of the proposed project. The PDFs listed in *EA Table 5* reduce potential adverse impacts by controlling the spread and introduction of invasive/non-native species.

Hydrology, Fisheries and Aquatic Habitat (EA Sections 3.3.2; 3.3.3): The project effects on water quality would comply with Oregon Department of Environmental Quality (ODEQ) standards. Effects to these resources would not have significant impacts since because:

In general, there would be no direct alteration of the physical features of project area stream channels or wetlands from timber harvest or logging operations, with the exception of culvert replacements on the haul routes.

The Proposed Action is unlikely to affect stream flow and potential increases in stream flow or to exceed the threshold for peak flow augmentation; therefore the project is unlikely to cause indirect effects to stream channels as a result of flow alteration or timing.

The project would maintain current stream temperatures by retaining the current vegetation and shading in the primary shade zone (stream protection zones, or SPZ) and most of the current levels of shading provided by the secondary shade zone.

It is unlikely that the Proposed Action would result in a discernible effect to the levels of turbidity or water clarity in project watersheds or that turbidity levels would reach levels that would impact aquatic organisms or cause additional treatment expense or technical difficulties for the downstream water providers. Water quality would be maintained because logging, road construction/renovation, culvert replacement, road maintenance and timber haul PDFs (*EA Table 5*) and SPZ are expected to prevent sediment from reaching streams and causing sediment/turbidity that would exceed ODEQ water quality standards.

Water quality would also be maintained because road construction would occur on gentle, stable slopes, thereby minimizing the possibility of mass movement and/or sediment delivery through surface runoff to streams. Runoff from new roads would drain to stable, vegetated slopes where it would infiltrate into the soil rather than connect to stream channels to transport sediment or augment peak flows.

No changes in project area hydrology due to project actions are likely to be detectable, including mean annual water yield, fog drip, base flow and peak flows.

The project would not impact stream channels, aquatic habitat or fish populations because it would not cause water quality impacts that exceed ODEQ water quality standards and would not detectably change project area hydrology.

Soils (EA Section 3.3.4): Effects to this resource would not have significant impacts because:

The PDFs (*EA Table 5*) limit machinery operations so that there would be an overall maximum increase of 12 percent of the project area in moderate to heavy compaction/disturbance of soils from all sources, which is within RMP standards (C-2, 10 percent from ground-based logging; and C-9, 2 percent from site preparation) analyzed in the RMP/FEIS.

In the Proposed Action no loss of growth and yield would be expected at the stand level because thinning treatments typically lead to acceleration of average tree growth and compacted soils affect less than half of the rooting area of individual trees.

In the Proposed Action no measurable loss in timber stand productivity is expected over the next rotational (full cycle of stand establishment to regeneration harvest and establishment of the next stand, approximately one century) due to soil compaction and disturbance from logging operations.

Following completion of thinning the majority of organic matter, understory vegetation and root systems would remain.

The project would not lead to any measurable increase in surface erosion and overall erosion would remain within the natural range of background erosion rates.

The project would maintain sufficient mycorrhizae populations because the root systems of most vegetation would remain undisturbed.

PDFs for the Hole in the Road project are in place to minimize impacts to soils (*EA Table 5*) Coupled with long rotations, no long term loss in soil productivity is expected.

Wildlife (EA Section 3.3.5): Effects to this resource would not have significant impacts because:

Proposed treatments (and non-treatment) would have trade-offs of effects in both the short and long term which would be beneficial to some species and detrimental to other species. The variation within the proposed treatment and maintaining untreated forest stands adjacent to all treated stands would provide a range of habitat conditions to balance the trade-offs of effects.

Existing snags and coarse woody debris (CWD) would be retained on site. Snags that need to be felled for safety would be left on site as CWD.

Proposed treatments would not significantly change species richness (a combination of species diversity and abundance) of the Migratory and Resident Bird community. No species would be extirpated from the local area as a result of thinning. No take of species is anticipated from thinning harvest due to seasonal restrictions during nesting season.

See Intensity Point # 9 (*Below, 40 CFR 1508.27(b) (9)*) for effects to northern spotted owl.

Air Quality and Fire Hazard/Risk (EA Section 3.3.6): Effects to this resource would not have significant impacts because:

After 3 to 5 years the fine fuels generated by thinning harvest would be decayed in the units and the risk of surface fire would decrease to near current levels. Under the Proposed Action fuels treatment for site preparation would immediately reduce the risk of surface fire to equal or less than current levels.

The project would comply with State of Oregon Air Quality Standards by strict adherence to smoke management regulations.

Carbon Storage, Carbon Emissions and Climate Change (EA Section 3.3.7): Effects to this resource would not have significant impacts because:

The short-term carbon emissions and difference in long-term carbon storage that could be attributable to the Proposed Action are of such small magnitude that it is unlikely to be detectable at global, continental or regional scales. Additionally, changes in carbon stores are unlikely to affect the results of any models now being used to predict climate change.

Recreation, Visual Resources, and Rural Interface (EA Section 3.3.8): Effects to this resource would not have significant impacts because:

Recreation visitation would be moderately restricted for short periods (weeks) in specific locations (units) during a 3–5 year period for safety, then should return to prior usage.

There are no authorized recreation trails to be impacted. No long term changes (more than weeks within a 3-5 year period) to public access would result from the project.

Changes to the landscape character would comply with Visual Resource Management (VRM) class II and III objectives. PDFs, time in view and unit locations mitigate any adverse effect to scenic resources according to VRM class II and III objectives (*EA Section 3.3.8*). Proposed timber harvest operations would not increase Off Highway Vehicle (OHV) access to units as most skid trails and all new roads would be blocked after operations are complete (*See Intensity Point # 7 (40 CFR 1508.27(b) (7)) below*).

[40 CFR 1508.27(b) (2)] - The degree to which the proposed action affects public health or safety (*EA Sections 1.7.1, 2.3, 2.3.1, 3.3.6, 3.3.8, 3.3.9, Table 5,*)*:* The project would not adversely affect public health or safety because:

Public access to hazardous work areas where there are accessible roads would be restricted by flaggers, warning signs and temporary traffic control barriers or devices.

Occupational Safety and Health Administration (OSHA) mandated health and safety regulations are applied to all project operations related to the project implementation.

All actions of the project must meet national and State of Oregon DEQ air and water quality standards, as provided for by the RMP/FEIS.

[40 CFR 1508.27(b) (3)] - Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas: Effects to these resources would not have significant impacts because:

The project would not affect historical or cultural resources because there are no known cultural resources within project units or other locations where they could potentially be impacted by project operations. On site cultural and historic surveys have been completed and have not produced evidence to support the previous or present existence of artifacts of significant cultural or historical value (*EA Section 3.3.9).*

There are no park lands, or prime farmlands within the project units to be impacted.

The Proposed Action would not infringe upon the suitable Wild and Scenic River's free-flowing values, and maintain or enhance in the long term its outstanding remarking values; which include Geology, Recreation use and Scenic quality (*EA Section 3.3.8*).

[40 CFR 1508.27(b) (4)] - The degree to which the effects on the quality of the human environment are likely to be highly controversial: The project is not unique or unusual. The BLM has experience implementing actions similar to the Proposed Action in similar areas so the effects are well known and not highly controversial.

[40 CFR 1508.27(b) (5)] - The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks: The effects of the project do not have any uncertain, unique or unknown risks because the BLM has experience implementing similar actions in similar areas without these risks. No potential unique or unknown risks were identified by the BLM or by comments submitted in response to internal and external scoping. PDFs would minimize the risks associated with the project (*EA Sections 2.1, 2.2, 2.3.1, 2.3.2*). See Intensity Point # 4 (*40 CFR 1508.27(b) (4)*), above.

[40 CFR 1508.27(b) (6)] - The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration: The project would not establish a precedent for future actions beyond the time frames analyzed nor would they represent a decision in principle about a further consideration for the following reasons:

The project is in the scope of proposed activities documented in the RMP/FEIS.

The BLM has experience implementing similar actions in similar areas without setting a precedent for future actions or representing a decision about a further consideration. See Intensity Point #s 4 (*40 CFR 1508.27(b) (4)*) and 5 (*40 CFR 1508.27(b) (5)*), above.

[40 CFR 1508.27(b) (7)] - Whether the action is related to other actions with individually insignificant but cumulatively significant impacts: The IDT evaluated the project areas in context of past, present and reasonably foreseeable actions and determined that there is a potential for cumulative effects on water quality and fisheries, peak flows and fisheries, visual impacts, and carbon storage and emissions. These effects are not expected to be significant for the following reasons:

Water Quality/Fisheries: The proposed project would be expected to temporarily increase stream sediment and turbidity as a result of culvert replacement, road maintenance, and road use (*EA Sections 3.3.2, 3.3.3*). These effects are not expected to be significant for the following reasons:

Any sediment increase resulting from thinning would be too small to be discernable relative to background sediment yields, would not be expected to exceed ODEQ water quality standards and would decrease quickly over time, returning to current levels within three to five years as vegetation increases (*Dissmeyer 2000*).

The limited magnitude of sediment inputs (non-detectable on 7th field watershed scale, not visible more than 800 meters downstream of crossings) and duration (primarily major storm events during the first year following disturbance at culvert replacement sites) of this effect would likely be insignificant for water quality on the watershed scale. Cumulatively, the Proposed Action would be unlikely to result in any detectable change for water quality on a 7th field watershed scale (even less effect on the larger 6th field watershed scale) and would be unlikely to have any effect on any designated beneficial uses, including fisheries (*EA Section 3.3.2.2, 3.3.3.2*).

Road use restrictions, road design and maintenance, protection measures and monitoring of road conditions would prevent increases in turbidity that exceed ODEQ standards which were established to maintain water quality (*EA Section 2.3.1., and Table 5*). When water quality is maintained within ODEQ standards, changes to sediment levels would not significantly impact fisheries, including listed fish habitat (LFH) (*EA Sections 3.3.2.2, 3.3.3.2*).

Peak Flows and Fisheries: The Proposed Action, combined with the effects of BLM's estimate of potential harvest on private lands over the next 10 years, would not augment peak flows to exceed the threshold for peak flow effects (*EA Sections 3.3.2.1, 3.3.2.2, 3.3.3.1*, *3.3.3.2*).

The project carries no risk for contributing to any existing cumulative effect to watershed hydrology because the watersheds are currently at a low risk for impacts and there would not be any detectable direct or indirect effects to surface flows or ground water (*EA Sections 3.3.2.1, 3.3.2.2*).

The project is at low risk for potential increases in peak flows so it would not affect stream channels, large wood or sediment levels in project areas streams and therefore would not significantly affect fisheries (*EA Sections 3.3.2.2, 3.3.3.2*).

Carbon storage and carbon emissions (*EA Section 3.3.7*): The Proposed Action would not contribute cumulative effects to carbon storage and carbon emissions. The effects are not significant for the following reasons:

The short-term increase in carbon emissions and difference in long-term storage that could be attributable to the proposed project are of such small magnitude, as determined by analysis, that it is unlikely to be detectable at global, continental or regional scales or to affect the results of any models now being used to predict climate change.

Visual impacts *(EA Section 3.3.8):* The Proposed Action would retain the features of the surrounding landscape which is comprised of a patchwork pattern with harvested and intact conifer stands of varying stand ages. The Proposed Action would not contribute to heightened sensitivity levels or cause the scenic quality of the overall landscape to change.

[40 CFR 1508.27(b) (8)] - The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources: The project would not affect these resources because no districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places exist within or near the proposed project vicinity (*EA Section 3.3.9).*

[40 CFR 1508.27(b) (9)] - The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act (ESA) of 1973: The project is not expected to adversely affect ESA listed species or critical habitat for the following reasons:

ESA Wildlife - Northern spotted owl *(EA Section 3.3.5):* Effects to the species are not significant because:

The Proposed Action modifies but maintains 354 acres of dispersal and suitable habitat in the affected watersheds. Habitat conditions are expected to improve as treated stands grow (greater than 20 years); and retained trees would increase in size and be available for recruitment or creation of snags, culls and CWD for prey species and nesting opportunities, particularly in Riparian Reserves. Seasonal restrictions on project activities within a quarter mile of centers of activity would prevent disturbance during nesting season. The Proposed Action implements management direction provided in the RMP and is within the effects analyzed in the RMP/FEIS.

Thinning of dispersal and suitable habitat is a "not likely to adversely affect" action for spotted owls as described in the Biological Assessment (BA) (*EA Section 5.1.1*). Spotted owl suitable habitat will be maintained by keeping at least 60 percent canopy closure after thinning. Dispersal habitat will be maintained by keeping at least 40 percent canopy closure.

The Proposed action is in compliance with the new Final Recovery Plan for the Northern Spotted Owl (*USFWS 2011*). The habitat is not located in LSR or critical habitat, and does not meet the criteria for Recovery Action 10 or Recovery Action 32. No Incidental Take of spotted owls is expected to occur as a result of the Proposed Action.

The proposed thinning connected actions described in this EA have incorporated the applicable General Standards that were described in the BA (*pp. 9-10*). This includes delaying proposed activities to avoid disrupting spotted owls at known spotted owl sites until after the critical nesting season, and monitoring/reporting on the implementation of this project to the USFWS.

The Proposed Action is not likely to affect spotted owl Critical Habitat, and not likely to diminish the effectiveness of the conservation program established under the Northwest Forest Plan (NWFP) to protect the spotted owl and its habitat.

ESA Consultation is described in EA Section 5.1.

ESA Fish – Upper Willamette River (UWR) Chinook salmon, UWR steelhead trout *(EA Section 3.3.3):* Effects to ESA fish are not significant because thinning is not expected to affect these species for the reasons stated in the Hydrology section (*EA Section 3.3.2*).

Effects of road maintenance and log hauling are not significant because PDFs (*EA Table 5*) would prevent sediment from entering streams in quantities sufficient to exceed ODEQ water quality standards. The main haul route is designed and maintained to support year around use and direct most water and sediment onto stable slopes where it infiltrates rather than delivering it to streams. The haul route on road 7-3E-15.1 would only be used in the dry season when runoff would not be generated. Condition related restrictions and monitoring would prevent generating and delivering sediment to streams.

New road construction would be located in stable locations and would not contribute to degradation of aquatic habitat or extend the stream network through ditches on new roads draining into streams.

ESA Consultation is described in EA Section 5.1.

[40 CFR 1508.27(b) (10)] - Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment: The proposed thinning harvest activities have been designed to follow Federal, State, and local laws (*EA Section 1.7*).

John Huston, Manager, Cascades Field Office – Unsigned, for Review and Comment

Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction

This environmental assessment (EA) analyzes the impacts of a proposed thinning project and connected actions on the human environment. The EA provides the decision-maker, the Cascades Field Office Manager, with current information to aid in the decision-making process. Chapter 1 of this EA provides a context for what will be analyzed in the EA, describes the kind of actions being considered, defines the project area, describes what the proposed and any alternative actions need to accomplish, identifies the criteria that will be used for choosing the alternative that will best meet the purpose and need for the proposed project, and describes the statutes and other authorities which govern the proposed project.

1.1 Proposed Action

The Cascades Field Office (FO), Northwest Oregon District Bureau of Land Management (BLM), proposes to thin approximately 354 acres of 42-137 year old[1] forest stands. Connected actions include: road maintenance, renovation, culvert replacement and/or improvement; road decommissioning, stabilization and closure; and fuels treatment. Approximately 6 acres will be cleared for new road construction.

1.2 Project Area[2] Location and Vicinity

The proposed project is located within Clackamas County, Oregon in Township 7 South, Range 3 East, Sections 15, 16, 17, 21, 22, 26 and 27. The Hole in the Road project area is within the Upper Molalla 5th field Watershed, and the Pine Creek Molalla River 6th field Watershed. BLM lands are intermixed with privately-owned industrial timberland, USFS and County land, creating a mosaic of ownership patterns.

[1] Total stand ages calculated as of September, 2015.
[2] "Project area" is the area proposed for treatment such as thinning or other operations such as road construction and road renovation. "Project vicinity" is the contiguous block(s) of BLM managed lands within the **sections** that contain the project area. The "Vicinity Map" shows the project vicinity and additional area.

Maps

Figure 1: Project Vicinity Map

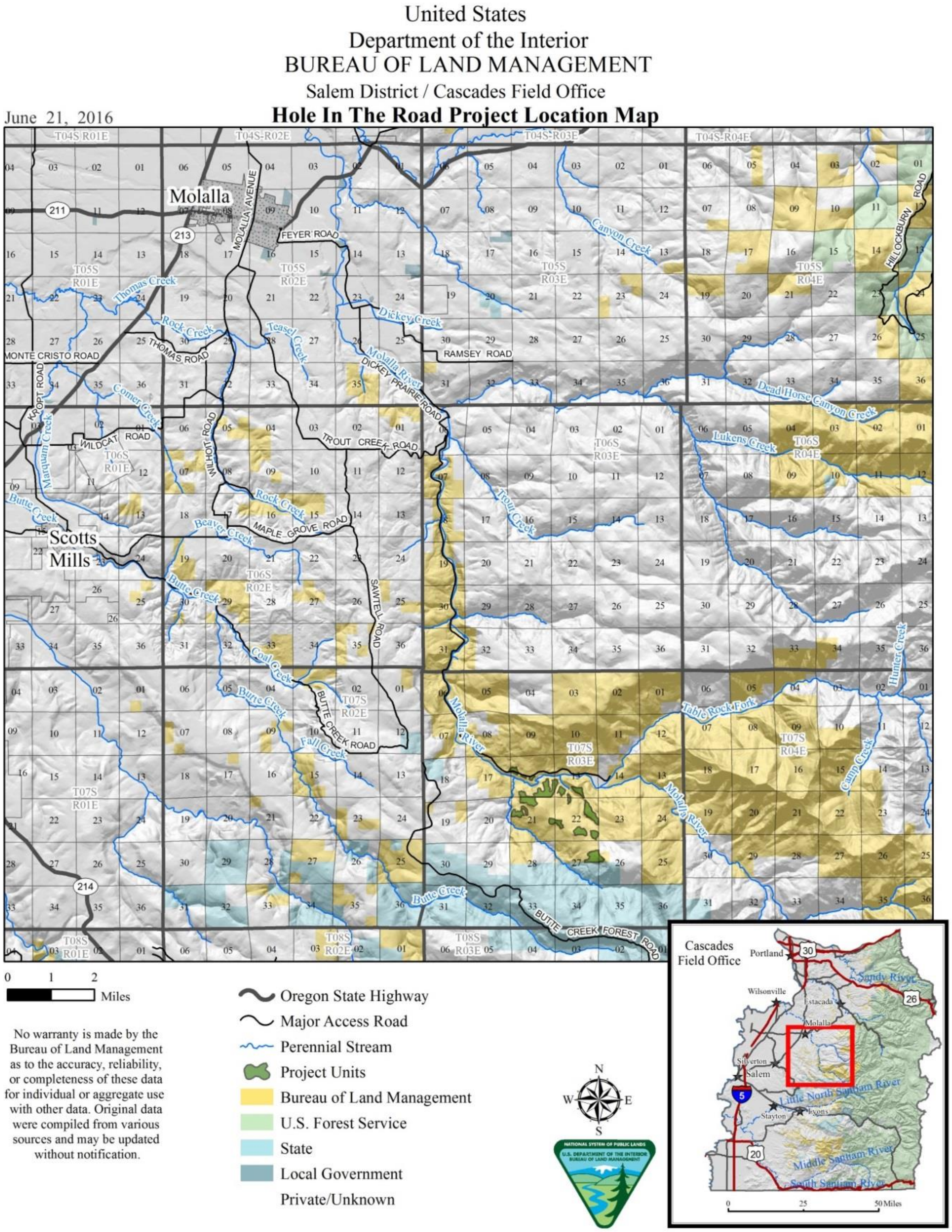


Figure 2: Section Map; T7S, R3E Section 15

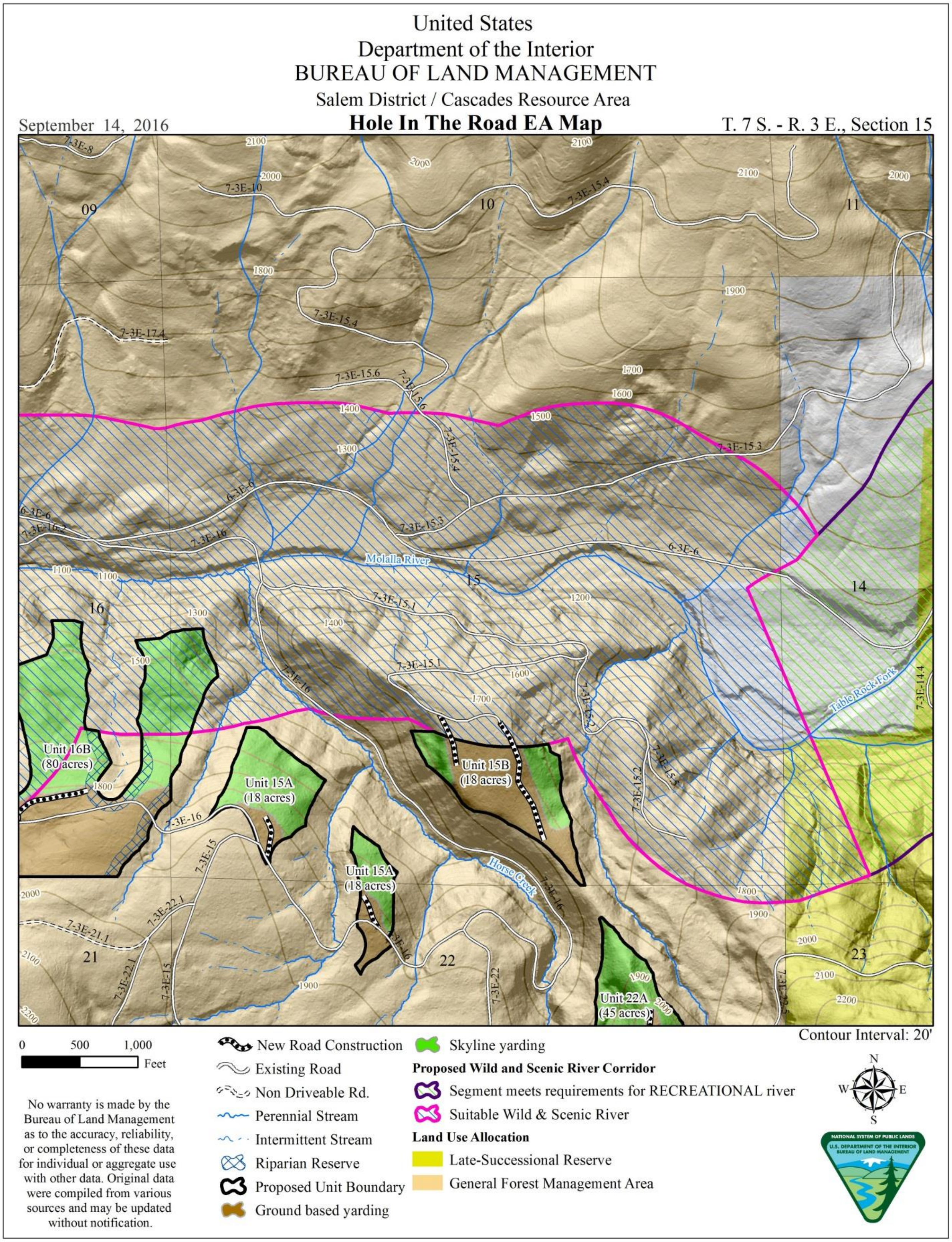


Figure 3: Section Map; T7S, R3E Section 16

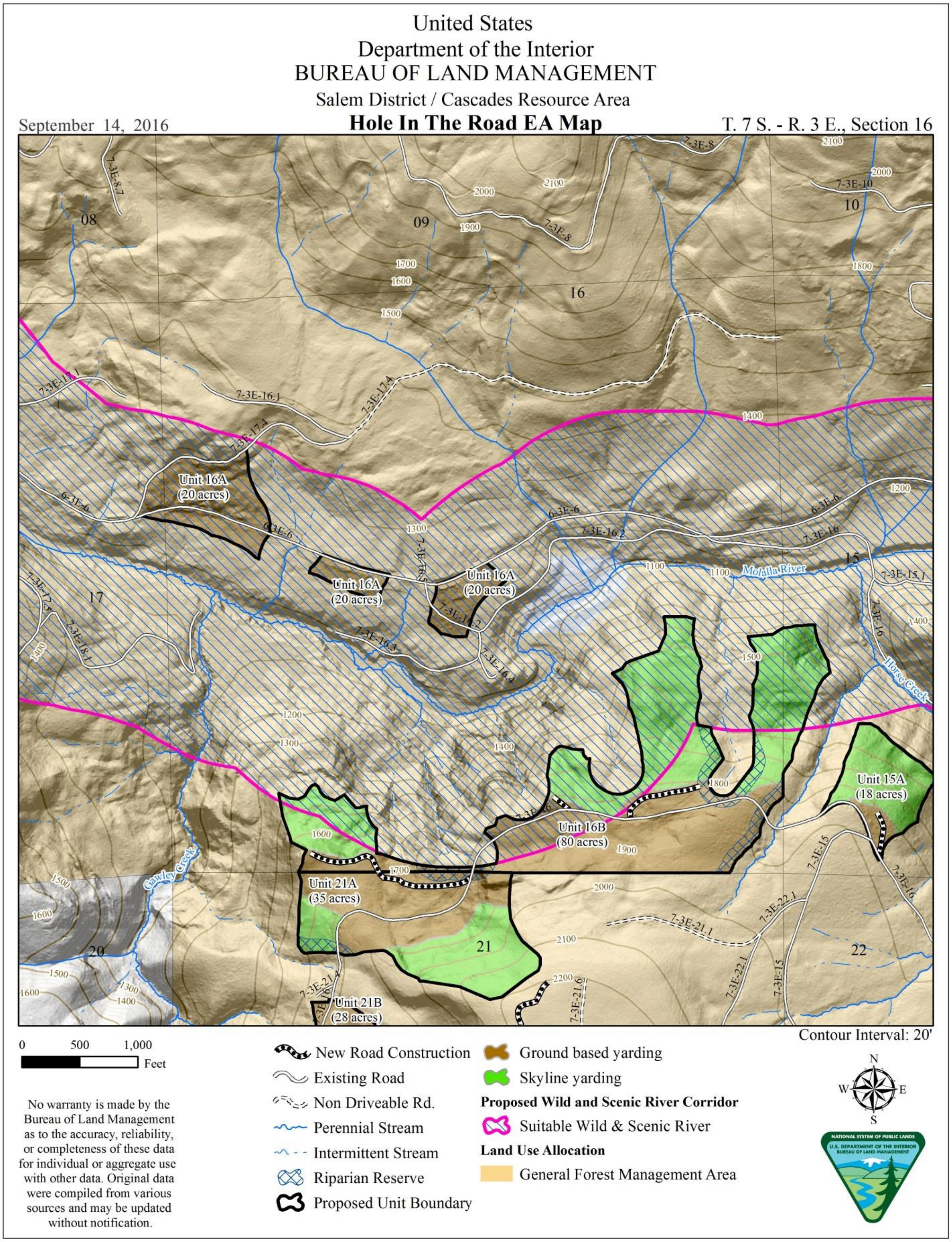


Figure 4: Section Map; T7S, R3E Section 21

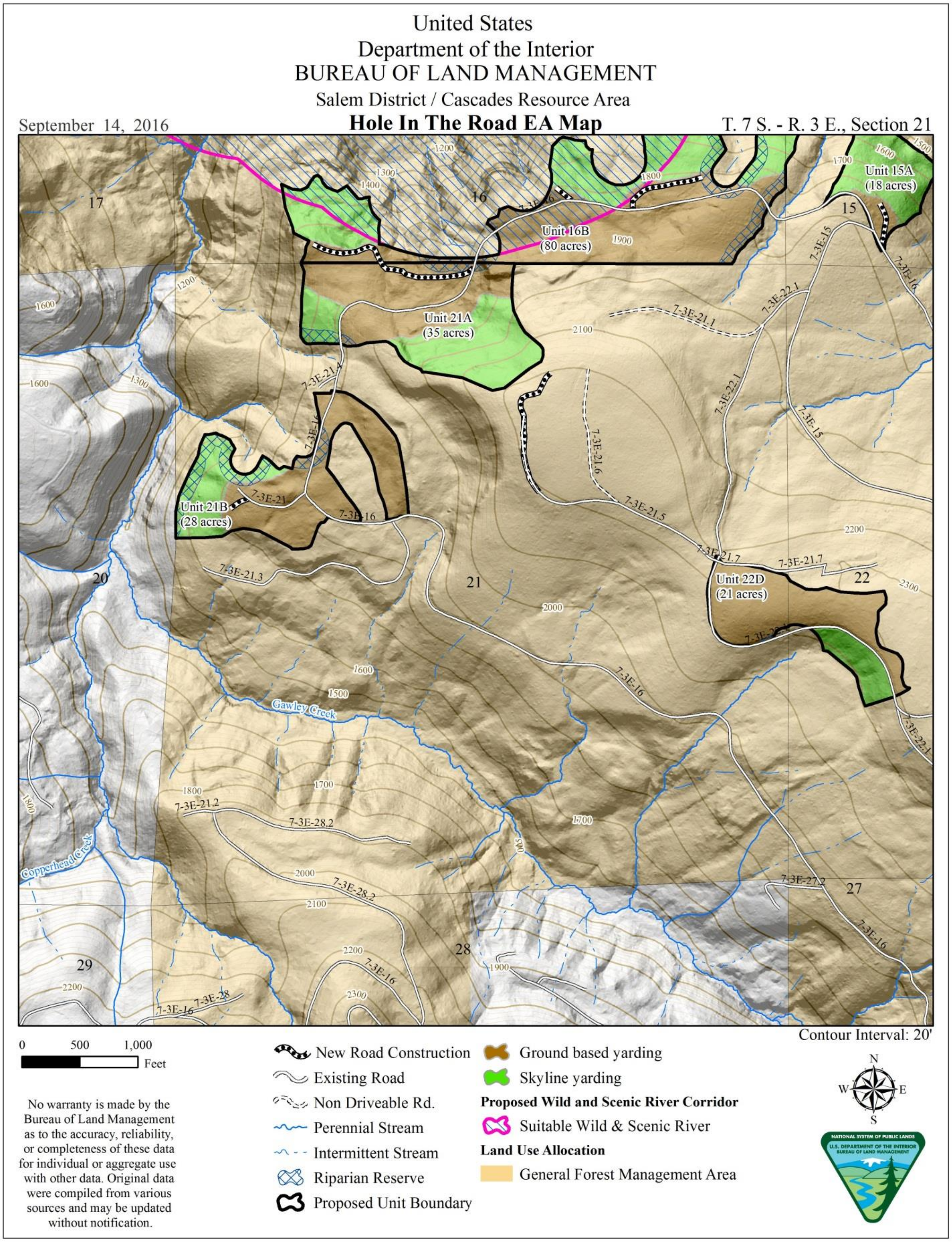


Figure 5: Section Map; T7S, R3E Section 22

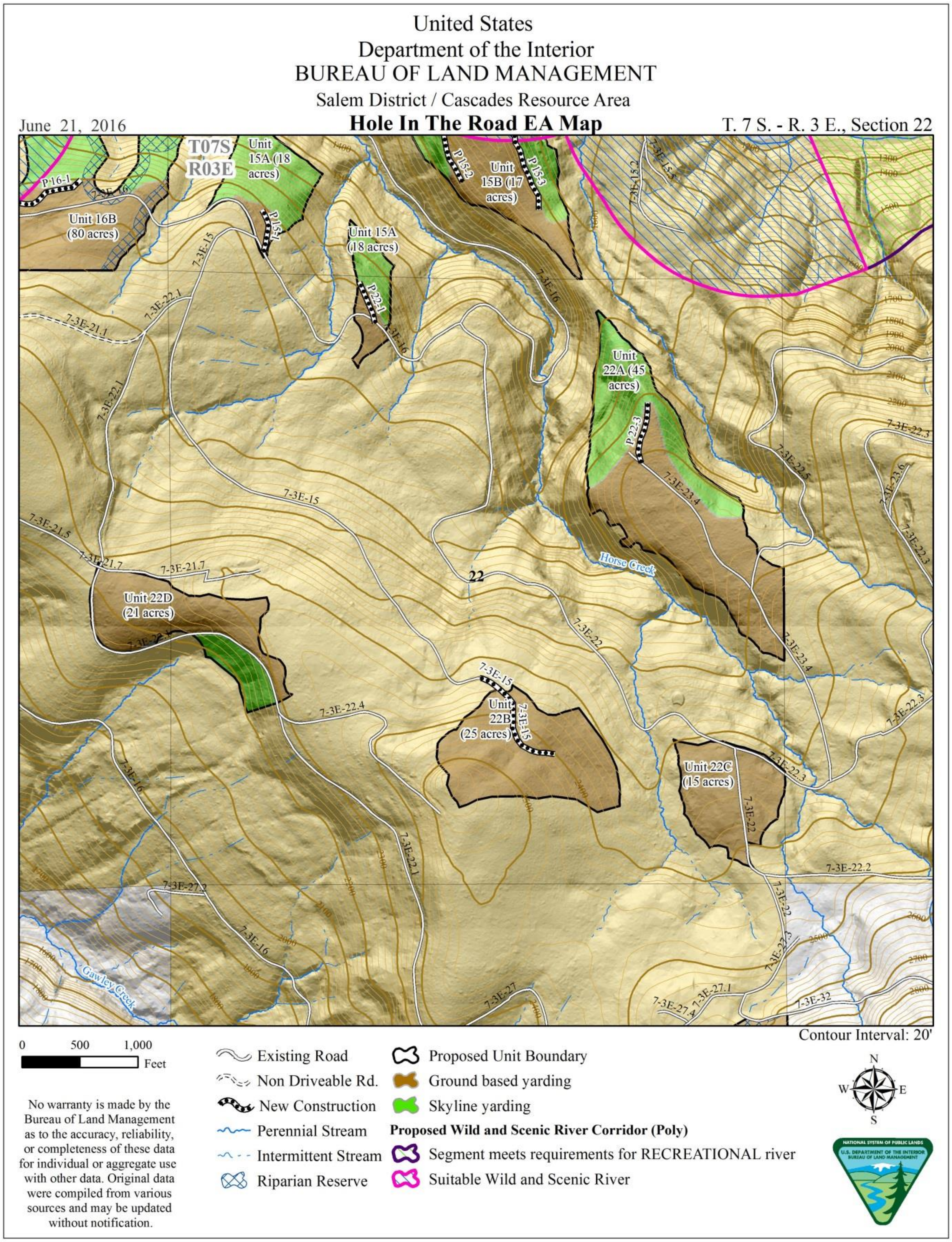
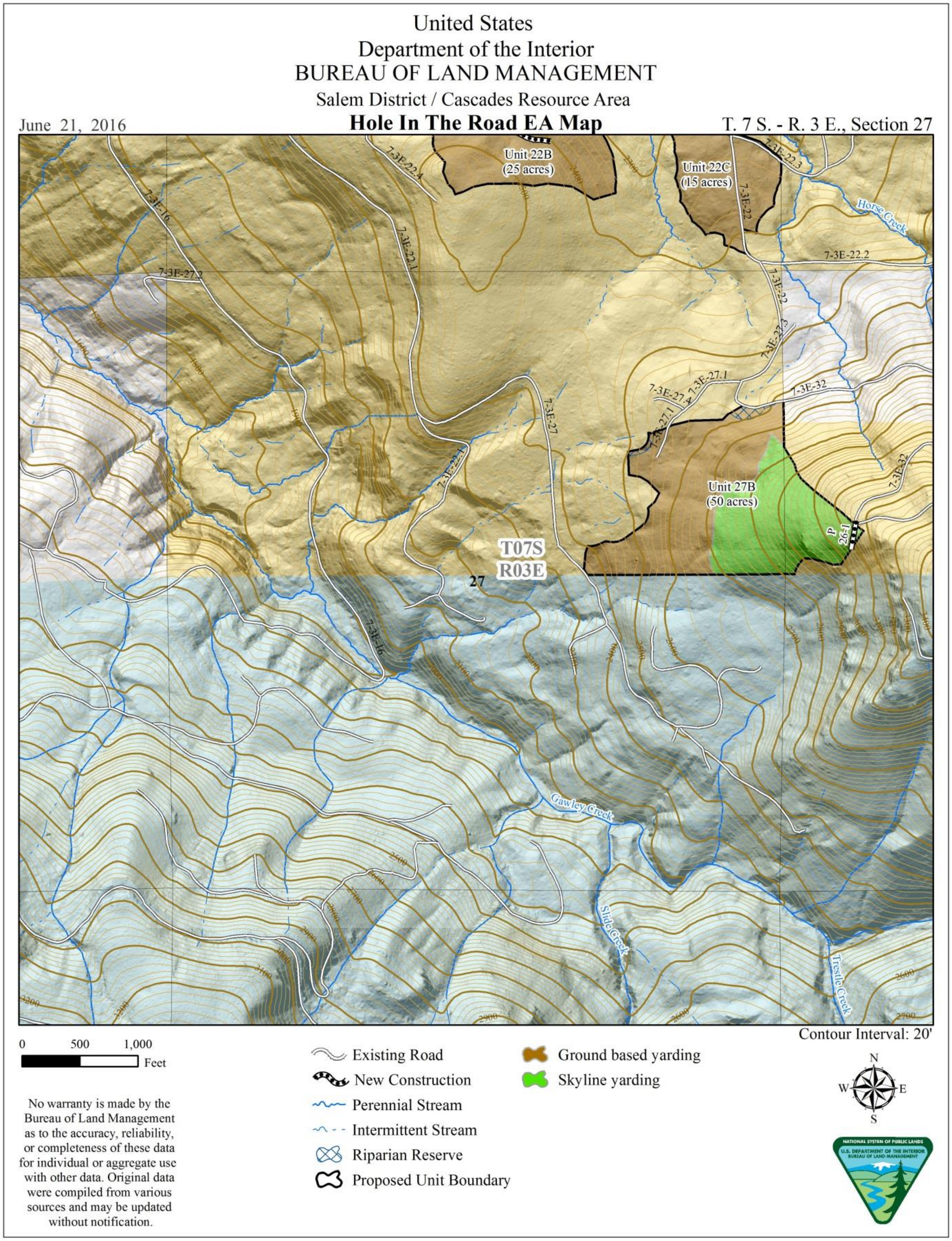


Figure 6: Section Map; T7S, R3E, Section 27



1.3 Purpose and Need for Action

The need for the Hole in the Road project is to manage revested Oregon and California (O&C) and Public Domain (PD) lands under the statutory requirements established under the O&C Act (*43 U.S.C. §1181a et seq.),* and the Federal Land Policy and Management Act of 1976 (*FLPMA, 43 U.S. C §1701 et seq.).* Management of these lands includes, but is not limited to, timber production that adheres to the principles of sustained yield management and ecosystem health as identified by the objectives outlined in the Salem District Resource Management Plan (RMP) in a manner that is consistent with the Land Use Allocations (LUA) within the project area.

The purpose for the action is to reduce stand density (thinning) within the Hole in the Road project area to meet the project objectives outlined in EA Section 1.4 and to increase the value of timber products and ecosystem health over the life cycle of these stands. Thinning these stands will meet the principles of sustained yield management by providing timber products now and in the future.

1.3.1 Need for a Timber Sale and Connected Actions

To meet requirements under the O&C Act and FLPMA

The land within the Hole in the Road project is in revested O&C land and PD land within the BLM Cascades FO. The statutory requirements of the O&C Act, which governs BLM-administered O&C lands in western Oregon, include, but are not limited to, managing the O&C lands for permanent forest production by selling, cutting and removing timber in conformance with the principles of sustained yield; determining the annual productive capacity of the lands managed under the O&C Act; and offering that determined capacity annually under normal market conditions. The statute states that the purpose of sustained yield management of these lands is to provide a permanent source of timber, contribute to the economic stability of local communities and industries, as well as benefit watersheds, regulate stream flows, and provide recreational use (*RMP p. 2; 2008 FEIS CH. 1 pp. 8-9 and A6-7*).

The FLPMA requires that public lands be managed for multiple uses and establishes a planning process. The FLPMA does not require that every parcel be managed for every value and timber is included in these uses. The FLPMA further specifically provides that if there is any conflict between its provisions and the O&C Act relating to management of timber resources, the O&C Act prevails (*43 U.S.C. §1701*).

Forest Management by BLM must be implemented in full compliance with a number of subsequent laws that direct how BLM accomplishes statutory direction. For further discussion of legal authorities which direct the proposed action alternatives see EA Section 1.7.

To meet objectives in the Salem District RMP

The RMP was developed under the requirements of FLPMA, while in compliance with other laws and statues including the O&C Act. The proposed Hole in the Road project has been designed to meet RMP objectives.

The RMP responds to both the need for a healthy forest ecosystem and the need for a sustainable supply of timber. "The Oregon and California Lands Act requires the Secretary of the Interior to manage Oregon and California lands for permanent forest production; however, such management must also be in accord with sustained-yield principles. Further, that Act requires that management of Oregon and California lands protect watersheds …" (*RMP pp. 1-2*).

The RMP is built around a strategy where "[l]ands administered by the BLM will be managed to maintain healthy, functioning ecosystems from which a sustainable production of natural resources can be provided. Ecosystem management emphasizes the complete ecosystem instead of individual components and looks at sustainable systems and products that people want and need.

"The building blocks for this strategy are comprised of several major land use allocations (LUA)… These land use allocations have differing management direction and are located and configured in the landscape to support overall ecosystem function and to meet the vision for management of federal lands in western Oregon…Each land use allocation will be managed according to specific objectives and management actions/direction." (*RMP pp. 4-5*). The Hole in the Road project area is located in the Matrix and Riparian Reserve (RR) LUA.

In the RMP, the Matrix LUA is divided into General Forest Management Areas (GFMA) and Connectivity/Diversity Blocks (CONN). The Hole in the Road project is located on GFMA lands within the Matrix LUA. Approximately 62 acres are proposed for thinning in the Suitable Wild and Scenic River (WSR) Area on GFMA lands within the Matrix LUA, and 12 acres are proposed for thinning in the RR LUA (*See maps, Figure 2*).

Below are the general RMP Objectives for the Matrix LUA and specific to GFMA lands, Suitable WSR lands, and the RR LUA which indicate the need for action:

Matrix: Lands within the Matrix LUA are designated to (*RMP p. 20*):

- Produce a sustainable supply of timber to provide jobs and contribute to community stability;
- Provide connectivity between Late-Successional Reserves;
- Provide habitat for a variety of organisms associated with both late-successional and younger forests;
- Provide for important ecological functions such as dispersal of organisms, carryover of some species from one stand to the next, and maintenance of ecologically valuable structural components such as down logs, snags and large trees; and
- Provide early successional habitat.

Wild and Scenic River: RMP management objectives and direction for lands within the Matrix LUA that are currently determined in the RMP as "eligible or suitable" for wild and scenic river designation (*See EA Section 1.3.1.1)* includes:

- Manage the natural integrity of river-related values to maintain or enhance the highest tentative classification determined for rivers found eligible or studied for suitability;
- Protect segments free-flowing values and identified outstanding remarkable values;
- Moderately restrict development of leasable and salable minerals; and
- Exclude timber harvest in RR within the WSR corridor.

Riparian Reserve: Lands within the RR[3] LUA are designated to (*RMP pp. 9-10*):

- Restore and maintain the ecological health of watersheds and aquatic ecosystems (*RMP pp. 5-6*), Aquatic Conservation Strategy (ACS)); and
- Provide habitat for terrestrial species (*RMP p. 9*).

1.3.1.1 Need for Thinning

In the Cascades FO and the Hole in the Road project area
Matrix Thinning

The proposed stands for thinning treatment in the Hole in the Road area are currently overstocked and/or at a density where the stands are exhibiting decreasing growth. Thinning the stands in the Matrix LUA proposed in this EA would contribute to higher timber productivity and value in the long term, as well as increased stand complexity benefitting fish and wildlife species.

How these principles apply to the Hole in the Road project is discussed in Chapter 3 of this EA.

Thinning in the Suitable Wild and Scenic River (WSR) boundaries

The RMP p. 38 states: "The corridor width for rivers found eligible or studied for suitability is generally defined as one-quarter mile on either side of the river (approximately one-half mile wide corridor). Technically these are not land use allocations at this time."

The BLM has identified within the Hole in the Road project area approximately 62 acres of previously harvested 40-45 year old conifer stands within the one-half mile corridor of a suitable WSR segment along the Molalla River that could benefit from thinning by increasing stand complexity, and enhancing the scenic character of the stand in the long-term (*See EA 3.3.1., 3.3.8*).

A 13.2 mile segment, referred to as Molalla River Segment B, of the main stem Molalla River was found 'suitable' for inclusion into the Wild and Scenic Rivers System (*See EA 3.3.1., 3.3.8.)*. A 'suitable' finding is made only after a detailed assessment by the BLM and constitutes a recommendation that the river be designated under the 1968 Wild and Scenic Rivers Act. The resource assessment for this segment was completed in 1993 and contained an analysis of the river's suitability for WSR designation (it is available for review at the Salem District Office) (*FEIS Appendix 2-87-90*). This segment has yet to be officially designated through the U.S. Congress.

Molalla River Segment B has been given a preliminary classification of "Recreational". This indicates the river is readily accessible by road, has some shoreline development and may have undergone some impoundment or diversion. Outstandingly remarkable values were identified as Scenery, Recreation and Geology.

BLM policy provides the option for a range of vegetation management and timber harvest practices within the suitable "recreational" designation provided that these practices are designed

[3] The Riparian Reserve (RR) Land Use Allocation (LUA) is a defined management allocation intended to protect riparian ecosystems; provide for the aquatic, hydrologic and terrestrial functions embodied in the Aquatic Conservation Strategy Objectives (ACSO); and to provide connectivity between upland habitat blocks. Riparian Reserves include both riparian area and upland area. (RMP pp. 2, 5-6, 7-8, 9-15)

to protect, restore, or enhance the river environment, including long-term scenic character (*BLM Manual 6400 Ch. 7 G-2*). Thinning the 62 acres and any connected actions within this designation and the Matrix LUA, as proposed in this EA, would contribute to meeting the objectives of Matrix lands as well as being consistent with RMP direction for Suitable WSRs (*RMP p. 38*).

Riparian Reserve Thinning

The Northwest Forest Plan (NWFP) (*p. C-32*) and the RMP (*p. 11*) direct the BLM to apply silvicultural practices in the RR to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy (ACS) objectives. The RMP (*p. D-6*) states that merchantable logs may be removed "where such action would not be detrimental to the purposes for which the Riparian Reserves were established". EA Section 3.3.11 describes the project's compliance with the ACS, including the nine ACS objectives. The NWFP (*p. B-31*) states that "active silvicultural programs will be necessary to restore large conifers in Riparian Reserves".

The BLM has also identified the need to introduce habitat variation and complexity in RR and to develop some habitat characteristics associated with structurally complex forests faster than they would be expected to develop in unmanaged stands. Desired characteristics include large diameter green trees, large diameter dead trees (both standing snags and down coarse woody debris), full crowns with large limbs, and understory diversity and complexity. Thinning stands identified in this project within the RR would meet the above needs under the NWFP and the RMP.

The following photos show some of the areas proposed for thinning in the Hole in the Road project in both GFMA and RR LUA's:

Figure 7: Unit 16A; Stand Age approximately 45 years. Photo taken from South Molalla Road.

Figure 8: Unit 27B proposed for thinning. Stand age approximately 116 years.

Figure 9: Unit 21B, looking west along existing road 7-3E-21. Stand age approximately 43 years

Figure 10: Left: Unit 22A; Stand age approximately 122 years

1.4 Objectives of the Project

The Hole in the Road project has been designed under the Salem District Record of Decision (ROD) and RMP and related documents which direct and provide the legal framework for management of BLM lands within the Salem District (*EA Section 1.7.1*).

1.4.1 Timber Harvest and Connected Actions

In this EA we describe specific objectives regarding the pertinent LUAs for the Hole in the Road project. Each resource is analyzed separately as a way to organize information, but the specific objectives and resources are all interrelated and each contributes collectively and cumulatively to meeting overall RMP objectives and management strategy. They work together and must be considered together to accurately reflect the place of this project in the concept of ecosystem management (*RMP p. 7*) and fulfill the objectives of the O&C Act and FLPMA.

The BLM proposes thinning in these forests stands to implement the resource management objectives described in the RMP, the NWFP, the O&C Act and FLPMA. The RMP, NWFP and related documents direct and provide the legal framework for management of BLM lands within the Northwest Oregon District (*EA Section 1.7.1*).

Objectives specific to the Matrix and RR lands defined by the Salem District RMP include:

Objectives Specific to the Matrix LUA (RMP pp. 20-21, 25-26, 46-48, D3-5):

Management actions and direction of Matrix lands include the following:

1. Manage developing timber stands via thinning on available Matrix lands, providing an output of merchantable timber and maintaining forest health and productivity (*RMP p. 20, D-4*):
    - Achieve a balance between wood volume production, quality of wood, and timber value at harvest;
    - Increase the proportion of merchantable volume in the stand;
    - Produce larger, more valuable logs;

- Harvest small trees as commercial wood products instead of letting them decline in vigor and die as the stand develops[4];
- Maintain good crown ratios and stable, wind-firm trees (*RMP p. D-2*) by applying silvicultural treatments to manage density with a commercial thinning;
- Produce a sustainable source of forest commodities (primarily timber) from the Matrix LUA to provide jobs and contribute to community stability (*RMP pp. 1, 20, 46-48*) by developing timber sales that can be successfully offered to the market place. Select logging systems based on the suitability and economic efficiency of each system to successfully implement the silvicultural prescription, protect soil productivity and water quality, and meet other land use objectives (*RMP p. 47*); and
- Provide early successional habitat (*RMP p. 20*).

2. Manage vegetation within the Matrix LUA on lands determined as suitable for WSR designation (*See EA Section 1.3.1.1*); provided these practices are designed to protect, restore, or enhance the river environment, including long-term scenic character (*BLM manual 6400, Ch. 7, G-2*) . RMP Management objectives/direction (*RMP p. 38*) for these segments with a preliminary WSR classification of "Recreational' includes:

    - Protect a segment's free-flowing values and identified outstanding remarkable values;
    - Moderately restrict development of leasable and salable minerals; and
    - Exclude timber harvest in the Riparian Reserves.

Objectives Specific to the Riparian Reserve (RR) LUA (RMP pp. 2, 5-6, 7-8, 9-15, D-6; NWFP pp. B-31, C-32):

3. Maintain and restore water quality standards, aquatic ecosystem functions and stream conditions embodied in ACS objectives 1-7 by designing the project to comply with Oregon Department of Environmental Quality (ODEQ) water quality standards:

    - Maintain effective shade for streams pursuant to BLM's agreement with the State of Oregon.
    - Develop, maintain and use new and existing roads to comply with ODEQ water quality standards for peak flows and sediment.

4. Maintain and restore the species composition and structural diversity of forest plant communities embodied in ACS objectives 8 and 9 by designing the project to apply silvicultural treatments in the RR to develop forest stand characteristics that maintain and/or restore the hydrology and sediment regimes of the watershed:

    - Apply silvicultural treatments in the RR to provide a diverse vegetation community in order to promote riparian and wetland functions as well as generate habitat support populations of riparian-dependent plant and animal species.
    - Apply silvicultural treatments in the RR to develop long-term structural and spatial diversity, and other elements of late-successional forest habitat.

[4] The RMP term for this is "anticipate mortality", p. D-2.

- Conduct thinning operations to develop large conifers and hardwoods for habitat and to recruit future large coarse woody debris, large snag habitat and in-stream large wood.

Objectives Common to All Land Use Allocations* (*RMP pp. 1, 11, 28, 62)

5. Implement an environmentally sound and economically viable timber sale that contributes to meeting the overall RMP Objectives described above and accomplishes objectives for each Land Use Allocation:
   - A timber sale provides the means to accomplish the specific objectives for the project and fulfills the O&C Act requirement that "…timber…shall be sold, cut and removed…for the purpose of providing a permanent source of timber supply…and contributing to the economic stability of local communities and industries…".
   - The project needs to be environmentally sound to be successfully implemented to meet the Overall RMP Objectives.
   - The project needs to be economically viable to be successfully implemented to meet the Overall RMP Objectives.
6. Protect, manage, and conserve federal listed and proposed species and their habitats to achieve their recovery in compliance with the Endangered Species Act (ESA) and Bureau Special Status species policies (*RMP p. 28*):
   - Maintain and develop habitat and forage for wildlife species in addition to Special Status species (IDT defined objective).
7. Maintain and develop a safe, efficient and environmentally sound road system (*RMP p. 62*) and reduce environmental effects associated with identified existing roads within the project area (*RMP p. 11*) by:
   - Providing appropriate access for timber harvest, silvicultural practices, and fire protection needed to meet these objectives; and
   - Perform road maintenance to prevent road deterioration or failure and to prevent road generated sedimentation that exceeds ODEQ standards.

Overall RMP Objectives (RMP p. 1)

8. Contribute to a healthy forest ecosystem with habitat that will support populations of native species and provide protection for riparian areas[5] and waters.

[5] "Riparian area", as used in this EA, refers to the aquatic habitat and the terrestrial zone where biotic and hydrologic elements interact with and affect each other directly. It is basically the area where plants grow rooted in the water table of streams, springs, wet meadows, etc. Related terms include aquatic zone/habitat, riparian zone/habitat and riparian buffer zone. These related terms are sometimes used in other documents as synonyms, and sometimes to indicate specific parts or functions of the overall riparian area, especially the terrestrial part of the riparian area. (RMP/FEIS 1994, Chp. 6 p. 12; Helms (Editor), 1998, *The Dictionary of Forestry*.)
Another related term used in this EA is Stream Protection Zone (SPZ) which is designated on the ground to include the riparian area and enough additional upland area to protect habitat in the riparian area and water quality. Related terms used in other documents include: stream buffer, riparian buffer, protection buffer, no-entry buffer or no-harvest buffer.

9. Contribute to providing a sustainable supply of timber and other forest products that will help maintain the stability of local and regional economies and contribute valuable resources to the national economy on a predictable and long-term basis

Timber Resources Objectives (RMP pp. 46-48)

10. Provide a sustainable supply of timber and other forest products by designing the project to:

    - Manage developing stands on available lands to promote tree survival and growth and to achieve a balance between wood volume production, quality of wood, and timber value at harvest.
    - Manage timber stands to reduce the risk of loss from fires, animals, insects and diseases.

The overall objectives defined by the O&C Act and FLPMA include:

Overall O&C Act Objectives (43 U.S.C. §1181a)

11. Manage O&C Lands classified as timberlands for permanent forest production and sell, cut and remove timber in conformity with the principle of sustained yield while:

    - Providing a permanent source of timber supply;
    - Protecting watersheds;
    - Regulating stream flow;
    - Contributing to the economic stability of local communities and industries; and
    - Providing recreational facilities.

Overall FLPMA Objectives (43 U.S.C. §1701 et seq)

12. Manage PD lands for the purpose of "Multiple use" which includes but is not limited to: recreation, range, timber, minerals, watershed, wildlife and fish, and natural scenic, scientific and historical values (*FLPMA Section 103*).
    Any land use plan (RMP) shall observe the principles of multiple use (*Sec 202*).

1.5 Decisions to be made

The following decisions will be made through this analysis:

To determine at what level, where, and how to thin trees on BLM-administered lands to meet Matrix and RR LUA objectives and timber resources objectives within the project area (*EA Section 1.4*).

To determine at what level, where and how to meet ACS objectives within RR in the project area.

To determine at what level, where, and how to implement the connected actions.

1.6 Decision Factors

In choosing the alternative that best meets the purpose and need, the Cascades FO Field Manager will consider the extent to which each project and each associated alternative would:

1. Provide timber resources to support local communities and industries, and to provide revenue to the government and the O&C Counties.
2. Provide for a sustainable supply of timber and other forest products on a predictable and long term basis.
3. Provide the option for timber harvest practices within the suitable Wild and Scenic Corridor that are designed to enhance the forest environment, including long-term scenic character, while ensuring protection of the river's free-flowing values.
4. Contribute to a healthy forest ecosystem with habitat that will support populations of native plant and animal species.
5. Maintain water quality, hydrologic processes, and aquatic/riparian habitat that will support populations of native aquatic and riparian plant and animal species.
6. Reduce erosion and subsequent sedimentation from roads, while providing safe, cost-effective access for logging operations, fuels management, reforestation, stand maintenance, fire suppression and public use of the land.

1.7 Conformance with Land Use Plan, Statutes, Regulations, and other Plans

The BLM has designed these projects to comply with the O&C Act and other relevant statutes and authorities as well as the Salem District ROD and RMP, May 1995 and related documents, which direct and provide the legal framework for management of BLM lands within the Salem District.

In summary, the project conforms to the:

1. *O&C Act, 1937:* The statutory requirements of the O&C Act (*43 U.S.C. §1181a et seq*.), which governs BLM-administered O&C lands in western Oregon, are described above in EA Section 1.3.1. The proposed project is designed to contribute to the objectives of the O&C Act as described in EA Section 1.4.
2. *The Wild and Scenic Rivers Act of 1968*: Declares the selection of certain rivers that possess "outstanding remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural or other similar values," that shall be preserved in free-flowing conditions. The proposed thinning in the Suitable WSR corridor is designed to meet the objectives of the WSR Act by maintaining the river's free-flowing condition and outstanding remarkable values.
3. *Salem District ROD and RMP*, May 1995: The RMP has been reviewed and it has been determined that the proposed thinning activities conform to the land use plan terms and conditions. Implementing the RMP is the reason for doing these activities (*RMP pp.1-3*).

4. *Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl and Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl*, April 1994 (the NWFP), as reflected in the RMP.
5. *Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines*, January 2001 (2001 ROD), as incorporated into the RMP. Surveys, monitoring and project design were planned to comply with the 2001 ROD. The project utilizes the December 2003 species list. This list incorporates species changes and removals made as a result of the 2001, 2002, and 2003 Annual Species Reviews (ASR) with the exception of the red tree vole. For the red tree vole, the Ninth Circuit Court of Appeals in KSWC et al. v. Boody et al., 468 F3d 549 (9th Cir. 2006) vacated the category change and removal of the red tree vole in the mesic zone, and returned the red tree vole to its status as defined in the 2001 ROD Standards and Guidelines, which makes the species Category C throughout its range.

Northwestern and Coastal Oregon Resource Management Plan

The BLM signed a Record of Decision approving the Northwestern and Coastal Oregon Resource Management Plan (2016 ROD/RMP) on August 5, 2016.

Revision of an RMP necessarily involves a transition from the application of the old RMP to the application of the new RMP. The planning and analysis of future projects such as timber sales requires several years of preparation before the BLM can design a site-specific project and reach a decision. Allowing for a transition from the old RMP to the new RMP avoids disrupting the management of BLM-administered lands and allows the BLM to utilize work already begun on the planning and analysis of projects.

The 2016 ROD/RMP (*p. 10*) allows the BLM to implement projects consistent with the management direction of either the 1995 RMP or the approved RMP, at the discretion of the decision maker, if—

- The BLM had not signed a project-specific decision prior to the effective date of the ROD;
- The BLM began preparation of NEPA documentation prior to the effective date of the ROD; and
- The BLM signs a project-specific decision on the project within two years of the effective date of the ROD.

The Cascades FO began preparation of NEPA documentation prior to the effective date of the 2016 ROD/RMP, as the FO initiated planning and NEPA documentation for this project on October 16, 2015. This project was designed to conform to and be consistent with the Salem District's 1995 Record of Decision and Resource Management Plan (1995 ROD/RMP).

This project meets the criteria described in the 2016 ROD/RMP that allows the BLM to implement projects that conform and are consistent with the 1995 ROD/RMP, with the exception of five categories of prohibited carry-over actions (*2016 ROD, p. 10*). The Hole in the Road project does not include any actions that are excepted and therefore precluded from the 2-year transition period under the 2016 ROD/RMP.

1. Regeneration harvest (construction of roads or landings does not constitute regeneration harvest) within the Late-Successional Reserve allocated by this ROD that is inconsistent with the management direction for the Late-Successional Reserve contained within the approved RMP.

   The Hole in the Road Project does not proposed any regeneration harvest on any land use allocation. Commercial thinning is the only harvest method proposed for the units identified for this project.

2. Issuance of right-of-way grants within the Late-Successional Reserve allocated by this ROD that are inconsistent with the management direction for the Late-Successional Reserve contained within the approved RMP.

   No right-of-way grants are proposed to be issued within the Late-Successional Reserve LUA, thus there are no inconsistencies between the management direction for the 1995 ROD/RMP and the 2016 ROD/RMP.

3. Commercial thinning within the inner zone of the Riparian Reserve allocated by this ROD that is inconsistent with the management direction for the Riparian Reserve contained within the approved RMP.

   The proposed units identified in the Hole in the Road project were designed to exclude commercial thinning within the inner zone of the Riparian Reserve. As such, there are no inconsistencies between the management direction for the Riparian Reserve under the 1995 RMP/ROD and the 2016 RMP/ROD.

4. Projects within the District-Designated Reserve – Lands Managed for their Wilderness Characteristics allocated by this ROD that are inconsistent with the management direction for the District-Designated Reserve – Lands Managed for their Wilderness Characteristics contained within the approved RMP.

   The Hole in the Road project is not proposed within a District-Designated Reserve – Lands Managed for their Wilderness Characteristics allocated by the 1995 RMP/ROD or the 2016 RMP/ROD, so there are no inconsistencies between the management directions for the two RMPs/RODs.

5. Timber harvest that would cause the incidental take of northern spotted owl territorial pairs or resident singles and does not have a signed Biological Opinion and Incidental Take Statement that predates the effective date of the Biological Opinion for the approved RMP.

   The US Fish and Wildlife Service (USFWS) was consulted with on the Hole in the Road project (*EA Section 5.1.1*). The Biological Assessment of Not Likely to Adversely Affect was submitted in June 2015 and concluded that the Hole in the Road proposal may affect and is not likely to adversely affect the northern spotted owls. (*See EA Section 5.1.1 for* *additional information on USFWS consultation*). The proposed project would not cause the incidental take of northern spotted owls because the project will maintain suitable and dispersal habitat with in the provincial home range of known sites and impose a seasonal restriction on operations during the critical nesting period.

The Interdisciplinary Team (IDT) incorporated information from the Molalla Watershed Analysis (1999) into the development of the proposed thinning activities and connected actions and into the description of the affected environment and environmental effects (*see EA Chapter 3*) and is hereby incorporated by reference.

The above documents are available for review in the Northwest Oregon District Office. Additional information about the proposed activities is available in the Hole in the Road EA Administrative Record, also available for review at the Northwest Oregon District Office.

1.7.1 Other Relevant Statutes/Authorities

This section is a summary of the other relevant statutes/authorities that apply to this project. The BLM designed the Hole in the Road project to conform to these additional statutes and authorities.

Migratory Bird Treaty Act, 1918 - Protects migratory birds (*16 U.S.C. 703*).
National Environmental Policy Act (NEPA), 1969 – Requires the preparation of EAs or EISs on federal actions. These documents describe the environmental effects of these actions and determine whether the actions have a significant effect on the human environment.
Endangered Species Act (ESA), 1973 – Directs Federal agencies to ensure their actions do not jeopardize threatened and endangered species.
Federal Land Policy and Management Act (FLPMA), 1976 – The Federal Land Policy and Management Act of 1976 (*FLPMA, 43 U.S.C. §1701 et seq.)* requires that public lands be managed for multiple uses and establishes a planning process. FLPMA does not require that every parcel be managed for every value and timber is included in these uses. FLPMA further specifically provides that if there is any conflict between its provisions and the O&C Act related to management of timber resources, the O&C Act prevails.
Archaeological Resources Protection Act (ARPA), 1979 – Protects archeological resources and sites on federally-administered lands and imposes criminal and civil penalties for removing archaeological items from federal lands without a permit.
Clean Water Act (CWA), 1987 – Establishes objectives to restore and maintain the chemical, physical, and biological integrity of the nation's water.
Clean Air Act (CAA), 1990 – Provides the principal framework for national, state, and local efforts to protect air quality.
Executive Orders 11644 (1972) and 11989 (1997) - Direct the BLM to control off-road vehicle use so as to protect public lands.
Healthy Forests Initiative (HFI), 2002 - Focuses on reducing the risk of catastrophic fire by thinning dense undergrowth and brush in priority locations that are identified on a collaborative basis with selected Federal, state, tribal, and local officials and communities. The initiative also provides for more timely responses to disease and insect infestations.
Executive Order 13443 (2008) - Facilitation of Hunting Heritage and Wildlife Conservation: directs the BLM and other Federal Agencies to "facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitat".

BLM Manual 6400 – Wild and Scenic Rivers – Policy and Program Direction for Identification, Evaluation, Planning and Management (2012) – Provides BLM management and staff with polices and program guidance for management of lands within the wild and scenic designations, suitable wild and scenic river segments, as well as guidance for conducting wild and scenic river studies, EA's, and legislative reporting.

Additional authorities and management direction are described in EA Section 3.3.10 Table 22. Additional details pertaining to statutes, authorities and management direction are presented in the discussions of specific resources throughout this EA.

1.8 Scoping and Identification of Relevant Issues

1.8.1 Scoping

The IDT of BLM resource specialists conducted internal scoping through the project planning process, which includes record searches, on-site field examinations of the project area by IDT members, professional observation and judgment, literature review and IDT discussion. In the project planning process the IDT considered elements of the environment that are particular to this project as well as elements of the environment that are common to all similar timber management projects.

The BLM conducted external scoping for this project by means of a scoping letter sent out to approximately 73 federal, state and municipal government agencies, nearby landowners, tribal authorities, and interested parties on the Cascades Field Office mailing list on October 16th, 2015. The BLM received 4 comment letters/emails during the scoping period.

The scoping comment letters and emails are available for review at the BLM Northwest Oregon District Office, 1717 Fabry Rd. SE, Salem, Oregon. A detailed listing of scoping comments and BLM responses was prepared as a separate report and is available for review with the scoping comment letters and emails. The IDT considered scoping comments in developing the list of relevant issues to be analyzed in this EA.

1.8.2 Relevant Issues

The IDT identified relevant issues based on applicable law, management direction contained in the RMP, and information gathered during the scoping and project planning process. Issues are considered to be relevant if they determine the appropriate range of alternatives to analyze, determine whether the proposed project should be modified, and determine the significance of the project's effects on elements of the environment. Analysis of these issues provides a basis for comparing the environmental effects of alternatives, including the No Action Alternative, and aids in the decision-making process.

The IDT considered the following issues as it reviewed scoping comments, developed and refined the project alternatives, identified project design features (PDF), and analyzed the environmental effects.

Issue 1: The Effects of Management Actions on Vegetation and Forest Stand Characteristics

How the proposed management actions would change vegetation and forest stand characteristics, both short term and long term, and how these changes would affect attainment of objectives for each LUA;

How the proposed management actions would affect structural complexity, including overstory, understory, dead wood and spatial complexity; and

How the proposed management actions would affect identified populations of species with special status (T/E, Survey and Manage, sensitive, etc.) or invasive plan species.

The elements of this issue are addressed in the following sections of this EA: 3.3.1., 3.3.3, 3.3.5;

Issue 2: The Effects of Management Actions on Water Quality and Hydrology– Including Achieving Related Aquatic Conservation Strategy (ACS) Objectives

How the proposed management actions would affect water quality including sediment from roads, sediment from forest management activities, sediment from landslides, sediment caused by unauthorized OHV use, and water temperature;

How the proposed management actions would affect stream channels; and

How the proposed management actions would affect water quantity (peak flows).

The elements of this issue are addressed in the following sections of this EA: 3.3.2, 3.3.3, 3.3.4;

Issue 3: The Effects of Management Actions on Fisheries, and Aquatic and Riparian Habitats - Including Achieving Related Aquatic Conservation Strategy (ACS) Objectives

How the proposed management actions would affect ESA listed fish, resident fish, and aquatic habitat;

How the proposed management actions would comply with ACS Objectives in the RR.

How the proposed management actions would affect sediment from reaching the streams, especially during hauling, and affect fish populations; and

How the proposed management actions would affect large wood recruitment.

The elements of this issue are addressed in the following sections of this EA: 3.3.1., 3.3.2., 3.3.3., 3.3.5;

Issue 4: The Effects of Management Actions on Soils and Site Productivity

How the proposed management actions would affect soil compaction, disturbance and erosion and the effects on site productivity.

The elements of this issue are addressed in the following sections of this EA: 3.3.1., 3.3.4;

Issue 5: The Effects of Road Management Actions on Resources

How the proposed road management (operations construction, improvement, renovation, maintenance, and culvert replacement/installation) would affect: Site productivity, water quality, fisheries and aquatic habitat, wildlife habitat, weed management, fire management, outstanding and remarkable values in the Suitable WSR corridor, and public safety and use; and

How the proposed road closures, stabilization and decommissioning would affect: Site productivity, water quality, fisheries and aquatic habitat, wildlife habitat, weed management, fire management, outstanding and remarkable values in the Suitable WSR corridor, and public safety and use.

The elements of this issue are addressed in the following sections of this EA: 3.3.1., 3.3.2., 3.3.3., 3.3.4., 3.3.5., 3.3.6., 3.3.8;

Issue 6: The Effects of Management Actions on Wildlife Populations and Habitats

How the proposed management actions would affect protection of terrestrial animals with special status designation (T/E, Survey and Manage, sensitive, etc.) and their habitats, including suitable habitat or critical habitat for the northern spotted owl;

How the proposed management actions would affect protecting and providing habitat and forage for terrestrial animals, including big game, that do not have special status designation;

How the proposed management actions would affect "legacy features" including snags, coarse woody debris (CWD), and remnant large tree habitats; and

How the proposed management actions would affect or enhance early successional habitat.

The elements of this issue are addressed in the following sections of this EA: 3.3.1., 3.3.5;

Issue 7: The Effects of Management Actions on Fire Hazard, Fire Suppression Capabilities, and Air Quality

How the proposed management actions would affect potential wildfire ignition, intensity and resistance to control; and

How the proposed fuel reduction would affect air quality.

The elements of this issue are addressed in the following sections of this EA: 3.3.6;

Issue 8: The Effects of Management Actions on Public Safety, and Public Use of the Areas

How the proposed management actions would affect public safety, visual resources, recreation and public access within the project area, including the suitable WSR corridor; and

How the proposed management actions would affect unauthorized OHV use in the project area, including the suitable WSR corridor.

The elements of this issue are addressed in the following sections of this EA: 3.3 8;

Issue 9: The Effects of Management Actions on Sustainable Supplies of Timber to Provide Jobs and Contribute to Community Stability

How the proposed management actions would affect sustainable timber supplies in the short and long term with the distribution of age class changes on the landscape; and

How the proposed management action PDFs would affect the economic viability of the project.

The elements of this issue are addressed in the following sections of this EA: 3.3.1;

Issue 10: The Effects of Management Actions on Carbon Emissions and Carbon Storage

How proposed management actions would affect carbon emissions and carbon storage on a local, regional and global scale.

The elements of this issue are addressed in EA 3.3.7

Chapter 2: Proposed Action and Alternatives

2.1 Alternative Development

Pursuant to Section 102 (2) (E) of the National Environmental Policy Act (NEPA) of 1969, as amended, Federal agencies shall "…study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources."

After development of the Proposed Action and Project Design Features (PDFs) and review of the submitted internal and external scoping comments, the BLM IDT determined that there were no unresolved conflicts concerning alternative uses of available resources. Although several alternatives were originally considered from comments received, many were determined not needed for analysis in detail (*EA Section 2.3.3.)*. Therefore, this EA will only analyze the effects of the current Proposed Action and No Action alternative.

2.2 Planning and Implementation Process

BLM planned the Hole in the Road project using an IDT process. An IDT composed of experienced professional BLM resource specialists developed and analyzed the Proposed Action, connected actions, PDFs and mitigation measures. The IDT requested comments from the public and other interested parties and agencies during this process through scoping (*EA Section 1.8.1*) and considered these comments when developing and analyzing the alternatives (*EA Section 2.3)*. The IDT analyzed the Proposed Action in specialist reports which are incorporated into this EA by reference. The IDT lead developed this EA from those reports.

The IDT and the Decision Maker will evaluate and incorporate information from the scoping process into the final project design, or selection of the No Action alternative, which will be described in the Final Decision Record and Rationale (DR), to be published later. The Proposed Action, including the PDFs from the best management practices (BMP) developed on a site-specific basis for the projects analyzed in this EA (*RMP Appendix C*, *RMP/FEIS Appendix G*).

For any timber sale the BLM would determine the final boundaries of the timber sale units and designate which trees would be retained and which trees would be cut and removed. BLM would develop a timber sale contract to implement the actions selected from the Proposed Action, connected actions and the PDFs analyzed in this EA. The timber sale contract would require the operator to accomplish the preventive and restorative practices analyzed in this EA. In all timber sale contracts, BLM enforces compliance through normal contract administration procedures where performance is monitored by authorized BLM personnel. The Contracting Officer enforces compliance with the contract and would suspend operations if the operator fails to perform the required preventive and restorative practices. BLM timber sale contracts require bonding in an amount sufficient for BLM to complete restoration work if the operator fails to perform the contract requirements.

2.3 Alternatives Developed

The Proposed Action was developed by BLM to provide for sustained yield of timber products both immediately (within approximately five years) and for several decades. Stand conditions, the expected effects of the Proposed Action, and the expected effects of selecting the No Action Alternative will be described in detail in Chapter 3 of this EA.

2.3.1 Proposed Action

Timber Harvest

In all LUAs:

In all areas proposed for thinning treatment, the prescription proposes to:

- Retain large (over 15 inches diameter and over 15 feet tall) snags in the harvest area and protect them from damage as much as feasible during timber harvest activities;
- Retain large (over 20 inches diameter and 20 feet long) down logs in the harvest area and protect them from damage as much as feasible during timber harvest activities;
- Retain hardwoods species over 7 inches in diameter; these trees do not count toward the leave tree retention requirement. Some hardwoods may be cut and left on site to facilitate logging along roadsides or other areas;
- Retain large remnant trees and generally protect them from logging damage; Individually designate such trees that are found inside unit boundaries for retention; and
- Retain trees which have been identified as part of Salem's tree improvement program.

In the Matrix (GFMA):

The commercial thinning would implement a "*thin from below*" prescription that generally designates trees to be retained based on a combination of tree size, crown position[6], spacing, species mix, vigor and potential future log quality (*Silvicultural Prescription*). Specifically, the prescription proposes to:

- Reduce trees per acre (TPA) densities from ~100-285 currently down to 54-94 TPA and relative densities (RD) of ~ 44-80 down to ~ 31-40 RD post treatment (*EA Table 12*);
- Retain trees that are larger than the average diameter for the stand, emphasizing the largest, healthiest and best formed dominant and co-dominant trees;
- Maintain a mix of conifer tree species, favoring western red cedar where present;
- Favor retaining Douglas-fir over western hemlock except where Douglas-fir is not present;
- Maintain an average canopy closure of approximately 60 percent over the unit area;
- In unit 15A retain the trees that are larger than the average diameter for the stand, emphasizing conifers 38 inches or larger in diameter; and
- Implement 1- 2 low density thinning (LDT) openings of up to 2.5 acres each retaining 18-20 trees per acre:
    - Openings would be located on gentle slopes, away from open roads, outside RR and VRM II areas.

---

[6] Crown position indicates the relative position of the live crown (branches) of a tree relative to the crowns of other trees in the forest canopy. Dominant and co-dominant trees are generally the tallest trees, most exposed to sunlight – also called "overstory trees" or "the overstory". Intermediate tree crowns reach into the canopy enough to get some light from above but not from the sides and are generally small and crowded. Suppressed trees are shaded by all of the other crowns and have low growth rates and low vigor as a result of competition with overtopping trees.

- Treat fuels to provide access for big game, seed-beds for grasses and forbs, and encourage growth of deciduous shrubs and understory vegetation on the ground cover. Retain up to approximately 10 percent of the slash piles.
- Seed or plant with native vegetation if needed based on future field surveys by BLM specialists.

Along with the "*thin from below*" prescription features listed above, there are additional design features that would be implemented in unit 16A along the South Molalla road in order to reduce visual impacts in the short-term (immediately following logging operations) and long- term (5 years post-harvest). These include, but are not limited to:

Before and during implementation:

- Only mark trees with blue paint within the unit boundary to be removed; do not paint leave trees within the thinning unit.
- Where feasible, cut stumps of harvest trees close to the ground ("flush-cut" – within 6 inches) within 25 to 50 feet of the South Molalla road.

After operations and fuels treatment are complete:

- Remove any boundary tags and flagging that may still be visible after operations; and
- Cover any orange paint on marked boundary trees visible from the road with black paint.

In the Riparian Reserve (RR) LUA:

BLM proposes to thin approximately 12 acres of 42-116 year old forest stands as one part of a management prescription to increase forest stand structural diversity within the RR, outside the suitable WSR corridor. Specifically, the prescription proposes to:

- Thin up to 1 percent of the RR acres in the project vicinity;
- Reduce TPA densities from ~100-285 currently down to 54-94 TPA and RD of ~ 44-80 down to ~ 31-40 RD post treatment (*EA Table 12*);
- Maintain a mix of tree species, retaining all western red-cedar and hardwoods over 7 inches DBH where present; and
- Maintain an average canopy closure of approximately 60 percent in the RR unit area.
- No treatment of approximately 99 percent of the RR in the project vicinity, allowing these stands to develop naturally and provide a different element of complex stand structure at the landscape level. These untreated areas in the RR include:
    - Stream protection zones (SPZ) – strips of untreated forest adjacent to streams;
    - Potentially unstable slopes;
    - Areas where stand structure already provides, or is developing, desired levels of structural complexity without silvicultural treatment;

- Areas where logging is not feasible; and
- Wetlands and areas with high water tables ("wet areas")

Table 1. **Proposed Action: Harvest Acres by LUA, Logging Systems and Prescription**

T7S, R3E Section, Units	Stand Age*	Total Acres	General Forest Management Area (GFMA)			Riparian Reserve (RR)		
			Ground based	**Skyline**	**Total GFMA**	**Ground based**	**Skyline**	**Total RR**
15A	137	18	3	15	18	0	0	0
15B	119	17	11	6	17	0	0	0
16A	45	20	20	0	20	0	0	0
16B	43	80	30	45	75	3	2	5
21A	43	35	17	16	33	1	1	2
21B	42	28	19	5	24	0	4	4
22A	122	45	28	17	45	0	0	0
22B	133	25	25	0	25	0	0	0
22C	129	15	15	0	15	0	0	0
22D	104	21	16	5	21	0	0	0
27B	116	50	28	21	49	1	0	1
Total thinning acres		**354**	**212**	**130**	**342**	**5**	**7**	**12**
R-o-W acres		6	6	0	6	0	0	0
Total Acres		**360**	**218**	**130**	**348**	**5**	**7**	**12**

*total stand age as of September, 2015

Logging Systems

BLM developed a basic logging systems plan (*see Logging Report and Table 1 of this EA*) designed to comply with the RMP and be technically and economically feasible, environmentally sound, use equipment and logging systems known to be commonly available in the area, and comply with BLM timber sale contract provisions and administration. There are many combinations of specific equipment and operating methods which could be used and the final plan implemented may be different than the plan analyzed in this EA.

Where there are recognized options, such as an area which may be logged with either ground based or skyline systems, the EA analyzes the logging system with the highest potential impact. BLM would analyze other logging systems, subsystems and methods which may be proposed by operators to ensure that the specific impacts and effects are within the scope of the impacts and effects analyzed in this EA. When BLM determines that the impacts and effects are within the scope analyzed, BLM would document the determination and approve the proposed logging plan.

Examples of this principle include:

Skyline yarding generally has less impact than ground based logging, so skyline yarding an area analyzed for ground based logging would generally be approved.
Not building a road generally has less impact than building it, so a logging plan that avoids building a road would generally be approved.
A rocked road surface is generally more stable than a natural surface road, so rocking a road would generally be approved when it is not analyzed for decommissioning after use.
Hand falling generally has less impact than mechanized falling with a processor, so hand falling would generally be approved.
Relatively few but larger landings or relatively many but smaller landings than anticipated would generally be approved because the total area impacted would be similar.

Some proposed logging plans may have some elements which would reduce impacts while other elements would increase impacts. For example, a proposal to extend or add a road spur (increased impacts) to skyline yard an area analyzed for ground based logging (decreased impacts); or a proposal to lengthen one road and shorten another; or to modify a road location would be evaluated by BLM to determine if the impacts and effects would be within those analyzed. If so, the change would generally be approved. Minor adjustments to boundaries and acreages between logging systems in a unit would not be documented because they would not have any potential to change the analysis or effects.

Connected Actions

Table 2. **Road Work, and Culverts on BLM lands**

Action **Roads**	**Associated Unit**	**Miles**	**Description/Notes**	**After the project**
New road construction, may rock	**15A,15B, 16B, 21A, 21B, 22A & 22B**	**1.44**	Road that may include rocking. Includes clearing vegetation in the road right-of-way using ground based logging equipment. Clearing would average less than 30 feet wide.	**Stabilize and Close or Decommission**
Maintain Existing Paved Road	**All**	**11.11**	Existing useable road, for hauling. Paved road.	**Road will remain open**
Maintain Existing Rocked Road	**All**	**20.93**	Existing useable road, including haul, maintenance operations and added rock. May include blading and shaping the road, cleaning ditches and culverts, replace/install culverts, and cutting roadside brush.	**Road will remain open**

Action	Associated Unit	Miles	Description/Notes	After the project
Renovate Existing Road	**16A, 16B, 15B, 21A, 21B, 22D, 27B**	**3.05**	Existing subgrade, not maintained to current safety standard. Road brought up to original design standard. Any vegetation in roadway to be removed, culverts added or replaced. Road segments to be stabilized and closed where appropriate after operations (see Table 3)	**Stabilize and close**
Renovate Existing Road	**16A**	**0.04**	Existing subgrade, not maintained to current safety standard. Road brought up to original design standard. Road segment to be fully decommissioned after operations.	**Decommission**
Culverts and Stream Crossings	**Associated Unit**	**Number of culverts**	**Description/Notes**	**After the Project**
Install or replace culvert, cross drain, no stream.	**15B, 21A, 22B, 22D, 27B**	**14**	Cross drain culverts. Installed during the dry season.	**Culverts would remain in place.**
Install or replace culvert, live stream crossing	**15B**	**1-2**	Live stream culverts will be installed/replaced during in-water work window.	**Culverts would remain in place**

Road work

Roads would be maintained, renovated or constructed as shown in Tables 2 to provide access for safe and efficient logging and hauling.

All newly constructed roads would have the option to be rocked at the purchaser's expense. If the purchaser chooses to not rock the new roads, they must decommission any new natural surface roads after operations as described below.

Rock Source

Pit run rock, aggregate, soil and boulders for use on project roads and berms would be obtained from commercial sources and established BLM quarries.

Decommissioning

New road construction not rocked

All newly constructed roads where no rock would be applied would be decommissioned after harvest operations and fuels treatments are complete. Decommissioning of new roads on BLM land in this project would include the following:

Earth and debris barricades would be placed at main road junctions to prevent vehicle access;

Waterbars would be constructed where appropriate along the road bed to re-establish natural drainage patterns and re-direct water flow off the main road bed and onto stable vegetated slopes;

The roads may or may not be tilled (decompacted); and

Roads would be seeded with native species to vegetate disturbed soil, or covered with logging slash and debris to provide additional stability and blocked to prevent vehicle use.

Existing spur in Unit 16A (P-16.3 in Table 4, see EA figure 3)

The existing road and landing in the far western portion of unit 16A (currently blocked) will be opened and utilized during harvest operations. When harvest operations and fuels treatment are complete this road and landing area would be fully decommissioned and rehabilitated. Decommissioning and rehabilitation for this road segment and landing would include the following:

The road and landing area would be tilled (decompacted) and planted with native vegetation;

Waterbars would be constructed where appropriate to re-establish natural drainage patterns and re-direct water flow onto stable vegetated slopes; and

Earth, debris and boulder barricades would be re-established along the main junction of the decommissioned spur and the South Molalla road to prevent vehicle access.

Stabilize and Close

New road construction rocked, and other renovated existing roads

Road subgrade would be water barred where appropriate and closed to vehicle traffic (e.g. earth, debris or boulder barricades).

Some newly constructed roads or landing areas may be tilled (decompacted) and seeded with native species, or covered with logging slash and debris.

Landings

The BLM would require the timber sale operator to construct ground based and skyline landings according to the approved logging plan (*PDFs introduction and PDF numbers 3 and 4, Table 5*). Landings would be located primarily on and adjacent to roads. Vegetation would be cleared for the landing and immediately adjacent to the landings to permit swinging and stacking logs for sorting and loading, and for piling logging slash and debris.

One to two larger landings would be located on BLM Matrix land to provide access for a skyline logging set-up for unit 27B. These landings would be located on and adjacent to existing road 7-3E-32, and along spur P 26-1 and will be up to approximately 0.5 acre each in size (*PDF numbers 5 and 6*).

Landings established for the skyline portion of 27B would be decommissioned where needed after harvest operations and site preparation are complete. Logging slash in these landings may or may not be burned after operations; decommissioning landings would include tilling (decompacting) of the landings where appropriate and/or covering the area with logging slash and debris to provide additional stability and blocked to prevent vehicle use. Decommissioned landings would be seeded and/or planted with native vegetation.

Fuels Treatments

Fuel reduction treatments would be conducted in selected areas to reduce the potential for human caused wildfire ignition, to reduce the potential for wildfire to cross property lines between BLM and private land, and to reduce both the intensity and severity of potential wildfires in the long term (compared to untreated fuels).

Fuel reduction treatments may include hand, machine, and landing pile construction; covering portions of piles with plastic sheeting; and burning piles within treatment areas, along roads, or along property lines.

Other options include slash pullback, slashing, lopping and scattering, and firewood cutting. In lieu of burning, BLM and the operator may remove slash at landing areas to be used as mulch to cover roadbeds during stabilization.

Post treatment fuels surveys would be conducted and the Stereo Photo Series for Quantifying Forest Residues in the Douglas-fir Type of the Willamette National Forest (*General Technical Report PNW-GTR-258, Ottmar, Hardy, Vihnanek May 1980*) or the Stereo Photo Series for Quantifying Forest Residues in Coastal Oregon Forests (*General Technical Report PNW-GTR-231, Ottmar, Hardy)* would be used to help identify areas with increased fuel loads.

All prescribed burning would require a project level Prescribed Fire Burn Plan that adheres to smoke management and air quality standards, meets the objectives for LUAs, and maintains or restores ecosystem processes or structure. The burn plan would comply with the Northwest Oregon (NWOR) Fire Management Plan for the Eugene District BLM, Salem District BLM, Siuslaw National Forest, and the Willamette National Forest dated May 20, 2009. All burning would be coordinated with the local Oregon Department of Forestry (ODF) office in accordance with the Oregon State Implementation Plan and Oregon Smoke Management Plan.

Table 3. **Fuels Treatments for Proposed Action (including site preparation)**

Harvest Type	Total Acres	Fuels Treatment Acres	Machine Piles[7]	Landing Piles
Commercial Thin	349	8	0	58
Low Density Areas	5	5	50	0
Road side	6	35	350	3
Totals	**360**	**48**	**400**	**61**

[7] Estimated amount of piles constructed within 35 acres of ground-based yarding areas; 50 feet into harvest units from edge of roads which are un-gated and open to public travel. Machine piles are estimated at around 10 piles per acre and landing piles occur 1 per cable landing where a landing is assumed to be 1/10th acre in area. For unit 27B, the skyline landings would be larger (approximately 0.5 acres) and landing piles would likely be larger.

Preventing Unauthorized Off-Highway Motor Vehicle (OHV) use (RMP p. 41)

BLM would block skid trails and make them impassible for OHV as part of the timber sale contract, as described under the PDFs. BLM would block closed roads and/or make them impassible for OHVs to effectively eliminate OHV use while making it feasible for fire suppression personnel to pen those roads with equipment commonly used for wildland fire initial attack response. Road and skid trail closure methods would be designed for each site to avoid causing erosion and avoid damaging retained trees (*PDFs Table 5*).

Table 4. **Road Work, Miles**

Road ID	BLM Land, road work in miles				Private/ State Land, miles	Associated Unit
	New Construction May Rock	Renovate existing road	Maintain existing road	Decommission or Stabilize and Close	Maintenance	
6-3E-6 A- I			11.11 (Paved)			All
7-3E-17.4		0.24		0.24		16A
P 16-3[8]		0.04		0.04		16A
7-3E-16.2		0.13		0.13		16A
7-3E-16 A-E part			4.16			All (-16A)
7-3E-15.1 A-B		1.11		1.11		15B
P 15-2	0.14			0.14		15B
P 15-3	0.19			0.19		15B
P 22-1	0.09			0.09		15A
P 15-1	0.12			0.12		15A
P 16-1	0.07			0.07		16B
P 16-2		0.04		0.04		16B
P 21-1	0.32			0.32		21A
7-3E-21		0.15		0.15		21B
P 21-2	0.04			0.04		21B
7-3E-22			1.58			22A, 22C, 27B
7-3E-22.3 part			0.18			22A & 22C
7-3E-23.4			0.66			22A
7-3E-22.5 part			0.07			22A
P 22-3	0.11			0.11		22A
7-3E-27.1		0.20		0.20		27B

[8] To be fully decommissioned after operations are complete.

Road ID	BLM Land, road work in miles				Private/ State Land, miles	Associated Unit
	New Construction May Rock	Renovate existing road	Maintain existing road	Decommission or Stabilize and Close	Maintenance	
7-3E-32 D part - F			0.30		0.65	27B
P 26-1	0.05			0.05		27B
7-3E-15 A-B			1.10			21A, 22B, 22D
P 22-2	0.21			0.21		22B
7-3E-22.1 A-D			1.12			21A, 22D, 27B
7-3E-21.5 A-B		0.47		0.47		21A
P 21-3	0.10			0.10		21A
7-3E-21.7		0.13		0.13		22D
7-3E-27 A-B		0.58				27B
Totals	**1.44**	**3.09**	**20.28**	**3.95**	**0.65**	

Hauling and Haul Routes

BLM has identified haul routes on BLM roads serving different portions of the project area as shown in Table 4 and on the maps in EA Section 1.2

Unit 15B will have a seasonal restriction, allowing for summer haul only along the 7-3E-15.1 road (*EA Figure 2*). One to two in-stream culverts will be replaced on the 15.1 road during the dry season (*EA Tables 2, 5, 6, EA Section 3.3.3*)

See Table 15 EA Section 3.3.3.1 for details of road numbers and distances to listed fish habitat.

Project Design Features (PDF)

This section summarizes the PDF that would be implemented in the Hole in the Road project to further reduce the project's effects on the affected resources described in EA Chapter 3.

The IDT of resource specialists developed this set of site-specific PDF to serve as the BMPs for this project. The IDT selected or created these PDF to implement management actions/direction as well as the principles of the design features and BMPs described in the RMP/FEIS (*pp. 2-35 – 2-37, 4-11 – 4-14, G-1 – G-2, S-1 – S2)* and RMP (*pp. 23-24, C-1 – C-2*). The IDT selected this set of PDF based on their combined experience, training, professional judgment, field analysis of this project area and familiarity with ongoing published research.

BLM would incorporate these PDF into the project layout, contract requirements, and contract administration to ensure that the project is implemented as analyzed in this EA and that the risk of effects to the resources are no greater than those described in EA Chapter 3. BLM would require the operator to implement each of the following PDF, unless otherwise stated.

The following PDFs would:

Protect Special Status species (Vegetation), soil productivity (Soil), water quality and quantity (Water), fisheries, listed fish and aquatic habitat (Fish), stand structure, habitat and species (Wildlife), air quality (Fire/Air), public safety, rural interface and recreation (Public), and cultural resources (Cultural);

Prevent or reduce the spread of invasive/non-native plant species populations (Invasives) and fire hazards and risks (Fire/ Air); and

Achieve the desired forest stand composition (Vegetation), Economic Efficiency (Economic), and fuel reduction (Fire/Air).

Table 5. **Project Design Features**

Project Design Features (RMP/FEIS references for key points)	**Applicable Resources / Objectives**									
	Vegetation	**Soil**	**Water**	**Fish**	**Wildlife**	**Invasives**	**Fire /Air**	**Public**	**Cultural**	**Economic**
In Unit Layout and All Logging Operations: RMP/FEIS (pp. 2-34 -- 2-37; 4-11 -- 4-13; G-1,2)										
1. Locate skid trails and skyline corridors to avoid concentrating runoff water flows that could cause rill or gully erosion with potential to displace soil more than a few feet.	♦	♦	♦	♦						
2. Lift the leading end of all logs off of the ground during yarding (one-end suspension) to prevent the blunt ends of logs from displacing soil in order to prevent creating a channel for erosion. Applies to both skidding and skyline yarding inhaul, but may not be feasible for winching and lateral yarding.	♦	♦	♦	♦						
3. Limit landing size to the minimum area needed for safe and efficient operations. Size varies with terrain, equipment size and log size and usually averages 60 feet by 80 feet (approximately 0.1 acre) located on and adjacent to roads.	♦	♦	♦		♦	♦	♦			♦
4. Limit number of landings to the minimum number needed for safe and efficient operations. Number of landings needed varies with terrain, equipment, log size and road access.	♦	♦	♦		♦	♦	♦			♦
5. 1 to 2 landings approximately 0.5 acre in size (outside the road prism) would be cleared of vegetation to access skyline logging areas in unit 27B. These landings would be decommissioned where needed after operations and fuels treatment are complete.	♦	♦	♦		♦	♦	♦			♦
6. Decommissioning of skyline landings for 27B would include: tilling (decompacting) of the landings where appropriate and/or covering the area with logging slash and debris to provide additional stability and blocked to prevent vehicle use. Decommissioned landings would be seeded and/or planted with native vegetation.	♦	♦	♦		♦	♦	♦			♦
7. Allow equipment with tracked carriages designed for forestry/logging use (such as commonly used for cut-to-length (CTL) processors, piling or shovel swing) to operate between designated skid trails when the following conditions are met: • Slopes are ≤45 percent. • The operator follows a BLM approved plan to prevent more than light soil compaction and displacement based on soil conditions at the time of operation. • Potential techniques include: single round-trip equipment travel in any place; creating a slash mat in front of the tracks prior to travel; minimal turning; dry soils; low ground pressure tracks; etc.	♦	♦	♦	♦						♦

Project Design Features (RMP/FEIS references for key points)	Applicable Resources / Objectives									
	Vegetation	Soil	Water	Fish	Wildlife	Invasives	Fire /Air	Public	Cultural	Economic
8. Generally limit landing equipment operations to the road prism or other approved portion of the landing designed and constructed for equipment operating area. Vegetation may be cleared, logs may be stacked, cables may be attached, anchors may be placed or installed, and equipment pads (i.e. yarder, processor) may be constructed outside of the equipment operation area when approved by the BLM.	♦	♦	♦		♦	♦	♦			♦
9. In thinning units, retain organic material including duff, litter and logging slash on the forest floor in average amounts not less than are present in the stand prior to management operations to provide soil stability and nutrient cycling.	♦	♦	♦	♦	♦	♦	♦			
10. Implement erosion control measures where BLM management operations have exposed or disturbed soil to prevent rill or gully erosion that would displace soil more than a short distance (several feet). Typical measures include: shaping to modify drainage (water bars, sloping, etc.); tilling; placing logging slash and debris on exposed soil; and seeding with native species.	♦	♦	♦	♦	♦	♦				
11. Prevent unauthorized OHV use through security measures during operations and physically blocking access and/or making potential routes impassible after operations. Road and skid trail closure methods would be designed to avoid causing erosion, to avoid damaging retained trees and to allow closed roads to be opened if needed for firefighting.	♦	♦	♦	♦	♦	♦	♦	♦		
12. Locate unit boundaries to provide Stream Protection Zones (SPZ) within the RR along both sides of all identified streams (SPZ widths are slope distance): • SPZs are *minimum* 60-85 feet wide (dependent on tree height and hill slope, Salem District revised guidance 10/08/2010) on each side of the perennial streams and 30 feet on intermittent streams. • SPZ are a minimum of 100 feet wide on each side of any intermittent stream, and 150 feet on each side of any perennial stream less than 1 mile from listed fish habitat (*EA Section 3.3.3*)	♦		♦	♦	♦					
13. Directionally fall trees[9] in the harvest units so that they generally do not enter the SPZ or adjacent untreated stands.	♦		♦	♦	♦					
14. When additional trees are identified for cutting to facilitate safe logging operations (hazard trees, skid trails and yarding corridors, attaching cables, etc.), BLM would designate which trees are to be removed and sold and which trees are to be retained in place as woody debris (including CWD) according to the LUA objectives for each unit.	♦				♦					♦

[9] Directional felling means to cut trees so that they fall in a specific, desired direction to achieve objectives such as: to avoid impacts to the SPZ, roads, adjacent stands or private property; reduce fuel accumulation next to roads or property lines; and protect retained trees. Directional felling is also used to increase efficiency of operations and worker safety by orienting felled trees within a logging unit to facilitate yarding and prevent trees from rolling/sliding onto workers.

Project Design Features (RMP/FEIS references for key points)	Applicable Resources / Objectives									
	Vegetation	Soil	Water	Fish	Wildlife	Invasives	Fire /Air	Public	Cultural	Economic
In Ground-based Logging Operations: RMP/FEIS (pp. 2-34 through 2-37; 4-11 through 4-13; G-2)										
15. Limit the area of skid trails plus the portion of landings which are outside of road rights-of-way to ten percent of the surface area of harvest units (*RMP C-2*).	♦	♦	♦	♦		♦				♦
16. Limit the width of skid trails to 12 feet (IDT, standard BLM timber sale contract provision).	♦	♦	♦	♦		♦				♦
17. Allow skidding (dragging logs behind a skidder) and other ground based logging operations during periods of low soil moisture content (*RMP C-2*), generally considered to be the dry season approximately June-October (IDT) (*RMP/FEIS pp. 4 – 12-13*).	♦	♦	♦	♦		♦				♦
18. Re-use existing skid trails whenever feasible for logging operations according to the approved logging plan.	♦	♦	♦	♦		♦				♦
19. Locate new skid trails generally on slopes not greater than 35 percent (*RMP, p. C-2; RMP/FEIS, p. 2—35*) to avoid gouging, soil displacement, and erosion with effects exceeding those analyzed in the RMP/FEIS.	♦	♦	♦	♦		♦				♦
20. Generally limit uphill skidding to slopes where skidders would not break traction to avoid soil displacement.[10]	♦	♦	♦	♦						♦
In Skyline[11] and Other Cable Yarding[12] Operations: RMP/FEIS (pp. 2-34 through 2-37; 4-11 through 4-13; G-1,2)										
21. Design the skyline yarding layout so that corridors average at least 150 feet apart on at least one end of the corridors and to laterally yard logs to the skyline to limit the ground area impacted by yarding corridors.	♦	♦	♦	♦						♦
22. For lateral yarding operations fall trees to orient logs so that they cause the least soil disturbance and damage to retained trees during lateral yarding.	♦	♦	♦	♦	♦					♦
In Other Operations: RMP/FEIS (pp. 2-34 -- 2-37; 4-8 -- 4-13; G-1,2)										
23. Hazardous fuels surveys would be conducted and site specific plans for hazard fuels reduction treatments would be implemented by the Authorized Officer following harvest operations.	♦						♦	♦		♦
24. A Prescribed Fire Burn Plan would be initiated and signed by the Authorized Officer prior to any prescribed burning activity.	♦	♦					♦	♦		♦

[10] Traction is a highly variable combination of the power required to skid logs, equipment characteristics and soil strength. The potential to break traction increases as slope steepness increases. BLM field experience confirms that 20 percent slope consistently provides for adequate traction when skidding uphill while steeper slopes require additional site-specific evaluation.

[11] In skyline yarding operations, a cable is suspended above the ground (a line in the sky) which holds a carriage that uses another cable to pull logs sideways across the slope to the skyline (lateral yarding). A yarder (machinery with a tower, cables and winches) located on the landing then pulls the carriage up the skyline and pulls (yards) logs up to the landing. The leading end of the log is typically lifted off the ground while being moved (one end suspension). In some situations the entire log is lifted off the ground while being moved toward the landing (full suspension).

[12] "Other Cable Yarding" includes a variety of equipment which pulls logs to a landing or skid trail with cables, but may not use a skyline. Some common systems include a "Yoder" (**Y**arder L**o**a**der**), a "tong tosser", or simply winching to a skidder.

Project Design Features (RMP/FEIS references for key points)	Applicable Resources / Objectives									
	Vegetation	**Soil**	**Water**	**Fish**	**Wildlife**	**Invasives**	**Fire /Air**	**Public**	**Cultural**	**Economic**
25. Burning would be conducted in accordance with the Salem District RMP, Oregon State Implementation Plan and Oregon Smoke Management Plan as administered by the ODF and would comply with the provisions of the Clean Air Act. It would be conducted under good atmospheric mixing conditions to lessen the impact on air quality in Smoke Sensitive Receptor Areas.	♦	♦				♦	♦	♦		♦
26. Prescribed burning may include landing pile or machine pile burning, swamper burning, or handpile construction and burning and may be used individually or in combination in areas where fuel loading is heavy or the fire risk is determined to be high.	♦	♦	♦	♦	♦	♦	♦			♦
27. When hand, machine, or landing piles are identified by the Authorized Officer as the specified fuels treatment the following requirements would apply: • Piles would be located as far as possible from large snags, green trees, and other reserved trees to minimize damage. • Large woody debris generally greater than eight inches in diameter would be retained on site as much as feasible and not piled (*RMP C-7)*. • Piles would not be constructed on top of stumps or existing CWD. • Piles would be covered with 4 mil (.004 inch thick) black polyethylene plastic. The plastic shall adequately cover the pile to ensure ignition and would be placed and anchored to help facilitate the consumption of fuels during the high moisture fall/winter burning periods. In skyline yarding areas: • Machine and landing piles would be constructed within 25 feet of designated roads and landings. • Equipment used in the construction of machine and landing piles would remain on the roads or landings during the construction. In ground based yarding areas: • A track mounted hydraulic excavator shall be used to pile woody debris. • The excavator shall be equipped with a hydraulic thumb or a rotating controllable grapple head. The machine shall have a minimum reach of twenty-five (25) feet. • Operating techniques would be designed to prevent gouging, soil compaction and displacement, and erosion. • Away from roads, the excavator shall be required to work on a slash mat in order to reduce compaction. • Machine operations would be limited on bare soils to dry conditions with less than 25 percent soil moisture content in the upper six inches of soil (*RMP C-7*). • Soil compaction would be limited outside of skid trails and landings to no more than two percent of the surface area of the unit – the	♦	♦	♦				♦			♦

Project Design Features (RMP/FEIS references for key points)	Applicable Resources / Objectives									
	Vegetation	Soil	Water	Fish	Wildlife	Invasives	Fire /Air	Public	Cultural	Economic
amount of compaction analyzed for tractor-constructed fire trails (*RMP C-9*). • Machine piles would not be constructed within 25 feet of property lines, or on slopes greater than 35 percent.										
28. Lopping and scattering of fuels would be incorporated where fuel loading is relatively heavy but not heavy enough to warrant burning.	♦						♦	♦		♦
29. Pullback of fuels would be incorporated where fuel loading is relatively light (especially along roads and property lines) but not heavy enough to warrant burning.	♦						♦	♦		
30. The Oregon Occupational Safety and Health Administration and BLM would require the operator to place signs, temporarily block roads with vehicles or moveable barricades, and/or use flaggers to ensure public safety during active logging, hauling, and fuel treatment operations.	♦						♦	♦		
Road Use, Construction, Renovation, Maintenance, Stabilization and Closure: RMP/FEIS (pp. 2-22,68,69; 2-75,76; 4-11 -- 4-19; G-2 -- G-7)										
31. Locate, design and construct roads wherever feasible to drain surface water to adjacent slopes where it would infiltrate into the soil and groundwater; and to avoid collecting water (in ditches and on road surfaces) where it could be channeled directly to streams (*Wemple et al. 1996*).		♦	♦	♦						
32. Locate, design and construct roads in upland areas on stable ground with side slopes generally less than 30 percent that do not require extensive cut-and-fill construction methods, in order to avoid increasing mass failure (landslide) potential and to avoid intercepting groundwater.		♦	♦	♦						♦
33. Conduct all in-stream activities (e.g. culvert removal and/or installation) during the designated In-Water Work Period. If water is flowing, divert (pipe or pump) water around the work site.			♦	♦						
34. Install sediment traps and/or filters in ditches that drain to stream crossings to prevent sediment transport that would cause a visible increase in turbidity from entering streams wherever it is not feasible to drain water from roads directly onto adjacent slopes. Typical methods include: maintain vegetation in the ditch; create small settling basins; or install artificial filters such as straw bales or wattles.			♦	♦						♦
35. Haul logs on forest roads only during times and road conditions that would not generate sediment that would enter streams and cause a visible increase in stream turbidity.			♦	♦						♦
36. In addition to the above, limit hauling on road 7-3E-15.1 to dry season and dry conditions, restricting haul during the wet season and/or wet conditions.			♦	♦						♦

Project Design Features (RMP/FEIS references for key points)	Applicable Resources / Objectives: Vegetation	Soil	Water	Fish	Wildlife	Invasives	Fire /Air	Public	Cultural	Economic
37. BLM authorized personnel would visually monitor turbidity (a visible reduction in water clarity)[13] caused by road-generated sediment entering the stream at stream crossings on the haul route to ensure ongoing compliance with Oregon Department of Environmental Quality (ODEQ) water quality standards of no visible (less than ten percent) increase in turbidity.			♦	♦						♦
38. BLM authorized personnel would check for turbidity beyond the mixing zone downstream (about 100 meters) if turbidity is visible in the stream at the crossing. If water clarity is visibly altered beyond the mixing zone, BLM would suspend hauling and other operations immediately and implement site specific measures to reduce fine sediment runoff into the stream. Allow operations to resume when weather and road conditions, combined with measures taken to reduce sediment transport to streams are deemed sufficient to comply with State of Oregon turbidity standards.			♦	♦						♦
39. Decommission newly constructed, non-rocked roads and close/stabilize newly constructed rocked roads as specified in the description of road work in EA section 2.3.1 during the appropriate season (*EA Table 6*) after fuels treatments (*EA Section 2.3.1*.) are completed.			♦	♦						♦
40. If road-generated sediment transport to streams and the resulting turbidity does not comply with ODEQ water quality standards during the wet season, BLM would not allow log hauling from this project in order to prevent adding to cumulative effects of sediment and turbidity.			♦	♦						
Culverts and subgrades of closed and stabilized roads would be left intact so that the road can be renovated for future use or fire control with minimal disturbance and expense.	♦						♦	♦		♦
41. When natural surface roads would be kept intact over winter for use on this project the next year, use one or more of the following methods to prevent erosion and sediment transport to streams that would cause a visible increase in turbidity: matting, mulching, constructing water bars or other surface shaping to drain runoff water to vegetated slopes, seeding, sediment traps and blocking the entrance to prevent unauthorized motor vehicle use.		♦	♦	♦				♦		♦
42. Restrict road construction, renovation, maintenance and decommissioning operations to times, weather conditions and soil conditions when the subgrade would not be damaged by operations and no sediment laden runoff would be generated.		♦	♦	♦						♦
43. Seed and mulch all disturbed soil at stream crossings with native species seed approved by BLM and sterile mulch (free of non-native seed). Place rock, logs or woody debris as necessary to stabilize disturbed soil.	♦	♦	♦	♦	♦	♦				

[13] Turbidity is a measurement of water clarity and is not convertible into a volume measurement of sediment yield unless correlated to suspended sediment data. "A visible increase in turbidity" has been found in field experience to correspond closely to Oregon DEQ standards for turbidity.

Project Design Features (RMP/FEIS references for key points)	Applicable Resources / Objectives									
	Vegetation	Soil	Water	Fish	Wildlife	Invasives	Fire /Air	Public	Cultural	Economic
44. Provide appropriate traffic control and other protection measures as needed to provide for public safety. Potential measures include signs, flaggers or temporary barricades and provide for traffic to pass through within an appropriate time.								♦		♦
Stand Structure, Wildlife Habitat and other Vegetation: RMP/FEIS (pp. 2-17,21,22,26,32-33,37-38,59-62,80-92; 4-11 through 4-13; G-1,2; K-1--3)										
45. Retain large remnant trees and generally protect them from logging damage. Individually designate such trees that are found inside unit boundaries for retention.	♦				♦					♦
46. In unit 15A retain the trees that are larger than the average diameter for the stand, emphasizing conifers 38 inches or larger in diameter.										
47. Retain snags larger than 15 inches diameter and taller than 15 feet intact and standing during logging and site preparation activities as much as feasible.[14]					♦					♦
48. Retain existing CWD meeting RMP standards of at least 20 inches diameter (large end) and 20 feet long wherever feasible and protect them from logging damage. Design skid trail location and operating techniques that require minimal movement of CWD to protect its physical integrity (*RMP p. 21*).		♦			♦					♦
49. Plan road and landing locations to avoid impacts to snags larger than 15 inches diameter and taller than 15 feet whenever BLM determines it is safe and feasible to do so.					♦			♦		♦
50. Plan road and landing locations to avoid impacts to large remnant trees whenever BLM determines it is safe and feasible to do so.	♦				♦					♦
51. Retain the following categories of green trees to meet objectives described in EA Section 2.3.1.	♦				♦					♦
52. Mark cut trees in blue, and do not mark any trees to leave in unit **16A** to reduce visual impacts after harvest operations. Include design features as described in EA Section 2.3.1.	♦				♦			♦		♦
53. As feasible, retain trees that have desirable characteristics for wildlife habitat (e.g. asymmetrical crowns with multiple or broken tops, large limbs, dead areas being used by cavity excavators, deep crevices and cavities).	♦				♦					

[14] Some snags would be cut to provide for safe operations as required by Oregon Occupational Safety and Health Division (OR-OSHA, Oregon Occupational Safety and Health Standards, OAR Chapter 437, Division 7, Forest Activities).

Project Design Features (RMP/FEIS references for key points)	Applicable Resources / Objectives									
	Vegetation	Soil	Water	Fish	Wildlife	Invasives	Fire /Air	Public	Cultural	Economic
54. Avoid incidental unapproved damage[15] to more than two retained trees per acre using techniques such as: requiring extra precautions to prevent damage when falling and yarding during the spring growing season when bark is easily damaged (typically March through June); directional falling to lead with skid trail or skyline corridor alignment; lateral yarding to skylines; using selected "cut" trees as rub trees in locations where logs "turn a corner" during logging; or using protective bumpers on retained trees used as rub trees. Trees identified in the logging plan to be used to facilitate logging (e.g. lift or tail trees, intermediate supports, guyline anchors, rub trees, cribbing, etc.) may be in addition to the two per acre.	♦				♦					♦
55. Retain trees in thinning units which have been girdled, topped, damaged or felled to facilitate logging (up to 2 per acre each of standing and felled) in project units to provide snags and CWD, when retaining those trees is consistent with safe and efficient logging practices.	♦				♦					♦
56. Retain created snags and topped trees marked with orange painted bands in unit 22A as much as is feasible with safe and efficient logging operations. Any of these trees felled to facilitate safe and efficient operations would be left on site as CWD. Leave as close to the cut site as possible.	♦				♦					♦
57. Low Density thinning (LDT) areas in Matrix would be located to provide small areas (up to approximately 2.5 acres in size) of early seral habitat with approximately 18-20 trees per acre retained. Locations would remain outside RR and VRM II areas. Locations would be determined by BLM based on site examinations. LDT areas would generally be circular.	♦				♦					♦
58. Within LDT areas: seed with forage species and/or plant with shrubs or tree seedlings as needed based on field surveys by BLM resource specialists	♦	♦		♦	♦	♦				
59. Within LDT areas, pile and burn logging slash and debris as needed to provide access by big game species. Retain up to ten percent of the piles for habitat features.	♦	♦		♦		♦				
60. Clean all ground-disturbing logging and road construction equipment, and the vehicles used to transport this equipment to the project area, to be free of off-site soil, plant parts and seed prior to entering the project area to prevent introducing invasive and non-native plants into the project area.	♦					♦				
61. Seed and mulch exposed soil using approved native plant species seed (such as Oregon certified blue wild rye (*Elymus glaucus*)) and sterile mulch, in order to stabilize the soil and prevent establishing invasive/non-native plant species on disturbed soil in the project area.	♦	♦	♦	♦	♦	♦				

[15] The standard for "damage" is bark damage on more than 50 percent of the tree's circumference.

Project Design Features (RMP/FEIS references for key points)	Applicable Resources / Objectives									
	Vegetation	Soil	Water	Fish	Wildlife	Invasives	Fire /Air	Public	Cultural	Economic
62. No habitat modifying operations (falling, yarding and road construction) would be allowed within disturbance range (0.25 miles) of known northern spotted owl (NSO) sites during the nesting season(March 1 – July 15) unless appropriate NSO surveys indicate that there are no nesting spotted owls within the disturbance range.					♦					♦
63. Restrict or suspend operations, or modify project boundaries at any time if plant or animal populations that require protection are found during ongoing surveys or are found incidental to operations or other activity in the project area.	♦				♦					
Cultural/Paleontological Resource Protection:										
64. Restrict or suspend ground disturbing activities immediately if prehistoric cultural or paleontological resources are encountered during project implementation. Conduct a professional evaluation of the resource site and develop appropriate management practices to protect the site/cultural or paelontological values.									♦	

Seasonal Restrictions and Operational Periods

The Seasonal Restrictions, Modifications and Operating Periods are summarized in Table 6

Table 6. **Summary of Seasonal Restrictions and Operational Periods**

Seasonal Restriction	**Reason**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Any logging and road building activities, March 1-July15 in units 22B, 22D, and 27B	Minimize disturbance during spotted owl breeding and nesting season. Restriction could be waived if surveys conclude no spotted owl nesting.												
Hauling, based on conditions	Water quality and sedimentation, protect fish												
Hauling on road 7-3E-15.1	Eliminate potential sedimentation to protect Listed Fish Habitat (LFH). Restricts haul from unit 15B												
Skidding operations and ground-based operations	Soil protection, site productivity, water quality												
Road Construction / Decommissioning/ Stabilizing / Haul on Natural Surface Roads	Erosion control, road damage												
In-water work: stream culvert maintenance/replacement	Protect fish and aquatic habitat												
Logging operations	Fire season, ODF regulated use												

K E Y	White: Operations typically do not require additional PDF to protect resources.	Gray: Operations may be prohibited (restricted) or require additional PDF to protect resources, or allowed as planned depending on conditions.*	Black: Operations are often prohibited (restricted). If allowed, are typically modified by added PDF to protect resources.

Timber Sale Contract Administration

The standard BLM timber sale contract would require the operator to submit a written operations plan. The operations plan identifies personnel, the equipment to be used for operations, and describes how operations will be accomplished in compliance with contract provisions and in accordance with the project design analyzed in this EA. Once approved by the BLM, this operations plan would become an enforceable part of the timber sale contract.

Performance would be monitored by authorized BLM personnel according to BLM regulations and contract administration procedures. Authorized Officers will inspect timber sale operations for contract compliance, generally at least once each week during contract operations. The Contracting Officer enforces compliance with the contract and would suspend operations if the operator fails to perform the required preventive and restorative practices analyzed in this EA. The BLM timber sale contract requires bonding in an amount sufficient for BLM to complete mitigation and restoration work if the operator fails to perform the preventive and restorative requirements of the contract.

2.3.2 No Action Alternative

The No Action alternative describes the current environmental baseline, against which the effects of the Proposed Action can be compared, i.e. the existing conditions in the project area and the continuing trends in those conditions if BLM does not implement the proposed project. The No Action alternative means that no timber management actions, or connected actions, would occur at this time. Selection of the No Action alternative would not constitute a decision to change the LUA of these lands and it would not set a precedent for consideration of future action proposals.

The No Action alternative may be selected for individual units, portions of units, or any connected actions, as well as for the entire project area.

Only normal administrative activities and other uses (e.g. road use, programmed road maintenance, harvest of special forest products on public land) would continue on BLM administered lands within the project area.

On private lands adjacent to the project area, forest management and related activities would continue to occur.

2.3.3 Alternatives Considered but not Analyzed in Detail

BLM considered several alternatives presented during the scoping process. Many of the alternatives listed below that were considered, but not analyzed in detail were included as part of the issues addressed in this EA (*EA Section 1.8.2*).

Additional acres considered in the Matrix LUA

Approximately 600 acres of forest stands were initially identified in the general area based on stand age, density, proximity and other information. Approximately 240 acres were dropped from further consideration and analysis prior to, or early in the IDT process for a variety of reasons such as wildlife protection, logging problems, low stocking, steep terrain, or stream protection.

Additional acres considered in the Late Successional Reserve (LSR) LUA

Approximately 60 acres were considered for density management thinning treatment within the LSR LUA. This area was included in maps during scoping and is located in T. 7 S., R. 3 E., Section 25. This stand was dropped from consideration in the Hole in the Road project primarily due to complications regarding the haul route. Any timber removed from this unit would need to be transported along a haul route separate from the rest of the proposed thinning areas, increasing costs and practicality of treating the area with the rest of the Hole in the Road thinning units. The IDT determined this area would benefit from thinning to accomplish objectives associated with the LSR LUA.

No timber harvest on lands not previously managed

This alternative was not analyzed because RMP direction does not restrict timber harvest to exclusively include previously managed stands (previously harvested, or pre-commercially or commercially thinned) (*RMP pp. 46-48*). Excluding these areas from thinning would not fully comply with RMP timber management objectives in the Matrix LUA or meet the purpose and need of this project.

No timber harvest in RR's

This alternative was not analyzed because proposed thinning in the RR in this EA is designed to meet RMP direction and the purpose and need of the project. The Salem District RMP directs the BLM to "Apply silvicultural practices within the Riparian Reserves to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy objectives" (ACSO) (*RMP p. 11*).

It has been asserted in scoping comments for this project, and argued in *Bark vs. BLM,* 643 F.Supp.2d 1214 (*D. Or. 2009*), that BLM was prohibited from thinning in the RR LUA "unless needed" to meet ACS objectives. The Court rejected Bark's reading of the RMP as requiring the BLM to show thinning was "needed" as a condition precedent to RR treatments, and accepted BLM's interpretation of its RMP as authorizing timber harvest in the RR LUA to apply silvicultural practices to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics. BLM does not interpret this provision as requiring a showing that treatment is absolutely "needed" to achieve ACS objectives when compared to taking no action. BLM has consistently interpreted this provision of the RMP since its adoption and has implemented numerous similar treatments to RR stands across the Salem District.

RR in the project area lack desired vegetation characteristics needed to meet ACS objectives. In identifying appropriate riparian areas to treat, the IDT *(EA Section 1.3.1.1*) identified stands with structure that would benefit from thinning to accelerate the development of complex habitat.

No road construction within the suitable WSR corridor

All actions proposed in this EA are designed to meet RMP direction regarding thinning and road construction in the GFMA LUA; this includes acres proposed within the suitable WSR. RMP direction and BLM policy do not prohibit road building in any suitable WSR segment with a tentative "recreation" designation (*RMP p 38, BLM manual 6400 Ch. 7, G-2*). In addition, the road segment proposed for construction would not be visible from the river and would not infringe up on the river's free-flowing values or outstanding remarkable values (*See Lidar map in EA Section 7.0 and EA Section 3.3.8.2*). Any new road construction to access this unit would, at minimum, be closed to vehicle traffic and stabilized after operations are complete (*EA Section 2.3.1*).

Approximately 480 feet of new road would be analyzed for construction within the WSR boundary in order to access Unit 15B extending an already existing road (*EA Figure 2*). Unit 15B is within the Matrix LUA and outside the mapped suitable WSR boundary.

Defer harvest of forests to store carbon

This alternative was not analyzed in detail for the following reasons. This alternative:

Does not respond to the purpose and need for the project (*EA Section 1.3*);

Is not in conformance with the RMP which sets the basic policy objectives for the management of the project area, in which Matrix lands are managed primarily for timber production, and RR are managed to help develop late successional habitat conditions in line with the ACS. The RMP does not include a LUA that reserves lands or stands for carbon storage; and

Is substantially similar in design to the No Action alternative which is analyzed in the EA in that this alternative would leave stands unaltered and unmanaged.

Chapter 3: Affected Environment and Environmental Effects

3.1 Analysis Assumptions and Methodology

3.1.1 Analysis Assumptions

Timber management activities would occur on BLM-administered lands allocated to planned, sustainable harvest. The Salem RMP/FEIS analyzed for both the short-term (10 years) and long-term (decades) impacts of implementing this type of timber management action. Under the RMP, this applies to Matrix/GFMA lands in the proposed project.

Timber management activities would re-use, where feasible, the transportation system of existing skid trails, landings and truck roads proposed for this project.

The RR LUA on BLM-administered lands would be managed for protection of watershed values such as water quality and aquatic habitat and for fish and terrestrial wildlife habitat on both a local and landscape level.

In RR stands, BLM would evaluate these stands, and other stands in the watershed, approximately each decade to determine if further silvicultural treatment is needed to recruit snags and/or CWD or to meet other RR objectives.

Stands within the Suitable WSR segment and Oregon Scenic Waterway designation would be managed for protection of their determined outstanding and remarkable values, and free-flowing values.

Drought exacerbated by climate change has the potential to increase the duration and severity of wildfire season to an unknown extent during the project period (three to five years). However, any change would not be expected to exceed the conditions used to model fire potential for this time period.

Most private industrial forest lands in these watersheds will be intensively managed with regeneration harvests scheduled on commercial economic rotations occurring at 40-60 year intervals (*PRMP/FEIS 1994, p4, and BLM observations of recent trends in industrial forest management*).

3.1.2 Methodology

The Forest conditions information was compiled from a variety of sources including BLM corporate data, stand exams, and field surveys by BLM personnel.

The RMP/FEIS provided general resource information for the Salem District planning area as of September 1994.

Research publications provided ongoing baseline information specific to forest vegetation and impacts of managing or not managing forest stands (see specialist reports for publications specifically relied upon in developing the Hole in the Road project).

GIS data, aerial photographs, satellite imagery, LIDAR data, BLM's Forest Operations Inventory (FOI) records, resource specific field surveys (see the following EA sections for specific surveys conducted) and field reconnaissance by BLM resource specialists were used to describe vegetation, habitat and plant and animal species on BLM lands.

3.2 General Setting/Affected Environment

Historical Influences on Forest Development in the Area Watershed

Sources: BLM Archival Records – Metzger's Atlas, Aerial photos, timber sale files and associated environmental assessments and management plans; GIS Database; Lidar data; Molalla Watershed Analysis 1999, Foster, Macalady, Ruzicka 2015, 2016 Hole in the Road Silviculture Prescription

Physical Setting

The Hole in the Road project area is located in the Upper Molalla River 5th field Watershed in Clackamas County, Oregon. The Upper Molalla River 5th field Watershed is approximately 129,299 acres in size, of which BLM administered lands comprise approximately 33 percent, or around 43,000 acres (*EA Table 7*).

The project area is approximately 20 miles from the City of Molalla, southwest of the Molalla River. Proposed thinning units are accessible from the main South Molalla Road, and southeast along the Horse Creek Access Road. Although gates are present on BLM lands in the area, most remain open, making the area generally accessible to the public. The thinning units are located between Horse Creek to the east, and Gawley Creek to the west, both of which flow into the Molalla River.

The forest stands proposed for thinning comprise mostly of mid-seral to mature Douglas-fir and western hemlock. Approximately 60 percent of the proposed thinning units are considered to be on flat ground, with the remaining acreage on steeper slopes running north toward the Molalla River, East /North East to Horse Creek or West/South West to Gawley Creek.

Historical Setting and Current Use

BLM Land Designations

There are several coinciding designations of the BLM forest land in this project area (*EA Section 1.3.1.1*), delineated through the Salem District RMP. The entire project area is within the Molalla River/Table Rock Special Recreation Management Area (SRMA) and the Matrix and RR LUA's. The 64 acres of Matrix land proposed for thinning is within the Suitable WSR area (*EA Section 1.3.1.1, Table 7*).

The project area includes stands that have been actively managed for timber production for the past 50-75 years. For purposes of description it can also be divided into to two distinct parts based on past ownership and management:

Acquisition through land exchange

The proposed thinning unit acres in Section 16 were included in an acquisition through a land exchange in the early 1990's. The acquired land consists of managed plantations that were either established following logging or were converted from pasture or farmland. Some photos from the 1950's show some of the areas acquired along the Molalla River as pasture. These plantations show evidence of intensive practices to ensure maximum utilization of the site for timber production. In the Hole in the Road project, the units proposed for thinning range in age from 43-45 years.

Long-Term BLM Ownership

The rest of the project area in Sections 15, 21, 22 and 27 has been in BLM management since the O&C Act of 1937. These are either natural stands that originated following fire, or as plantations following logging. They range in ages from 43-137 years. All or portions of units 22A, 22B, 22C and 22D were commercially thinned in the early 1970's and 1980's. The younger stands have had intensive practices applied including pre-commercial thinning and fertilization (*EA Section 3.3.1.1*).

State of Oregon Designations

In 2014 and 2015 the State of Oregon Parks and Recreation Department (OPRD) undertook studies of the Chetco, Molalla and Grand Ronde Rivers for possible protection under the 1970 Oregon Scenic Waterways Act. This state law protects the free-flowing character of designated rivers for fish, wildlife, and recreation; protects and enhances scenic, cultural and natural values along scenic waterways; and establishes a process and criteria for adding new rivers to the scenic waterway system (*OR 390.805 and ORS 390.925*). The boundary associated with the Oregon Scenic Waterway is similar to that of the Suitable WSR boundary along the Molalla: generally ¼ mile on either side of the Molalla River (*OR 2015 p. 11*).

Any project proposed on BLM land that falls within the designated Oregon Scenic Waterway will be designed to adhere as much as feasible to the State of Oregon guidelines for this designation. However, federal law and policy will continue to take precedent in management of these lands (*EA Section 1.7)*, including management guidelines associated with Suitable WSRs, as illustrated in the RMP (*RMP p. 38*), BLM policy guidance (*BLM Manual 6400 Ch. 7 G-2)*, and Visual Resource Management (VRM) guidelines *(RMP pp. 36-37*).

Table 7 shows the breakout of the Matrix lands within the Hole in the Road Project, including lands proposed for thinning within the Suitable WSR corridor and the newly designated Oregon Scenic Waterway.

Table 7. **Land Designations on BLM-administered land by Unit**

		Molalla River/Table Rock SRMA					
		O&C land		PD land - Acquired		Suitable Wild and Scenic River – PD land	Oregon Scenic Waterway
Unit	**Total Acres**	GFMA	RR	GFMA	RR	GFMA	GFMA
15A	18	18	0	0	0	0	0
15B	17	17	0	0	0	0	0
16A	20	0	0	20	0	20	20
16B	80	0	0	75	5	42	42
21A	35	33	2	0	0	0	0
21B	28	24	4	0	0	0	0
22A	45	45	0	0	0	0	0

22B	25	25	0	0	0	0	0
22C	15	15	0	0	0	0	0
22D	21	21	0	0	0	0	0
27B	50	49	1	0	0	0	0
R-o-W	6	6	0	0	0	0	0
Totals	**360**	**253**	**7**	**95**	**5**	**62**	**62**

Existing Watershed Condition

The project is within the Upper Molalla 5th field watershed. Age class distributions of the 5th field Watershed are illustrated in Table 9 of this EA (*EA Section 3.3.1.1*). The distribution of land ownership within these watersheds is illustrated in Table 8.

Table 8. **Land ownership in associated 5th field watershed, acres**

Watershed	BLM	USFS	State and Local Govt.	Private-Industrial	Private- Non industrial	Total Acres*
Upper Molalla River Watershed	43,084	2,511	3,669	68,968	11,067	129,299

*Sum of published Watershed Analysis acres with updates based on current BLM Forest Operations Inventory GIS data.

Scope of the Project Proposal

The Proposed Action would harvest:

- 354 acres of the 43,084 BLM acres, or 0.8 percent of BLM lands in the Upper Molalla Watershed.
- Within the 354 acres proposed for harvest, 97 percent of the proposed acres are in GFMA (Matrix) and 3 percent in RR.

Cumulative Actions

The actions described below have occurred within the Upper Molalla 5th field Watershed since 1995. Those listed do not include all actions that have occurred in Molalla Watershed, but encompass several previous and on-going projects on BLM lands along the Molalla River or within the general vicinity of the proposed Hole in the Road thinning units.

Previous Actions

BLM Timber sales:

- Nothing Yet II: 17 acres of regeneration harvest in the Matrix LUA (GFMA). Completed in 1998.
- Good Gawley: 182 acres of regeneration harvest and 52 acres of commercial thinning in the Matrix LUA (GFMA). Completed in 2000.
- Bauercrest: 96 acres of regeneration harvest in the Matrix LUA (GFMA). Completed in 2000.

- Pine Rock: 311 acres of commercial thinning in the Matrix LUA (GFMA) and RR. Completed in 2004.
- B-Cubed: 554 acres of commercial thinning in the Matrix LUA (GFMA). Completed in 2012.
- Annie's Cabin: 572 acres of commercial thinning in the Matrix LUA (GFMA) and RR. Completed in 2013

Private Timber sales: Several hundred acres have been harvested within the watershed on private industrial timber lands since 1995. One private clearcut is adjacent to BLM ownership in Section 25, and appears to have been completed between 2014 and 2015.

Recreation development and restoration work within the Suitable WSR Corridor:

- Two recreation sites were completed in the summer of 2013: Three Bears Recreation Site for first-come, first-serve camping and river access and Cedar Grove Recreation Site for group overnight camping under Special Recreation Permit.
  - Construction included clearing approximately 3-5 acres of vegetation within the RR LUA, adjacent to the Molalla River for 11 tent camp sites, 10 picnic sites, restrooms, potable water access, trails and paved road access and parking.
- Manual treatment of noxious weeds, included scotch broom and blackberry, along the South Molalla Road and within day-use areas. Approximately 3-10 acres are treated every other year within GFMA and RR areas.
- Restoration of 9 previously designated day-use sites totally approximately 5 acres within the Matrix LUA (GFMA) and RR. Restoration work started in 2013 by Molalla River Watch volunteers and BLM staff.
  - Restoration of these sites included but was not limited to: closing and stabilizing previous road and parking areas, blocking these areas from future vehicle access with earth berms and boulders where appropriate, and planting native vegetation.

Fuels Treatment within the Suitable Wild and Scenic River Corridor: Approximately 200 acres within the Matrix LUA (GFMA) and RR, 50 feet of the South Molalla Road were treated for fuels reduction between 2007 and 2009. Trees were pruned, slash piled and burned, or chipped. Fuels reduction was accomplished via service contracts, Oregon Department of Forestry (ODF) fuel reduction crews, Northwest Youth Corps crews and BLM staff.

Ongoing Actions

BLM Timber sales: There are currently no active timber sales on BLM land within the watershed.

Private Timber sales: Private industrial timber land continues to be harvested within the watershed; no harvest adjacent to the proposed thinning units is currently ongoing.

Recreation development and restoration work within the Suitable WSR Corridor:

- Restoration of previously designated day-use areas is ongoing. Restoration of these sites includes but is not limited to: closing and stabilizing previous road and parking areas, blocking these areas from future vehicle access with earth berms and boulders where appropriate, and planting native vegetation.
- Development of the Rosette Basalt Overlook and Ivor Davies Wayside for safe and accessible river access and resource protection.
- Development of safe river access for visitors at multiple day-use sites along the corridor.
- Shared use trail re-routing and maintenance.
- Trail development connecting recreation sites to trailheads.

Foreseeable Future Actions:

Private Timber sales: Stands that are at least 40 years old are expected to be assessed for timber harvest.

BLM timber sales: None are currently proposed; however, any lands that may meet the guidelines for harvest with current management direction will be assessed and could be considered for analysis within the next 5-10 years

Recreation development and restoration work within the Suitable WSR Corridor:

- Restoration of previously designated day-use areas is anticipated.
- Future recreation developments within the next 5-10 years include:
  - On-going projects listed above; and
  - Maintenance/replacement of recreation structures as needed.

3.3 Resource Specific Affected Environment and Environmental Effects

This section of the EA describes the current condition and trend of the affected resources and the environmental effects of the alternatives on those resources. The IDT of resource specialists reviewed the elements of the human environment, required by law, regulation, Executive Order and policy, to determine if they would be affected by the proposed project (*BLM Handbook H-1790-1: p. 137), [40 CFR 1508.27(b)(3)], [40 CFR 1508.27(b)(8)] (EA Section 1.7)*, as well as the issues raised in scoping (*EA Section 1.8.3*).

The resources potentially affected by the proposed thinning activities are described in the following sections: Vegetation and Forest Stand Characteristics; Hydrology; Fisheries and Aquatic Habitat; Soils; Wildlife; Air quality and Fire Hazard/Risk; Carbon Storage and Carbon Emissions; Recreation and Rural Interface; Visual Resources; and Cultural Resources.

3.3.1 Vegetation and Forest Stand Characteristics

Sources: Hole in the Road Silviculture Prescription (Sivliculture Prescription or Silviculture Report); Foster, Macalady, Ruzicka 2015 and 2016; Hole in the Road Project EA Wildlife Report; Murphy 2015; Hole in the road Fuels Specialist Report; Macalady 2015; Hole in the Road Botany Report, Fennell 2015.

Assumptions:

- As relative density (RD)[16] increases above 50, competition for light, nutrients and water begins to reduce growth rates and increase stresses on individual trees and on the stand as a whole.
- Forest stands with relative densities about 65 have lower tree vigor, high mortality of suppressed trees, and higher susceptibility to insects, disease and more severe fire behavior than stands with lower densities (*Perry 1994; Hann and Wang 1990; Curtis 1982).* These conditions reduce stand resiliency and resistance to environmental stresses.

Methodology:

- For stand structure information, Stand Exams were conducted in 2009 and 2014. Cascades FO Silviculturalists did field reconnaissance of all proposed harvest units.
- The plot data was analyzed by the FO Silviculturalist using BLM's EcoSurvey Program and the ORGANON growth model (*Hann et al 2006*). The BLM analyzed and incorporated data into the description of existing vegetation and forest stand characteristics and for developing the prescriptions that would be implemented under the proposed project (*EA Table 12, Sivlicultural Report*). Stand ages were calculated by these programs using weighted averages of sample ring counts (cores) to determine a stand "birthdate".
- Threatened/Endangered/Special Status/Special Attention Botanical Species: BLM Botanists for the Cascades FO conducted two types of surveys within the project area and vicinities; Known Site Surveys (data search) and Field Surveys (*Botanical Inventory*). The Botanist conducted comprehensive botanical inventories of the project area in July and August of 2014.

3.3.1.1 Affected Environment

Molalla Watershed

The following three tables, compiled from the Molalla Watershed Analysis (*Chapter 5 pp. 71-72*) show the seral stage acres in the Upper Molalla 5th field watershed, seral stage acreage on federal lands by LUA, and the definitions used for those seral stages. This acreage shows

[16] Relative density (RD) is a measure of crowding in a stand of trees, expressed as a percentage of density (based on number and size of trees) relative to a theoretical maximum density. Curtis Relative Density (RD) is calculated by dividing the basal area per acre by the square root of the quadratic mean diameter. Other common ways of communicating density in a forest stand include trees/acre, basal area/acre, average spacing and crown or canopy closure.

general patterns, but acres may differ from current BLM GIS data which is used elsewhere in this EA.

Table 9. **Seral Stage Acres by Ownership – Upper Molalla 5th Field Watershed**

Seral Stage used for Watershed Analysis	**Ownership**									
	BLM		USFS		State		Private		Totals	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Non Forest*	959	2	40	2	5	0	4306	5	5310	4
Early-Grass Forb.	4803	11	70	3	312	9	8617	11	13802	11
Open Sapling/Brush	9900	23	283	11	652	18	29255	38	40090	31
Closed Sapling	3191	7	23	1	2635	70	34746	43	40595	31
Mature	19766	46	765	30	25	1	1163	1	21719	17
Old Growth	3397	8	1330	53	0	0	2	0	4729	4
Young Hardwood	37	1	0	0	15	1	165	0	217	0
Mature Hardwood	1031	2	0	0	25	1	1781	2	2837	2
Totals	**43084**	100	**2511**	100	**3669**	100	**80035**	100	**129299**	100

* Non-forest includes roads, rock quarries, rural residential and agriculture lands, meadows, rock cliffs/talus and other natural openings.

Table 10. **Seral Stage Acreage on Federal Lands by LUA in the Watershed**

Seral Stage used for Watershed Analysis	LUA					
	Matrix				LSR	
	GFMA		Connectivity			
	Acres	%	Acres	%	Acres	%
Non Forest	252	2	44	4	703	2
Early-Grass Forb.	2066	14	169	14	2379	8
Open Sapling/Brush	4920	32	465	39	4769	16
Closed Sapling	1466	10	222	19	1788	6
Mature	5076	33	0	0	15453	54
Old Growth	964	6	282	24	3482	12
Young Hardwood	37	1	0	0	0	0
Mature Hardwood	386	3	0	0	645	2
Totals	15167	100	1182	100	29219	100

Table 11. **Seral Stage Definitions**

<table>
<tr><th colspan="2">Seral Stage used for Watershed Analysis</th><th rowspan="2">Age Class (years)</th><th rowspan="2">Seral Stage used for Wildlife Habitat**</th><th rowspan="2">Age Class</th></tr>
<tr><th>Hardwood seral stages</th><th>All other seral stages</th></tr>
<tr><td></td><td>Non Forest</td><td>*</td><td>*</td><td>*</td></tr>
<tr><td rowspan="3">Young Hardwood</td><td>Early-Grass Forb.</td><td><10</td><td rowspan="2">Early Seral</td><td rowspan="2">0 to 30</td></tr>
<tr><td rowspan="2">Open Sapling/Brush</td><td rowspan="2">11 to 40</td></tr>
<tr><td>Early Mid Seral</td><td>30 to 40</td></tr>
<tr><td rowspan="5">Mature Hardwood</td><td rowspan="2">Closed Sapling</td><td rowspan="2">41 to 80</td><td>Mid Seral</td><td>40 to 60</td></tr>
<tr><td>Late Mid Seral</td><td>60 to 80</td></tr>
<tr><td rowspan="2">Mature</td><td rowspan="2">81 to 199</td><td>Early Mature Seral</td><td>80 to 120</td></tr>
<tr><td>Mature</td><td>120 to 200</td></tr>
<tr><td>Old Growth</td><td>200+</td><td>Old Growth</td><td>200+</td></tr>
</table>

* Non-forest includes roads, rock quarries, rural residential and agriculture lands, meadows, rock cliffs/talus and other natural openings.

**See footnotes to Table 16 in EA Section 3.3.5 (Wildlife)

Stand Structure and Development

The forest stands proposed for treatment are well stocked to overstocked, early mid-mature, mid-mature to mature conifer-dominated stands. Table 12 provides a summary of key descriptors for each unit.

Unit Level Descriptions

The RD in the Hole in the Road units ranges from 44 to 80 with a high canopy closures ranging from 73 to 88 percent. The stocking of these stands range from 100 to over 280 trees per acre.

Unit 15A & B: This stand is characterized as a mature, well-stocked, even-aged stand in the 140 year age class. Topographically, the stand lies on a generally north/northeast facing slope between 1,500 and 1,900 feet in elevation. Although no evidence of a past harvest or wildfire was observed, this stand likely regenerated through natural processes following a stand replacing disturbance in the late 19th century. The species composition is largely Douglas-fir with a minor component of Western hemlock, Western red cedar, red alder and bigleaf maple.

Structurally, these stands have a low to moderate level of complexity. There is a second cohort of approximately 40 hemlock saplings per acre in the understory and several dominant trees greater than 36" dbh. There is some physical damage to the dominant trees (broken tops) from wind events funneled through the Molalla River Corridor, some *Phellinus pini*, (red ring rot or white speck) and at least one pocket of mortality in the western polygon of 15A caused by *Phellinus weirii* (laminated root rot). There are few large snags within these stands.

Unit 16A: This stand is characterized as a mid-seral, well stocked, even-aged stand in the 50 year age class. BLM records indicate this stand was acquired in 1991 through the Molalla Land Exchange from Cavenham Timber. Consequently there are no BLM records of past harvests or treatments, but the stand was very likely planted following a regeneration harvest in the late 1960's.

Topographically, the stand lies on a gentle south to southwest facing slope between the South Molalla Road and the Molalla River at an average elevation of approximately 1,100 feet. The species composition and structure of this stand is rather simple and exhibits the attributes of a managed industrial plantation. Aside from a couple of natural openings in the eastern third of the stand, the stand consists predominantly of dense, Douglas-fir.

Units 16B and 21A: This stand is characterized as a mid-seral, well stocked, even-aged stand in the 40 year age class. The stand is comprised of two stands divided by two section boundaries – Sections 16 and 21. The portion of the stand that falls within Section 21 is O&C land that was clearcut harvested in 1968, planted and re-planted in 1970 and 1971 respectively, and pre-commercially thinned to 222 trees per acre in 1984. Section 16 was acquired in 1991 through the Molalla Land Exchange from Cavenham Timber. Just like Unit 16A there are no BLM records of past harvests or treatments, but based on the even-aged structure, homogenous species composition, and the measured ages in the stand exam, this stand was likely clearcut in the late 1960's and reforested with primarily Douglas-fir.

Collectively, both of these units are close to the stem exclusion stage of development and at an optimal stage of development for thinning. Considering that both stands were evidently clearcut harvested within a few years of each other, their adjacency to each other, and that the stand exam reveals two stands with negligible differences in metrics, both will be treated together.

Topographically, the stand lies on moderate north to northwest facing slopes between 1,500 and 2,200 feet in elevation. Although the structure and composition of this stand is rather simple, there are some *Phellinus weirri* pockets around mid-slope of unit 16B that has caused some over-story mortality and consequently contributed to a localized greater abundance and diversity of under-story species. There is a small swale with sedges and hardwoods on a bench along the bottom third of this unit.

Unit 21B: This stand is characterized as a mid-seral, well stocked, even-aged stand in the 40 year age class. Topographically the stand lies on moderately sloped west aspect between 1,400 and 1,800 feet in elevation. The stand was artificially regenerated from 1969 through 1971 following a clearcut harvest in 1968. The stand was subsequently pre-commercially thinned in 1984 to 222 trees per acre. Approximately eleven additional acres of an adjacent young stand is also recommended to be treated with this stand. This portion is four years younger, but very similar in terms of structure and composition to the rest of 21B. This eleven acre add-on was also artificially planted in 1979 and 1980, pre-commercially thinned in 1990 to 302 trees per acre, and aerially fertilized in 1998.

The stand structure and composition of the stand is a rather simple, one layered stand of primarily Douglas-fir with a minor component of Western hemlock, Western red cedar, and native hardwoods. Although the RD hasn't quite reached the stem exclusion stage of development, the conspicuous absence of saplings during the stand exam suggests that most of the available growing space has been accounted for by the overstory trees.

Unit 22A: This stand is characterized as an early mature seral, well stocked, even-aged stand in the 120 year age class. Topographically the stand straddles a generally northwest-southeast running ridge between Horse Creek to the west and an unnamed 1st order stream to the east that flows directly into the Molalla River. Slopes range from zero to nearly 90 percent while the elevation ranges between 1,600 and 2,200 feet.

Unit 22A incorporates portions of three different stands, two which have been thinned twice before in 1976 and 1988 under two different timber sales. Records indicate the third stand was also thinned twice in 1971 and in 1988; however the portion of this FOI that falls within the unit has not been previously treated. The relatively flat portion of this proposed unit, which have been thinned twice already, have fairly short trees for its age and relatively low five and ten year growth intervals. Some snags were created in this unit via service contract in the early 2000's.

In terms of structure and composition, the stand overall doesn't exhibit a high degree of variability in either of these categories. In the previously thinned portions of this unit, the stand structure is fairly simple. Past entries were likely "thin from below" prescriptions where the biggest and best formed Douglas-fir trees were left, thereby leaving a well-spaced residual stand of dominant and codominant Douglas-fir.

Unit 22B: This stand is characterized as a mature, well stocked stand, in the 130 year age class. Topographically the stand lies on a gentle to moderately sloped northeast aspect ranging in elevation from 2,200 feet to nearly 2,600 feet.

According to BLM records portions of this unit were thinned in the 1971 and in 1973. Despite the previous commercial thinning, the average stand density is very high at over 350 trees per acre with a Curtis RD greater than 80. For a stand over 130 years old, heights are low (likely averaging less than 100 feet). The average diameter of the stand is a low 12.5 inches; moreover, many of the five and ten year growth intervals measured during the stand exam reveal diameter growth less than ¼ and ½ inch respectively.

There is little differentiation in terms of structure, and the species composition is almost exclusively comprised of Douglas-fir and Western hemlock.

Unit 22C: This stand is characterized as a mature, well stocked stand, in the 130 year age class. Topographically the stand lies on a gentle north facing slope between 2,300 and 2,400 feet in elevation.

According to BLM records this unit was previously thinned in 1971 and the portion east of the 7-3E-22 Road was thinned again in 1981. The stand Quadratic mean diameter (QMD) is seven inches greater than 22B and average heights are well beyond 125 feet. This is partly a function of the high density conditions that 22B developed under, but more likely a function of those biophysical attributes (i.e. soil characteristics) that contribute to a more productive site.

The stand has a fairly wide diameter distribution, has differentiated, and to some degree is represented by three cohorts. The majority of the basal area is represented in the over-story layer which is over 130 years old and largely Douglas-fir. In addition to the over-story, a minor mid-story component of Douglas-fir and Western hemlock is approximately 90 years old, while an under-story layer of over 200 Western hemlock saplings per acre is approximately 25 years old.

Unit 22D: This stand is characterized as an early mature seral, well stocked, even-aged stand in the 100 year age class. Topographically the stand lies on a moderately sloped southwestern aspect at around 2,200 feet in elevation.

This stand regenerated after a stand replacing wildfire event likely during the first two decades of the 20th century, corroborated by the relatively frequent occurrence of decay class 4 & 5 snags with char. The species composition of this stand is rather simple and dominated by Douglas-fir with a minor component of Western hemlock and native hardwoods. Structurally, the stand has a low to moderate level of complexity attributed to the presence of larger diameter differentiated dominants, snags, and a patchy distribution of Western hemlock in the under-story. Upslope or north of the 7-3-22.1 road was commercially thinned in 1981.

Unit 27B: This stand is characterized as an early mature seral, well stocked stand, in the 120 year age class. Topographically the majority of this stand lies on a moderate to steep west facing slope between 2,300 and 3,100 feet in elevation.

The stand likely regenerated naturally following a stand replacing fire during the first two decades of the 20th century. Char was observed on decay class 4 & 5 snags in this unit. Additionally BLM records indicate 30 acres were salvaged following the Horse Creek Fire in 1976. Considering the structure and overall age of the stand, this appears to have been a low intensity/ low severity event.

Table 12. **Stand attributes of proposed harvest areas, before and after treatment with the Proposed Action**

T-R-S Unit,	Stand Age	GFMA harvest acres[17]	Proposed thin acres RR	Seral Stage	CWD feet/ acre[18] Hard/ Soft	Snags/ac >15" Dia. & >15' Tall Hard/Soft	Current Conditions: Trees per acre	Current Conditions: Avg. Dia.[19] (in)	Current Conditions: Curtis RD	Average Dia. Year 20 no treatment	After Treatment: Trees per acre	After Treatment: Avg. Dia. Year 1	After Treatment: Ave. Dia. Year 20	After Treatment: Curtis RD Yr. 1
7-3-15A	137	18	0	Mature	69/144	0/0	100	23.5	62	27.5	58	25.2	30.9	44
15B	119	17	0	Early Mature	115/0	0/0	152	20.9	80	26.5	62	24.7	30.1	40
16A	45	20	0	Mid Seral	0/0	0/0	159	14.8	50	18.7	81	17.1	22.1	31
16B	43	75	5	Mid Seral	0/0	0/0	197	13.9	54	17.5	94	16.1	20.6	33
21A	43	33	2	Mid Seral	0/0	0/0	244	12.0	55	17.3	92	16.5	20.9	33
21B	42	24	4	Mid Seral	0/0	0/0	174	15.2	56	19.1	81	17.8	22.5	42
22A	120	45	0	Early Mature	21/0	2.8/0	123	18.3	44	20.1	55	24.4	27.5	36
22B	133	25	0	Mature	86/0	0/0.7	364	12.5	88	16.0	69	29.5	22.5	35
22C	129	15	0	Mature	225/86	5.3/3.8	115	21.9	64	15.5	58	24.4	31.4	38
22D	104	21	0	Early Mature	114/57	0/1.7	161	20.3	80	23.6	54	26.2	30.3	38
27B	116	49	1	Early Mature	45/87	0/1.8	285	13.7	79	15.4	61	22.3	24.2	35
Totals		**342**	**12**											

[17] These acres do not include the 6 acres of Right-of-Way proposed for the project (see Table 1)

[18] Linear feet/acre (average), greater than 19 inches diameter and over 20 feet long, hard (decay classes 1-2)/soft (decay classes 3-5) logs.

[19] Quadratic mean diameter (QMD) is the diameter of the tree of average per tree basal area.

Threatened/Endangered/Special Status/Special Attention/Survey & Manage Plant Species

No Threatened and Endangered (T&E) vascular plant or suitable habitat was found during field surveys and there are no known sites within the proposed harvest areas as determined by a known site data search.

No Special Status species or Survey and Manage species were found during field surveys and there are no known sites within the proposed harvest area(s) as determined by a known site data search.

Invasive / Non-native Plant Species (including Noxious Weeds)

During field surveys the following invasive/non-native species were found to occur adjacent to the proposed harvest areas within road corridors; tansy ragwort (*Senecio jacobaea*), Canadian thistle (*Cirsium arvense*), bull thistle (*Cirsium vulagre*), St. John's wort (*Hypericum perforatum*), scotch broom (*Cytisus scoparius*), Himalayan blackberry (*Rubus discolor*), cut leaf blackberry (*Rubus laciniatus*) and meadow knapweed (*Centaurea pratenis*),

3.3.1.2 Environmental Effects

Proposed Action

Stand Structure and Development after Thinning in the Matrix

Observed Characteristics and Direct Effects Immediately after Treatment

The Proposed Action would increase the growth rates of the residual trees remaining after thinning. The stands should appear healthy with wider spacing between trees, and more uniform in spacing and in diameter and height. The average diameter of the forest stand would be larger that prior to thinning because "thinning from below" primarily removes the smaller trees from the stand.

Tree crowns would be more widely spaced, allowing more light to reach the forest floor. The wider spacing of the residual trees will result in increased growth of understory trees and shrubs which will provide a richer more diverse habitat for wildlife.

Some damage can be expected to the residual trees from the logging operation. Scraping of bark and damage to roots can be expected in or near yarding roads. There would be some visible damage to retained trees, but contract requirements and administration would prevent more than two trees per acre being damaged for more than half the circumference as defined in the PDFs. The total net yield for the site will not change but the final harvest volume will have larger and higher quality timber. By following standard Best Management Practices for logging, the soil disturbance will be kept to a minimum and should not adversely affect long term site productivity.

Observed Characteristics and Trends in the Long Term

In the long term (10-30 years), tree crowns would continue to grow as limbs grow longer and lower limbs continue to grow instead of dying and self-pruning. As crown closure increases (limbs grow and fill in the open space in the tree canopy) the amount of light reaching the forest floor would slowly diminish. Understory brush, conifer seedlings, and ground cover species would grow rapidly in response to increased light reaching the forest floor then begin to decline in vigor in the second decade as crown closure increases. Some areas of damaged bark and cambium on retained trees would heal while some of the trees with more than 50 percent of the circumference damaged would be expected to develop decay pockets or die and become snags. Some individual tree and small group wind throw would be expected.

Indirect Effects

Indirect effects would include diameter growth rates on retained trees increasing due to decreased competition for site resources (light, water, nutrients) resulting in larger trees available for future harvest or other management options (*EA Table 14*). Crown ratios would increase with lower crowns and larger limbs compared to trees in an overstocked stand. Stand structure would become more complex as understory and ground cover develops, compared to an overstocked stand with limited light reaching the forest floor.

Tree mortality, wind throw, and decay that began as a result of injury to some trees would add snags and CWD elements of structural complexity of the stands.

The following photos show stands in varying age classes in thinned and un-thinned conditions in the Lower and Upper Molalla River Watersheds:

Figure 11: Unthinned area, adjacent to Unit 8 of "Annie's Cabin" thinning sale. Approximately 60 years old. T6S, R3E, Section 30.

Figure 12: “Annie’s Cabin” Unit 8, post-thinning. Harvested in 2011. T6S, R3E, Section 30. Stand is approximately 60 years old.

Figure 13: "Annie's Cabin" Unit 8, post-thinning, adjacent to newly designed squirrel creek loop trail. Harvested in 2011. T6S, R3E, Section 30.

Figure 14: “B-Cubed” timber sale, Unit 3, 110 year old stand thinned to approximately 50 dominant TPA. Photo taken 10 years post-harvest. T7S, R3E, Section 3.

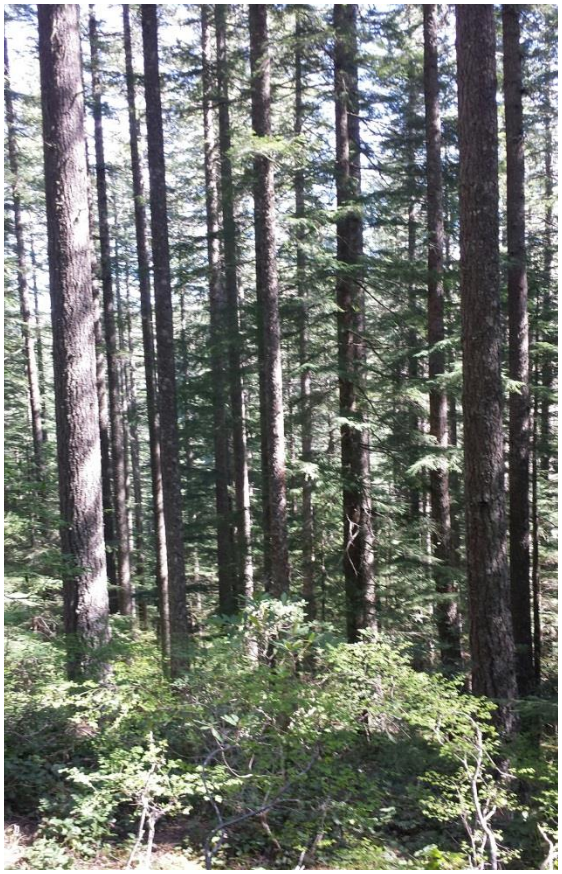


Figure 15: "B-Cubed" timber sale, untreated area adjacent to Unit 3. T7S, R3E, Section 3.

Stand Structure and Development after thinning in the Riparian Reserve

Observed Characteristics and Direct Effects Immediately after Thinning

Immediately following timber harvest the thinned stands would be very similar to the adjacent Matrix stands. The stands would be more uniformly spaced and more uniform in diameter and height than before treatment; portions of the stands within the RR are generally too dense to facilitate immediate development of older forest characteristics. The average diameter of trees should increase as many of the smaller diameter trees are removed from the stand.

Some logging damage would be evident. Additional snags (girdled trees) and CWD (up to 2 per acre each) would be added to the stands by not removing some merchantable trees which would be damaged by equipment or felled to facilitate logging (*EA Section 2.3.1., and Table 5 PDF*).

Observed Characteristics and Trends in the Long Term

Tree and forest stand growth patterns would be similar to those described for the adjacent Matrix stands. Growth of residual trees would increase and continue at a steady rate over the next 20 years. Crowns should expand and fill the gaps left in the canopy until the site is fully occupied. An increase in understory vegetation growth is expected initially but will become less vigorous as the canopy closes. Some conifer regeneration is expected. Advanced regeneration already in the stands will increase in growth and vigor.

Trees would continue to die, break, and/or fall due to disease, lightning, wind throw or snow break which would add to the numbers of decadent and asymmetric trees, snags and dead/down wood in the stands. Silviculture treatments may also be completed to create additional habitat features in the future.

Indirect Effects

As described above for the adjacent Matrix stands, increased growth rates would result in fewer, but larger diameter trees in the stands compared to unthinned stands. In addition to the effects described for the adjacent Matrix stands, the following effects which contribute to meeting the objectives of the RR LUA are described here:

Just as with the larger diameter of the overstory (dominant and co-dominant) trees, retained trees in the understory (intermediate and suppressed) would also grow larger in diameter due to increased sunlight penetrating through the canopy until the canopy closes and again suppresses those trees over the following several decades. Some of those would eventually die from suppression mortality in the next several decades and the resulting snags and down woody debris would persist longer as dead wood habitat and be valuable to more species than if they had died while they were smaller diameter trees.

The trees would develop deeper crowns which have more whorls of live limbs growing on a larger proportion of the total height of the trees because the limbs live longer. Deep crowns and large limbs provide microclimate and habitat features for species which prefer large limbs and crowns.

When large trees with large crowns die or fall over the next several decades, additional sunlight would reach the forest floor and stimulate growth in patches of the understory. Where a closed canopy remains intact, the understory would decline in vigor over the next several decades. These differences increase the structural complexity of the understory across the stand.

Threatened/Endangered/Special Status/Special Attention/Survey and Manage Plant Species

There are no known T&E, /Special Status/Special Attention/or Survey and Manage species or habitat within the proposed Hole in the Road project area. Due to the nature of the Proposed Action, potential adverse impacts to suitable habitat or any undiscovered Special Status or Survey and Manage species is not anticipated.

Invasive, Nonnative Species

In timber harvest areas adjacent to the proposed project area(s) there was no evidence to indicate that adverse impacts from invasive/non-native species would occur as a result of the proposed project. With mitigation measures in place, it is not anticipated that the proposed project would contribute measurably to the cumulative effects of invasive/non-native species in Oregon.

A Noxious Weed Risk Assessment (*BLM Manual 9015*) of the proposed project area was conducted and the area was found to have a risk assessment rating of moderate. A moderate rating indicates the proposed project should proceed as planned with measures in place to control the spread of the existing invasive/non-native species populations and prevent the introduction of new invasive/non-native plant species.

Cumulative Effects

No cumulative effects at the watershed level would be expected with regard to forest cover because the proposed thinning would maintain a forested setting in the same age class as before thinning and would not change overall vegetation patterns in the watershed.

Threatened/Endangered/Special Status and Survey and Manage Plant Species

No T&E vascular plant or suitable habitat was found during field surveys and there are no known sites within the proposed harvest area(s) as determined by a known site data search.

No Special Status or Survey and Manage species were found during field surveys and there are no known sites within the proposed harvest area(s) as determined by a known site data search.

No cumulative effects are expected to due to the nature of the proposed project and the habitat modification that would occur, and suitable habitat to support some Special Status and Survey and Manage Species within the proposed project areas would be modified but not lost. Suitable habitat would remain in reserve areas adjacent to the proposed harvest areas and although indirect impacts (i.e. increased sunlight, temperature increase, etc.) to reserve areas may occur, no adverse impact to that habitat is anticipated.

Invasive/Non-native Plant Species

No cumulative effects are expected with regard to invasive/non-native plants because the project would not contribute to the spread of invasive species populations or to the introduction of new species with the implementation of project design features; and little or no difference in the composition or numbers of invasive/non-native species populations have been observed in similar projects on BLM lands in the vicinity.

No Action Alternative

Stand Structure and Development (all land use allocations)

In the short term the current stands would continue to grow to increasing density. In the untreated, overstocked stands height growth would continue at approximately the current rate while diameter growth continues to slow. Slower diameter growth develops stronger wood with a higher proportion of heartwood compared to faster growth, but it takes longer to develop source material (large diameter live trees) for recruiting the large-diameter dead wood (snags and CWD) that are especially valued as habitat (*EA Section 3.3.5 Wildlife*). Heartwood is generally stronger and more decay resistant than sapwood, so a higher percentage of heartwood with smaller growth rings tends to result in suitability for some high-strength wood products and more durable dead wood which persists longer in the forest stand.

The limbs of any closely spaced trees in an overstocked stand touch and interlock, blocking most of the sunlight from reaching anything below the dense canopy. Lower limbs of dominant and co-dominant trees, the entire crown of trees in the intermediate and suppressed positions, and understory vegetation in the stand would continue to be shaded. In addition to competing for light, all vegetation would compete for limited nutrients and water. Competition for site resources of light, water and nutrients leads to the following trends:

As lower limbs in the crown self-prune, crown size relative to the height of the tree (crown ratio) would continue to decrease. This leaves tall, clean boles with no limbs below a relatively small crown. As this trend continues trees lower limbs are shaded by adjacent trees, very few crowns develop large diameter limbs which may reduce stand vigor and so reduce resilience and resistance to disease, insects, wind and fire. Clear boles with small knots contribute to higher lumber grades while small diameters contribute to higher logging and processing costs.

The smallest trees would die from lack of sufficient site resources, a process called suppression mortality, which naturally thins the stand. Over time, suppression mortality limits or eliminates conifers from the subdominant positions in the stand. This natural thinning process creates relatively large numbers of small diameter snags from the smallest trees in the stand. Small diameter snags tend to be short-lived, falling to become short-lived, small diameter woody debris on the forest floor. Trees which die from suppression mortality are lost as potential commercial forest products.

Understory vegetation including conifer reproduction, brush and ground cover plants would decrease in abundance, size and species diversity without sufficient light reaching the forest floor.

The accumulation of small diameter dead and decaying wood on the forest floor increases fuel loads without green vegetation to hold moisture. This increases potential for fire spread and resistance to control in the stand (*EA Section 3.3.6*).

Trees would continue to grow with a slower rate of diameter increase compared to thinned stands, yielding larger numbers of smaller diameter stems with denser wood (higher ring count per inch) and a higher proportion of heartwood compared to thinned stands. In Matrix stands these trends affect sustained yield timber production because: The future logging costs per unit of wood volume would be higher for many small logs compared to the same board foot volume in fewer large logs. The market for wood with those characteristics would probably be different from the faster grown wood that results from thinning, but there are too many market variables to predict relative value. Suppression mortality would result in those trees never being harvested for wood products, reducing the total net yield and value of the stands over the full rotation.

In Riparian Reserve stands these trends are important because: The long term, indirect effects of stands developing from overstocked stands often delay or preclude characteristics associated with some late-successional and old-growth stands such as large diameter trees, snags and CWD; large crowns with large diameter limbs; healthy conifers in understory and intermediate canopy positions; and well developed understories of brush and ground cover species. Many of the desired characteristics would eventually develop without silvicultural management but these fully to overstocked conifer stands are overrepresented at the landscape level on BLM lands and the No Action alternative would miss the opportunity to increase the variety of stand types across the landscape (diversity) which provides a wider variety of stand structures and habitat for a variety of species than large tracts of uniform stands provide.

The dominant trees in some existing old-growth forest stands have long (100 feet), clean boles, while others developed with large limbs much nearer the ground (less than 50 feet). It appears (BLM observations, personal communication) that the first type grew from dense stands that self-pruned and the large trees survived for centuries while many of the smaller trees died and allowed multiple stories to develop. The No Action alternative would trend toward extensive stands of relatively uniform and dense second growth forests developing along the first trajectory while bypassing the opportunity to introduce the second trajectory in the stands proposed for treatment under the action alternatives.

Tappeiner et al. (*1997*) determined that the complex tree and stand structures associated with some old-growth forest stands such as large limbs lower on the bole apparently developed with low stocking levels (as low as 40-50 trees per acre) rather than from self-thinning of overstocked stands. Stands with this type of old-growth trajectory based on lower densities would be rare in the uniform stands in this watershed without management action.

Threatened/Endangered/Special Status/Special Attention/ Survey & Manage Plant Species and Invasive / Non-native Plant Species (including Noxious Weeds)

No changes to existing conditions and trends would be expected.

3.3.2 Hydrology

Sources: Hole in the Road Hydrology/Channels/Water Quality Specialist Report (Hydrology Report); Hawe, 2015, Hole in the Road Fisheries Report; Zoellick 2016; Hole in the Road Logging Systems Report; Bernards 2015

Methodology:

- o BLM's Hydrologist researched public records for beneficial uses and various aspects of water quality and stream status.
- o The Hydrologist examined the project area and vicinity to determine current status of stream conditions, water quality, stream locations and wetlands.
- o The Hydrologist used the State of Oregon Risk Assessment tool to evaluate the immediate and cumulative effects of potential harvest on peak flows in area streams.
- o The Hydrologist evaluated roads, stream crossings and proposed logging and road work plans to evaluate current and potential sources of sediment.

3.3.2.1 Affected Environment

Precipitation and Basin Hydrology

The project area is located in the Oregon Western Cascades range at elevations between 1,000-3,600 feet[20]. Most of the proposed project area lies in the transient snow zone (TSZ), an area subject to rain-on-snow events (ROS) that have the potential to increase peak flows during winter or spring storms. The project area receives approximately 60-80 inches of rain annually; increasing steadily from west to east with elevation. The approximate mean 2-year precipitation event is between 3.0 and 3.5 inches in a 24-hour period (estimated at: http://www.nws.noaa.gov/ohd/hdsc/noaaatlas2.htm).

The project is in the Pine Creek and Headwater Molalla 6th field Watersheds with approximately 46,349 combined acres (72 miles^2) in drainage area. The area is tributary to the Molalla River main channel, upstream of river mile 30 (*USGS 4th field watershed #17090009 in the Willamette*

[20] Unless otherwise indicated, geographic information is an estimate derived from the BLM GIS database.

Basin). The Molalla watershed is utilized as a drinking water source for the cities of Molalla and Canby; therefore, the project lies within the headwaters of the municipal watershed. The project is not located in a key watershed.

Project vicinity stream channels (ACS Objective 3)

The project area is situated in the Western Cascades physical province and streams reflect the geologic origin of the area[21]. Most of the terrain around the treatment units is composed of undifferentiated tuffaceous sedimentary rocks, tuffs, and basalt from the late Oligocene and early Miocene epochs approximately 30 million years before present. More recent basalt flows from flats and escarpments at higher elevations on the watershed ridgelines.

Stream channels immediately adjacent to, or in some cases within, the proposed treatment units are a mix of 1st order headwater channels with intermittent flow that converge in 2nd - 3rd order perennial channels tributary to the Molalla river.

The Cascades Field Office Hydrologist determined that all channel reaches observed in the project vicinity were in "proper functioning condition" (PFC) (*USDI, 1998*) because there is adequate vegetation, landform, or large woody debris present to: dissipate stream energy, filter sediment, aid ground-water recharge, aid floodplain development, stabilize streambanks and maintain channel characteristics. [22]

Intermittent channels

The small headwater tributary channels formed in the deeper soils of the benches and ridges in the project area flow intermittently on the surface before disappearing underground, only to pop out again down-slope. It's likely that ground water and intricate patterns of subsurface flow, as opposed to surface run-off, is the primary system of water delivery to these channels. Most are moderate gradient (4-10 percent) with small substrates (sands and small gravels) reflecting the adjacent soils. Utilizing the Montgomery-Buffington typology (*Montgomery & Buffington, 1997*), these channels would be classified as colluvial: "small, headwater streams at the tips of a channel network that flow over a colluvial valley fill and exhibit weak or ephemeral fluvial transport." Most have too low of a gradient to be subject to debris torrents or landsliding.

Some of the small tributaries in the project area are much steeper and potentially unstable due to channel incision into the resistant volcanic rocks. The basalt cliffs on the northwest side of the Molalla main channel in Section 16 support channels of this type. These channels are often steep A3/4a+ channel types (Rosgen classification): steep channels incised into resistant bedrock and subject to debris flows. They have slope gradients that are prone to landsliding and, because it is difficult for conifer in these locations to establish, they tend to be dominated by deciduous species such as red alder and salmon berry. Due to the relatively frequent disturbance regime in

---

[21] For a more detailed description of stream channel formation and geomorphology the reader is referred to ***Geomorphology of Steepland Headwaters: The Transition From Hillslopes to Channels*** (Benda *et al*., 2005).

[22] A determination of "proper functioning condition" means that the channel elements and physical processes are in working order relative to an area's capability and potential. It does not mean that the channel is functioning at full biological potential or that nothing could be improved by human intervention (i.e., placing additional wood structure, repairing infrastructure, thinning adjacent forest, etc.).

these channels, they are often open (i.e., not fully stocked) and "brushy" with large quantities of downed wood and heavy loads of sediment in transport.

Perennial channels

The small headwater tributaries adjacent to the proposed treatment units eventually reach larger perennial channels (Horse Creek and Gawley Creek) that flow to the Molalla main channel. These larger 3rd order streams have entrenched into the relatively resistant bedrock forming constrained valleys with moderately steep adjacent slopes (average 50-60%). There is a low to moderate supply of gravel and cobble sized material actively transported in these Rosgen "B3" channel types. Utilizing the Montgomery-Buffington typology, these perennial streams would be classified as step-pool channels: "Step-pool morphology generally is associated with steep gradients, small width to depth ratios, and pronounced confinement by valley walls."

Some of these channels are shaded by dense stands of second growth conifer; others are dominated by hardwoods with an understory of salmon berry and shrubs. Wood and shade are limited on the main Molalla River channel adjacent to the project area (*Figure 16 below*). Banks are stable and channel morphology is controlled by bedrock features with a cobble-boulder bed. Shade here is largely a result of topographic features as the main channel is confined to a deep bedrock canyon with little floodplain. Trees of any age or size class on the adjacent terraces have little or no influence over channel form or function in this reach. The perennial channels in the project area are highly resilient and unlikely to be altered significantly by disturbance.

Figure 16: View upstream adjacent to 16A. Note solar angle on North Slope (3PM in August), where the south slope (left side) provides no shade.

Existing roads in relation to stream channels

In most locations culvert dimensions (shape, area and slope) are adequate to allow for the transport of most or all of the water, sediment and organic materials from upstream. In this case, the stream is said to be "at grade" and channel morphology upstream of the road fill is not affected.

In some cases (*EA Section 2.3.1*) undersized culverts and/or collapsed road beds have restricted the passage of water, sediment and organic materials from upstream resulting in the deposition of sediment above the crossing and the stream is said to be "aggraded". The length of aggraded channel upstream of culverts will vary with channel slope and the supply of material and water, but (based on professional judgment and observation) is generally restricted to less than 100 feet in the small streams in the project area.

There are several perched culverts throughout the project area where culvert outflows erode the channel bed. Perched culverts may restrict upstream passage for aquatic organisms.

Area wetlands

There are two wetlands in the project area identified on National Wetlands Inventory maps. Both sites are adjacent to Unit 16A on the main Molalla River channel and are classified as R3USC (e.g., riverine, perennial with unconsolidated shoreline). The BLM GIS Water Bodies theme (for smaller wetlands, ponds and lakes), which has more detailed mapping of wet areas within the project and the BLM GIS Timber Production Capability Classification (TPCC) theme and has a category for sites with high water tables (symbol- FW, or fragile water), identified small forested wetlands throughout the area associated with perennial channels. These inventories are based primarily on review of aerial photographs with some field verification and thus small (less than 1 acre) areas with high water tables may not have been identified, particularly when situated under forest canopy. During field review of the project area locations with high water table were identified and, where appropriate, either the TPCC, hydrology, or lakes GIS themes were updated to reflect these features. In all cases wetlands and areas with high water tables (i.e., "wet areas") are excluded from treatment.

Project Area Hydrology (ACS Objective 6)

Stream Flow

The Molalla River is gauged several miles downstream from the project area near Canby, Oregon. Bull Creek, a small tributary to the Molalla upstream from the project watersheds, has been gauged since 1993. None of the tributary channels in the project area have been gauged. Stream-flow is typical of Western Cascades streams where most stream flow occurs during winter storm events.

Base-flow or low-flow occurs during late summer and early fall when mean stream discharge drops below 20 percent of the mean winter flow. Many small headwater channels dry up completely during this period. For a more complete discussion of the flow characteristics of the Molalla see the Molalla River Watershed Analysis (*U.S.D.I. 1999*).

Peak Flow

Peak flow refers to the instantaneous maximum discharge associated with individual storm or snowmelt events (*U.S.E.P.A. 1991*). In the Western Cascades, peak flows are often associated with rapid and substantial depletion of the snow-pack during prolonged ROS periods. The two largest peak flow events in the last century took place in 1964 and in February of 1996. Both were estimated at or above a 100 year flood return interval and both were in response to substantial snow pack melt-off. Smaller peak flows are associated with snow pack melting during the spring. The State of Oregon has estimated peak flows for most watersheds in Western Oregon, including project area watersheds. These estimates may be viewed at the following web site: http://www.wrd.state.or.us/surface_water/flood/index.shtml.

Potential for peak flow: current conditions

Gawley Creek (GC) and Horse Creek (HC) 7th field Watersheds currently have low risk for peak-flow enhancement due to forest openings in the project area (*OWEB 1997*). This low risk is primarily because these watersheds are largely outside the elevation zones for ROS events.

Table 13 displays statistics in the Gawley Creek and Horse Creek 7th field Watersheds. The proportion of the Gawley Creek and Horse Creek 7th field Watersheds in ROS is 75 percent and 62 percent, respectively. The risk of peak flow enhancement will vary with the proportion of this area that has crown closure of <30 percent *(see horizontal axis, Figure 17*). At present, 17 percent and 12 percent, respectively, of the ROS areas have been recently harvested (based on 2012 satellite imagery review) placing the watershed well below the line for “potential risk” (*see blue and red markers on Figure 17*). This analysis indicates that there is currently a low risk for peak-flow enhancement due to forest openings in the project area, primarily because these watersheds are largely outside the elevation zones for ROS events.

Table 13. **Risk of Peak Flow Enhancement by 7th field Watershed in Hole in the Road**

7th Field Subwatershed Name	*Watershed Area (acres)*	*Percent of Watershed in ROS Areas*	*Percent of ROS area with <30% Current Crown Closure*	*Peak-Flow Enhancement Risk*
Gawley Creek	3,382	75% (2,538 acres)	17% (431/2,538 acres)	Low
Horse Creek	5,774	62% (3,603 acres)	12% (446/3,603 acres)	Low

Figure 17: Graph for determining risk of peak flow augmentation.

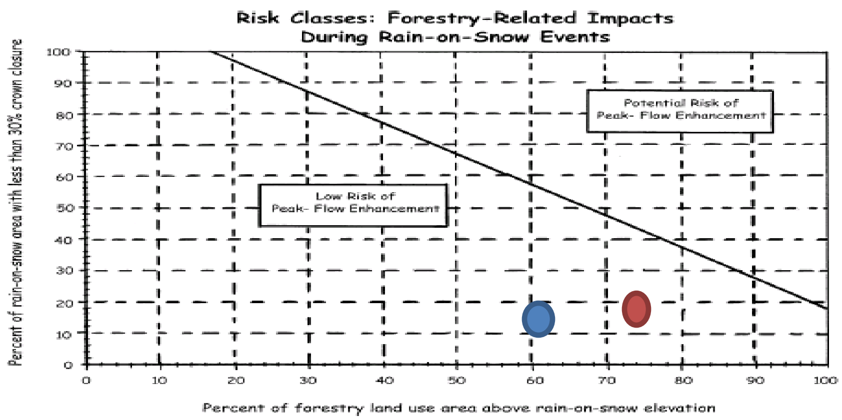


Figure 3. This graph is used to help you estimate the risk of peak-flow enhancement to subwatersheds from forestry-related impacts during rain-on-snow events.

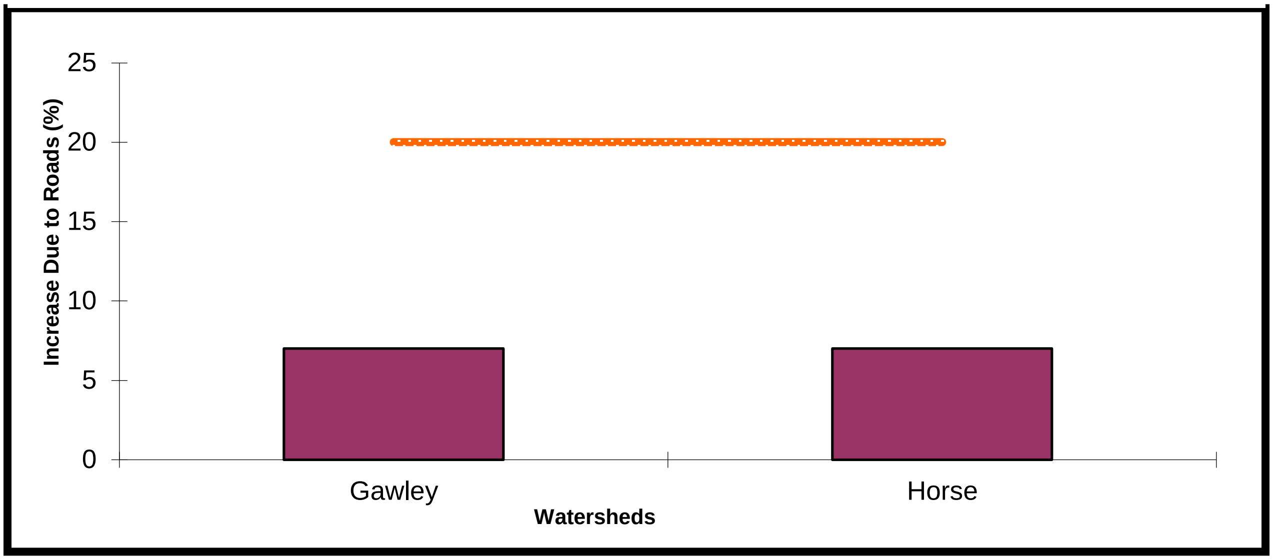
Peak Flow[23]/Water Quality Effects from Roads

Watersheds in the project area are currently at low risk for augmentation of peak flows due to the road network because the watersheds analyzed would have only a 7 percent increase in stream length due to stream/road intersections. Toman (*2004*) and Wemple et al. (*2003, "the Wemple study"*) identified roads as potential contributors to increased peak flows in the Western Cascades, acting as an extension of the stream network when ditches intercept water and route it directly to streams. The Wemple study indicates that stream drainage increases of approximately 20 percent or greater (indicated by the line in Figure 17) have the capacity to alter the timing and quantity of peak flows.

As a surrogate for risk, the increase in drainage density due to road/stream intersections was calculated for the two seventh field watersheds in the project area. Figure 18 displays estimated channel network expansion at road-stream intersections for two project 7th field watersheds (Gawley and Horse Creeks) assuming a 200 foot increase in stream length/road intersection.

[23] OWEB, 1997 located at http://www.oweb.state.or.us/OWEB/docs/pubs/OR_wsassess_manuals.shtml

Figure 18: Estimated channel network expansion at road-stream intersections for project watersheds.



Roads in the project area were inspected by the Cascades Field Office specialists. Most road surfaces are well maintained and in good condition with little potential to contribute fine sediment to area streams.

Streams near roads are at higher risk for water quality contamination from arterial washed off the road surface and for increased stream temperature as a result of reductions in streamside shading. During storms, runoff from unpaved forest roads may deliver sediment to streams resulting in increased sediment transport, deposition of fines in gravels and turbidity levels that exceed natural background levels (*Beschta 1978; Binkley and Brown 1993*).

Project area ground water

The Oregon Department of Environmental Quality (ODEQ) has not identified any groundwater pollution problems within project watersheds. The Water Resources Department (OWRD), together with the ODEQ, is responsible for the regulation and protection of ground water quality and quantity in Oregon.

Local conditions of groundwater relative to quantity, location, flow and quality is understood only in a general sense. In the forested uplands, water that drains from the soil profile quickly moves along preferred pathways in the subsurface either to emerge again down-slope as a "spring," become trapped in subsurface storage, or infiltrate deeply into the watershed aquifer. Thus, the forested uplands are groundwater "recharge" zones: the surface and subsurface conditions in headwaters ultimately may influence the quantity and quality of groundwater in the valleys below. In forested uplands, shallow ground water levels fluctuate in response to seasonal patterns of precipitation. Interaction between surface flow and subsurface flow is intricate and varies across the landscape in response to conditions in soils, topography and lithology.

The soils in the project area have infiltration rates between 0.25 - 2 inches/hour. Under natural conditions, most precipitation either drains through the soil profile or is transpired by vegetation rather than becoming surface runoff.

Areas of existing compaction do not have an identifiable effect on overall infiltration or groundwater in the project area because these compacted areas are generally scattered and at different stages of recovery. It is expected precipitation in compacted areas will puddle near the soil surface, free to either transpire, evaporate or runoff and infiltrate adjacent vegetated areas.

Forest roads and landings can intersect ground water and reroute it to surface streams, which can alter patterns of subsurface flow. This conversion of ground water to surface run-off can alter the timing and size of peak flows and result in a proportionate reduction in water available for ground water storage (*see the previous discussion "Peak Flow/Water Quality Effects from Roads*").

Water Quality and Beneficial Uses

The State of Oregon designs the beneficial uses for which all waters of the state are utilized. Water quality standards are ultimately meant to protect beneficial uses of water in the state, as designated by the State of Oregon, http://www.oregon.gov/DEQ/WQ/index.shtml/.

Designated Beneficial Uses and Water Rights

Identified site specific beneficial uses of surface water from the project area are displayed in Table 14.

Table 14. **Beneficial uses associated with streams in the project area**

Stream (Watershed)	Project Action	Beneficial Use	Distance from Project Action	Information Source
Molalla River	Timber harvest: density management Road construction and reconstruction.	Salmon rearing and spawning	Immediately downstream in Molalla main channel .	BLM
		Resident fish & Aquatic Life	Adjacent to several units	BLM
		Irrigation & Domestic Drinking Water	> 10 miles in main stem Molalla river	WRIS*
		Municipal Drinking Water (Cities of Molalla and Canby)	> 10 miles in main stem Molalla river	WRIS*

*WRIS – Water Rights Information System of the Oregon Department of Water Resources

There are two municipal water users on the Molalla downstream from the project area as well as water withdrawals for domestic use, irrigation and livestock watering. Both resident and anadromous fish are downstream from several of the proposed units. Additional beneficial uses include: Industrial Water Supply, Wildlife & Hunting, Fishing, Boating, Anadromous Fish Passage, Water Contact Recreation, Aesthetic Quality and Hydro Power. Designated beneficial uses for the Willamette Basin may be viewed on-line at: http://www.deq.state.or.us/wq/standards/GenBenUseTablesFinal/FTable340A_Willamette.pdf

Municipal Water Providers and Source Water Assessments

The Cities of Molalla and Canby withdraw water from the lower reaches of the Molalla River to treat and provide city residents with drinking water. A *Source Water Assessment* for the water provider is available on-line at: (http://www.deq.state.or.us/wq/dwp/swrpts.asp).

The source water assessment for Canby identified 111 potential sources of contamination within the watershed; forestry related activities were noted specifically, cited as a potential source of contamination. The source water assessment for Molalla identified 34 potential sources of contamination within the watershed; forestry related activities were specifically noted three times at locations of identified "clearcut logging" and cited as a potential source of contamination.

Water Quality Limited Streams

The ODEQ's 2010 Integrated Report on surface water quality is a database compilation of streams (http://www.deq.state.or.us/wq/assessment/2010Report.htm) which do not meet the state of Oregon's water quality standards

The water quality parameters with the potential to be affected by forest harvest and road construction and maintenance include stream temperature, dissolved oxygen (DO) concentrations (both inter-gravel and in water), and turbidity. Additional water quality parameters (e.g., nutrients, pesticide and herbicide residues, bacteria, etc.) are not highly sensitive to forest harvest and road construction (*U.S.E.P.A. 1991*) and were not reviewed for this analysis.

Stream Temperature

The Molalla River was listed as not meeting water quality standards for summer stream temperatures. In response, the ODEQ has developed a Total Maximum Daily Load (TMDL) for the Willamette basin. As part of the TMDL, the BLM submitted the Salem and Eugene District Water Quality Restoration Plan (WQRP) for the Willamette Basin which details how the BLM will implement the TMDL on federal lands. The plan was approved by the ODEQ on July 18, 2008.   BLM will implement the WQRP on all public lands in the project area even when they lie upstream from the stream segments listed as water quality limited.

The Molalla Watershed Analysis indicated that summer stream temperatures at two sites (Pine Creek and at Horse Creek bridge) near the project area (measured in the summer of 1997) were found to be above the State of Oregon's threshold of 17.8° C. These sites were monitored again in the summer of 2004. The lower site at Pine Creek (T. 6S, R. 3E, Section 30 at river mile 27) was again above the State of Oregon standard for portions of the summer. The upper site near Horse Creek (T. 7S, R. 3E, at river mile 38) was also above standard during much of August 2004.

The Molalla Watershed Analysis indicated that the openings in the canopy along portions of the main channel might be contributing to increased stream temperatures. Crown closure is less than 35 percent adjacent to large portions of the main channel and many tributaries in the watershed, particularly on private land. However, field surveys, review of aerial photographs and Lidar data indicate that shading is near to full potential along most of the small streams on public lands in the project area with canopy closure exceeding 80 percent along most reaches.

No stream temperature data has been collected on any of the small tributaries or headwater streams that flow out of the project area on BLM lands. However, most of these tributaries are intermittent and do not flow in the summer. In addition, full forest cover on the public lands adjacent to these streams likely maintains temperatures below the state threshold and within the range of natural variation.

Dissolved Oxygen, Inter-gravel Dissolved Oxygen, pH, and Conductivity

No data for these variables in the immediate project area was located for this assessment. Since all the channels in the project area are currently well shaded and in proper functioning condition, it's likely that these water quality variables are well within the range of natural variability.

The Molalla Watershed Analysis reported pH and conductivity data for two sites at the mouth of Pine Creek and Horse Creek, downstream from the project area. Values for these variables were within the range expected for Western Oregon streams and did not exceed state water quality thresholds.

Sediment Supply, Transport and Turbidity[24]

Mass wasting

The project area was field reviewed for mass wasting potential and there are no mapped landslide features in the project area. Mass wasting is the primary process responsible for the bulk of sediment production and transport in mountainous terrain. Sediment transport in headwater basins is dominated by highly episodic, large erosion events. 64 percent of the suspended sediment transport for the entire year of 2004 occurred in the Little North Fork Santiam, only a few miles from the project area and consisting of similar geology, in a single three day storm event (*North Santiam River Basin Turbidity and Suspended-Sediment Study*[25]). This is not atypical and therefore, short term approaches to understanding, measuring, studying and quantifying sediment transport and yield are likely to miss the most important events.

Surface erosion, stream bank and channel erosion

Soil surface run-off or overland flow (water moving over the surface with the energy to erode soil) is rarely observed on forest slopes (*Leopold 1997*). Due to the high infiltration capacity of local soils, heavy vegetative growth and deep layers of surface organic material (i.e., soil duff-layer), surface erosion on undisturbed forested land in the project area is rare.

Unusual levels of stream bank and channel erosion were not observed in field surveys of streams in the project vicinity. Historically, channel roughness throughout forested regions in Western Oregon was quite high due to large quantities of wood in channels and the activities of beaver.

---

[24] For a more detailed description of sediment supply and transport processes in forested watersheds and the effects of forest management on these processes the reader is referred to *Suspended Sediment Dynamics in Small Forest Streams of the Pacific Northwest (Takashi et al, 2005)* and *Sediment Transport and Channel Morphology of Small, Forested Streams (Hassan at el., 2005).*

[25] http://or.water.usgs.gov/proj/or00311/index.html).

Streams in the project area appeared to have moderate levels of wood in place with well vegetated banks.

Stream power increases with higher peak flows and with narrowing or increasing the gradient of a channel such as may occur when a culvert is installed, which could increase the rates of ban and/or channel erosion. Indicators of increased stream flow (relative to historic ranges) in project area streams were not noted during field surveys. Channel adjustments at culverts were within the range expected for these channel types.

***Turbidity and Sediment*[26]**

Limited data for stream turbidity or sediment delivery in the project area was located for this assessment. Some storm turbidity data was collected throughout the Molalla basin by the BLM in 1996. Pine Creek was identified as exhibiting some "high" turbidity values. However, the highest recorded in this period was 19.5 Nephelometric Turbidity Units (NTU)[27], which is low compared to NTU's in the hundreds reported in the North Santiam river in the same year. Since these were "grab" samples at single sites they could not be used to determine if state water quality criteria for turbidity had been exceeded.

3.3.2.2 Environmental Effects

Proposed Action

Channel and Wetland Morphology (ACS Objective 3)

Direct and Indirect Effects

In general, there would be no direct alteration of the physical features of project area stream channels or wetlands under this proposal: stream banks, channel beds and wetlands are protected with no entry buffers (i.e., stream protection zones or SPZ) from direct physical alteration or disturbance by harvesting equipment. With the exception of the proposed restoration of road/stream crossings (discussed below) direct disturbances by equipment or yarding are kept out of SPZ.

In addition, the Proposed Action is unlikely to affect stream flow (see the following discussion under watershed hydrology) and therefore any indirect effects to stream channels as a result of flow alteration or timing is unlikely. Thus, the Proposed Action would not result in detectable effects to channel morphology, such as increases in bank erosion, channel incision, scouring of substrates or gravel deposits utilized by fish for spawning, loss of floodplain connectivity or alteration of local wetland hydrology that could result from augmented peak flows or altered watershed hydrology.

New road construction would not cross stream channels or wetlands, however, work at stream crossings that have not been maintained is proposed. Engineering review has determined that these stream crossings are failing fills and/or culverts or the culverts are undersized (*EA Section 2.3.1*, *Table 2).*

---

[26] For a description of sediment supply and transport processes in forested watersheds and the effects of forest management on these processes the reader is referred to **Suspended Sediment Dynamics in Small Forest Streams of the Pacific Northwest** (Takashi *et al*, 2005)

[27] ***http://or.water.usgs.gov/grapher/fnu.html***

Approximately 1-2 culverts would be installed or replaced on stream crossings on the road accessing Unit 15B. Approximately 14 cross-drain culverts would be installed or replaced on existing roads to access Units 15B, 21A, 22B, 22D and 27B. Replacement of these culverts would provide improved stream flow and passage of sediment, organic materials and aquatic organisms and will eliminate the chronic erosion and turbidity at these sites. Some slight channel adjustment to grade or width may occur within the first year (varies with the timing and magnitude of storm events) following disturbance as the channel reaches equilibrium with flow and sediment transport. Based on previous experience with these type of channel crossings (i.e., judgment of the field hydrologist) long term effects to channel function or morphology from disturbance at these sites would be unlikely because the channels are resilient (i.e., they resist change) and would adjust to accommodate the disturbance without creating bed or bank instability. Channel morphology adjustments would be unlikely to extend more than 100 feet upstream or downstream from the site of disturbance.

Cumulative Effects – Channel and Wetland Morphology/Physical Integrity

With the exception of disturbance to the channel at the culvert replacement sites, the Proposed Action would not result in any direct effects to channel or wetland morphology and therefore would have no cumulative effect. At the locations of direct channel disturbance, adjustments would be limited to the site of disturbance (i.e., not extend more than 100 feet downstream or upstream from the disturbance) and would not result in alterations to channels or floodplains downstream or elsewhere in the watershed. Channel adjustments at the site of disturbance, if they occur at all, would be of relatively low magnitude and short duration (channel adjustment within one year). Finally, since channels in the project area already have properly functioning dimensions and form (*see discussion in Affected Environment*) there is no cumulative effect to contribute.

Project Area Hydrology (ACS Objective 6)

Mean Annual Water Yield

Increases in mean annual water yield[28] following the removal of watershed vegetation have been documented in numerous studies around the world (*Bosch et al. 1982*). Forest vegetation intercepts precipitation and through the processes of sublimation (the direct conversion of snow from a solid to a gas without entering a liquid phase) and/or evapo-transpiration, the forest returns to the atmosphere over 50 percent of the annual precipitation that might otherwise become runoff. Therefore, this proposal would likely result in some incremental increase in annual water yield correlated to the removal of the conifer over-story (*Troendle et al. 2006*). However, other than the augmentation of peak and/or base flows (discussed below) the "increase in fall and winter discharge from forest activities is likely to have little biological or physical significance" (*U.S.E.P.A. 1991*).

Base flow and fog-drip

No studies have been located for this analysis to indicate that fog drip is a large contributor to stream flow in the project area. In addition, no studies have documented reductions in fog drip

[28] Total yield of water from a watershed in one year averaged across a period of record.

with forest stand thinning, as in this case. Based on these two factors, it is unlikely the proposed action would have a detectable effect on fog drip.

Outside of fog-drip zones, total removal of the forest cover usually results in an immediate increase in summer base flow (i.e., low-flow), presumably due to the reduction in evapo-transpiration and interception, followed by a slow recover to pre-treatment flows after several years (*Harr et al. 1979*). Similarly, small watershed studies in the Pacific Northwest have shown that forest harvest typically increases summer low flows[29].

The Mount Hood National Forest completed an assessment of fog drip effects on low flows in the Upper Sandy Watershed Assessment of 1996 (*pp. 4-162*). Based on research in the Bull Run watershed, in areas where fog drip is a major source of precipitation, clear cut harvesting resulted in a decline in low flow. They note that reductions in low flows in the Bull Run watershed study were attributed to reductions in fog drip in Fox Creek after 25 percent of the watershed was clear cut in the 1970s. However, recovery of fog drip and the expected increase in low flow due to reduced evapo-transpiration was later observed after a few years of vegetation re-growth.

Peak Flows

This proposal would not increase openings (areas greater than 30 percent canopy closure) within the TSZ in project watersheds. Since canopy closure will remain greater than 30 percent in this proposal, the increase in snow accumulation and melt-off during ROS events would remain below a level likely to result in measureable increases in peak flows according to the State of Oregon risk assessment methodology (*see page 9 of Hydrology report).*

Peak Flow effects from Roads

Road construction in this project has a low risk of altering watershed hydrology or peak flows because intercepted water does not reach stream channels any faster than precipitation which falls on the forest floor. Figures 17 and 18 in EA Section 3.3.2.1 show the 7th field watersheds for the project area are well within the range of "low risk" for increase in peak flows.

New road locations are proposed on slopes generally under 30 percent and would not require full bench or cut and fill construction. Roads constructed on these surfaces result in little or no sub-surface disturbance. These roads would have no effect on sub-surface or groundwater flow and thus have no effect on the timing or volume of stream flow in the watershed (*Wemple et al 2003*). Since no additional permanent stream crossings are proposed, there would be no additional routes for water intercepted by road surfaces to reach streams. Intercepted rainfall on these roads would be drained to the adjacent undisturbed forest floor where, because of the high permeability of forest soils, it quickly infiltrates into the ground.

Groundwater

The Proposed Action is unlikely to affect peak or base flow and so, by extension, it has little capacity to affect groundwater patterns which are intimately linked to the surface. Compacted surfaces will be limited to less than 10 percent of the project area and will partially coincide with existing compacted surfaces. New road construction is unlikely to intersect ground water flow.

[29] MacDonald, Lee H. 1991. Monitoring Guidelines to Evaluate Effects of Forestry Activities on Streams in the Pacific Northwest and Alaska. Page 95. EPA/910/9-91-001.

These surfaces are located on topography with low to moderate slope so water that does not infiltrate here will either be evapo-transpired or will infiltrate quickly into adjacent soils that are not compacted.

Cumulative Effects – Peak Flows

The proposal is not likely to result in a direct effect to peak or base flow, thus the proposal would not contribute to any cumulative effects to peak or base flows in these watersheds. Current condition of the watersheds in the project area indicates low risk for augmentation of peak flows due to forest openings. The Proposed Action would result in no net increase in forest openings in ROS areas with crown closure less than 30 percent and therefore would not contribute cumulatively to the augmentation of peak flows even if they were occurring in these watersheds as a result of recent forest harvest. Proposed road use and construction is unlikely to alter surface or subsurface hydrology in a manner that would alter stream-flow patterns or timing or contribute cumulatively to any change from current conditions in the watershed.

Since there would not be any direct or indirect effect to the watershed's ground water, the Proposed Action carries no risk for contributing to any existing cumulative effects to this resource.

Water Quality (ACS Objective 4)

Direct and Indirect Effects

Summer Stream Temperature Maximums in Perennial Streams

The Proposed Action is unlikely to result in any detectable change in stream temperature, would maintain stream temperatures in their current range and would protect beneficial uses. Field reviews of the perennial stream channels in the project area by area personnel found that they are well shaded and functioning properly on BLM land (*EA Section 3.3.2.1*). This proposal would maintain effective shade within the range required under the Willamette TMDL which requires the recovery or maintenance of full potential shade along all perennial streams in the watershed.

The project meets or exceeds the Northwest Forest Plan Temperature TMDL Implementation Strategies (*U.S. Forest Service and Bureau of Land Management, 2004*): no shade producing vegetation within the "primary shade zone" (estimated to extend outward from the active stream channel to a maximum of 85 feet, varying with tree height and slope gradient) of perennial streams would be cut or removed, and any thinning beyond the 0-85 foot primary shade zone would maintain an average canopy closure of 50 percent or higher. Wilkerson, et al. (*2005*) and Groom, et al (*2011*) found that similar or less (maintaining 25 percent density to within 25 feet of streams) shade retention resulted in no detectable changes in stream temperature.

Summer Stream Temperature Maximums in Intermittent Streams

A reduction in stand density in the riparian forest near these streams is unlikely to result in any measurable alteration of temperature regime. A SPZ would be retained adjacent to intermittent streams under this proposal and most primary shade zone vegetation would be retained. Most channels in the project area have an intermittent flow regime and therefore do not flow on the surface during most summers (*EA Section 3.3.2.1*). Water temperature in these channels is influenced directly by soil temperature which is a function of elevation, aspect and soil type.

These streams are protect by SPZ, which maintains shade, even though reducing stand density near the streams would be unlikely to result in increased water temperature.

Dissolved Oxygen (DO) pH and Conductivity

The Proposed Action would unlikely result in any measurable effect on DO levels in project area streams. Available data indicates that most forest management activities have little effect on pH or conductivity (*U.S.E.P.A.1991*). Heavy inputs of fine, fresh organic materials, particularly when combined with increases in stream temperature, sedimentation and reduced re-aeration, can severely reduce the concentration of dissolved oxygen (DO) in small forested streams (*Hall and Lantz 1969*). Since the proposed action is unlikely to alter stream temperatures or sedimentation, would not place large amounts of fine organic material in the stream and will not alter re-aeration.

Turbidity

Road construction and maintenance

New roads would not be connected to the stream system and therefore no pathway would exist for delivery of fine sediment which could increase turbidity in streams. All new road construction would occur on low to moderate slopes emanating from the existing road network, on stable surfaces (i.e., surfaces that are not contributing to landsliding or mass wasting) and therefore road related landslides in these locations are also unlikely. All road construction would utilize the BMPs required by the Federal Clean Water Act (as amended by the Water Quality Act of 1987) to reduce non-point source pollution to the maximum extent practicable[30]. Since new road construction would occur on stable surfaces well away from streams and incorporate appropriate BMPs, there would be no opportunity for these roads to deliver sediment to the stream system.

Maintenance and improvements of existing roads (i.e., added rock and blading of road surfaces), replacement of stream crossing culverts and removal of the blocked and eroding culverts would occur during the driest period of the year, the "in-water work period," to avoid increasing turbidity of local streams during periods of higher flow. Nevertheless, there may be increased turbidity (i.e., a visible reduction in water clarity) relative to background or upstream water clarity during the first winter following the project if storm events wash some of the fines off disturbed surfaces and deliver them to the stream.

Based on research (*Foltz and Yanosek 2005*) conducted at culvert replacement projects in forested watersheds, turbidity levels at the sites of disturbance would be unlikely to exceed the State of Oregon water quality standards (i.e., greater than 10 percent increase relative to background levels) beyond the mixing zone downstream (about 100 meters) and would decrease as disturbed surfaces and the channel bed become "armored" (i.e., fines are removed). A turbidity plume downstream from the disturbance may be visible during the actual project (such as the replacement of culverts at stream crossings) and would likely decrease by an order of magnitude within two hours after disturbance ceases. In-stream disturbance at these sites would probably be completed during one work day so any increase in turbidity would be unlikely to exceed eight hours.

---

[30] See http://www.epa.gov/owow/nps/forestrymgmt/ for a review of applicable BMPs.

To further reduce potential increases in turbidity, BLM staff would visually monitor turbidity as required by the State of Oregon during in-channel work at these sites. If Oregon State Standards were exceeded at any time, BLM would stop all in-stream activities and require the contractor to take appropriate steps to reduce turbidity to acceptable levels.

Any increased turbidity would be unlikely to be visible or detectable beyond 800 meters below the site of the disturbance (*Foltz and Yanosek 2005*), would not likely exceed the standards set by the State of Oregon. Therefore, water quality standards would be maintained and beneficial uses protected on streams adjacent to treated forest.

Hauling

Timber hauling during periods when water is flowing on roads and into ditches could potentially increase stream turbidity and suspended sediment transport with indirect detrimental effects on the streams physical and biological attributes (*Cederholm et al. 1980*). Most of the harvest would be conducted with ground based equipment and hauling here would be primarily in the dry season. Hauling will only occur during the dry season on road 7-3E-15.1, which will restrict haul for unit 15B (*EA Section 2.3.1, Table 6)*. However, cable yarding units would normally be available for work during winter months and winter haul may occur on roads accessing these units. To ensure haul is not contributing to increased turbidity in local streams, the authorized officer will visually monitor the road network and turbidity levels at road/stream intersections during haul. If water clarity is visibly altered below the mixing zone it will be assumed that it is approaching limits set by the ODEQ. In this case, the authorized officer will require the BLM contractor to reduce fine sediment run-off into the stream. Methods include, but are not limited to, adding rock to the road and re-grading of the road surface to improve drainage, placement of bark bags or other material in the ditch to filter sediment out of the water, restricting haul until conditions improve.

Based on BLM's previous field experience with haul on forest roads, following the standards previously described would effectively eliminate most fine sediment delivery to streams during or after haul. Therefore, any increases in turbidity attributable to hauling would be unlikely to exceed the State of Oregon water quality standards (greater than 10 percent increase relative to background levels). Increased turbidity as a result of hauling is unlikely to be visible or detectable beyond 800 meters below the site of the disturbance (*Foltz and Yanosek 2005*), would not exceed the State of Oregon's water quality standards and would therefore protect beneficial uses.

Indirect effects from sediment delivery to stream systems include risk to water quality and aquatic organisms due to turbidity. Sediment transport normally increases during large storm events thus increasing turbidity and reducing the clarity of the water so that turbidity increases under this alternative would be unlikely to be discernible by the average observer. As stream flows recede sediment would deposit and turbidity would return to background levels at low flow. Therefore, it is unlikely that the Proposed Action would result in a discernible effect to the levels of turbidity or water clarity in project watersheds. Similarly, turbidity levels would be unlikely to reach levels that would cause additional treatment expense or technical difficulties for the downstream water providers.

Cumulative Effects – stream temperatures, pH, dissolved oxygen

Overall, the Proposed Action is unlikely to have any measurable direct or indirect effect on stream temperatures, pH, or dissolved oxygen. Current conditions and trends in water quality would likely be maintained under the all alternatives. Therefore, the proposal has little potential for contributing to any cumulative effects to these water quality attributes in these watersheds.

The risk of short term (during the action and the first winter following) increases in stream turbidity as a result of winter haul, road repair and maintenance may contribute to increased turbidity levels directly below road/stream intersections (i.e., direct effect). These would be maintained below the limits required by the ODEQ. Cumulatively the limited extent (not visible more than 800 meters downstream of the crossing), magnitude (greater than 10 percent of upstream turbidity levels) and duration (primarily during heavy rainfall events in the first winter following road repairs) of this effect would be non-detectable on the scale of the 6^{th} field watershed and would be unlikely to contribute cumulatively to turbidity levels in project watersheds.

Sediment Regime (ACS Objective 5)

Forest Management Practices

Yarding or falling of trees directly into streams, wetlands or ponds could result in increased sediment inputs into these water bodies. Tree falling and yarding into or through streams is not proposed and the SPZs would eliminate most disturbance of stream-side vegetation. Therefore, this proposal would not increase bank erosion or channel cutting by altering channel roughness, redirecting flows or altering bank-stabilizing vegetation. The potential for increases in stream energy due to alterations of peak flows is low, as was discussed previously.

Forest management on steep slopes may accelerate mass wasting processes. Two factors have been proposed as the primary mechanisms for increased rates of mass wasting: 1) loss of root strength following tree felling which direct reduces slope stability and, 2) increases in soil pore pressure due to the concentration of water on mass wasting susceptible areas on the slope.

Areas with potential for slope instability and mass wasting were identified and verified by BLM personnel during work for the project proposal. All proposed treatment units are outside of any areas mapped as unstable or prone to mass wasting in the TPCC. Tree removal is not proposed on steep, unstable slopes where the potential for mass wasting adjacent to stream reaches is high as defined by the TPCC. Therefore, increases in sediment delivery to streams due to mass wasting induced by loss of root strength and increases in soil pore pressure are unlikely to result.

The sediment filtering mechanism of Riparian Reserves

Under the Northwest Forest Plan, all stream channels, including intermittent headwater channels that only flow during the winter, are protected with buffers of natural vegetation which extend along all tributary reaches toward the watershed boundary. The effectiveness of SPZ for protecting water quality in forestry operations has been demonstrated in research studies around the world (*Norris 1993*). In fact, some research suggests that buffer widths proposed may be more than necessary for the protection of water quality on slopes less than 30 percent. Borg et al. (*1988*) concluded that 300-600 foot buffers in forest operations in Australia provided no additional protection for water quality or stream morphology than buffers half that size.

Where harvesting within riparian reserves is proposed, the SPZ on all streams would act, in addition to retaining all the primary shade, to protect banks and filter overland flow or sediment. The SPZ's may extend further than the minimums in order to account for site specific conditions such as the flow regime in the affected channel, the riparian forest stand, and slope stability/surface erosion potential of adjacent slopes. In fact, field review by area personnel of SPZ's left on previous harvests on BLM lands found that most are actually greater than the minimum standard and often exceed 100 feet even on intermittent channels.

Tree harvest, including ground based logging, would not increase sediment supply to streams because of factors discussed previously, including: forest cover would be retained with at least 50 percent canopy closure, water would normally infiltrate rather than runoff and erode soil, untreated SPZ would further filter any runoff or subsurface flow during high rainfall events, and design features would prevent concentrating runoff from roads and areas compacted by logging operations.

Yarding corridors, if sufficiently compacted and disturbed, have the potential to route surface water and sediment into streams. However, field reviews (*Hawe 2012*) of cable logged units on BLM land during intense rainstorm events from 2007-2012 found no evidence of overland flow or sediment transport on cable yarding corridors where erosion models had predicted sediment transport under similar conditions. As noted in these field reviews, several factors prevented surface erosion: 1) even when compacted, large quantities of residual slash (i.e., brush, limbs and branches) on yarding corridors (both machine and cable) contributed to reducing the accumulation of runoff by deflecting and redistributing overland flow laterally to areas where it infiltrates into the soil, 2) gentle to moderate slopes in much of the project area provide little opportunity for surface water to flow, 3) the no-treatment zones in riparian areas have high surface roughness which functions to trap any overland flow and sediment before reaching streams, 4) the small size of trees being yarded limits surface disturbance to minimal levels and 5) most skid road surfaces are too distant from stream channels to deliver any sediment.

Where yarding operations are resulting in excessive compaction and/or gouging of the soil surface, the contracting officer would require the operator to take additional actions, such as utilizing intermediate supports, and constructing water bars to reduce impacts to reduce effects below a detectable level.

Fuels Treatment

Pile burning would be unlikely to have any influence over water quality, stream channels or watershed hydrology and any effects to soils and hydrology would be short term and limited to the immediate site because the piles to be burned would be located on level ground outside of riparian areas so there is no delivery mechanism by which ash or soil from the pile locations could reach stream channels. Other fuel treatment methods (e.g. lop and scatter, mastication) do not create ash or erosion, so none could be introduced into streams.

Cumulative Effects - Sediment

Since there would be no detectable increase in sediment supply or transport as a result of the Proposed Action, there is no possibility to contribute to a cumulative effect.

No Action Alternative

Under the No Action alternative the existing water quality conditions, stream flows, and channel conditions at the project site would continue their current trends.

3.3.3 Fisheries and Aquatic Habitat

Sources: Hole in the Road Fisheries Report; Zoellick 2016; Hole in the Road Hydrology/Channels/Water Quality Specialist Report (Hydrology Report); Hawe, 2015

Methodology:

- BLM Cascades Field Office's Fisheries Biologist conducted surveys to determine resident fish distribution. Survey methods commonly used include data in State and Federal records, field surveys of channel and stream habitat characteristics including barriers to fish passage, electro-fishing, and snorkel surveys of project area streams. Fish presence and habitat surveys for the Hole in the Road project were conducted in May of 2013, April of 2014 and April of 2015.
- BLM civil engineering staff, logging systems specialist, fisheries biologist and hydrologist examined locations and conditions of existing culverts, proposed stream crossings, and log hauling roads and various times during 2014, 2015 and 2016.

3.3.3.1 Affected Environment

Fish and Aquatic Species: Presence and Habitat in the Project Area

Resident Fish

Coastal cutthroat trout (*Oncorhynchus clarki clarki*) are common in the Molalla River, and in Horse and Gawley creeks, which are tributaries to the Molalla River. Several Project units in Sections 21 and 27 are adjacent to Gawley Creek. Units in Sections 15, 16, and 22 are adjacent to the Molalla River and Horse Creek. No 1st or 2nd order tributary streams located in or adjacent to the units support fish populations. These streams either have too small of surface flows to support fish populations, or are located upstream of steep gradient channels or bedrock falls that prevent fish access.

Native resident fish known to inhabit the Molalla River include cutthroat trout, rainbow trout (*O. mykiss*), mountain whitefish (*Prosopium williamsoni*), redside shiner (*Richardsonius balteatus*), northern pikeminnow (*Ptychocheilus oregonensis*), largescale sucker (*Catostomus macrocheilus*), and longnose dace (*Rhinichthys cataractae*; *U.S.D.I 1999*).

Aquatic Habitat

Stream channels in the project area are stable due to vegetation (substrates are generally gravel dominated; *BLM Fish Inventories 2013*), well-shaded (greater than 90 percent effective shading; *BLM Fish Inventories 2013*), and stream banks are stable (greater than 90 percent of banks vegetated with riparian and streamside vegetation; *BLM Fish Inventories 2013*).

The Molalla River adjacent to the project area flows through a highly confined valley (gradients of 2-4 percent; Rosgen B-channel type; Rosgen 1994). Tributary streams to the Molalla River, including Gawley and Horse creeks, drain to the river in confined valleys, with channel gradients of 2 to 5 percent (*U.S.D.I. 1999*).

In-stream habitat of Gawley Creek is in good condition in the vicinity of the project area *(U.S.D.I. 1999*). Frequency of pools and pool volume was rated in good condition and Large Wood (LW) amounts were high (*U.S. BLM 1999*). The Molalla River in the project vicinity has good percent pool and pool frequencies. LW amounts and secondary channel availability is poor in this reach (*U.S.D.I. 1999*).

Threatened and Endangered Species

Winter steelhead trout (*O. mykiss*) and spring Chinook salmon (*O. tshawytscha*) inhabit the Molalla River in the vicinity of the project area. Upper Willamette River (UWR) winter run steelhead trout, and UWR spring Chinook salmon are listed as 'threatened' under the Endangered Species Act of 1973 (ESA). Salmon and steelhead populations in the Upper Willamette River evolutionary significant unit (ESU) are substantially reproductively isolated from other populations and are an important component in the evolutionary legacy of those species (*NOAA 2005*). The Molalla River is in the Molalla-Pudding River subbasin of the Upper Willamette River ESU.

Spring Chinook salmon and winter steelhead trout are distributed in the Molalla River from its confluence upstream to near the Copper Creek confluence, (*T.7S, R.4E, Section 32; Streamnet 2014*). Winter steelhead are also present in Gawley Creek upstream to BLM-managed lands in Section 27 (*T.7S, R.3E*). Timber thinning units in Sections 15, 16, and 21 are located adjacent to, or on reaches of Gawley Creek and the Molalla River that provide habitat for Chinook salmon and winter steelhead (*EA Table 15*). Timber thinning units in Sections 22 and 27 are generally located 0.9 to 3.4 miles upstream of listed fish habitat, except for several units (22D, 27B) that are located on or within 0.6 mile of winter steelhead habitat in Gawley Creek (*EA Table 15*).

Table 15. **Distances (in miles) to ESA listed fish habitat**

Unit Number	Distance to resident cutthroat trout habitat	ESA Listed Fish Species	
		Distance to steelhead trout habitat	Distance to Chinook salmon habitat
15A	380 ft to Horse Creek	0.2	0.2
15B	380 ft to Horse Creek	0.4	0.4
16A	440 ft Molalla River	440 ft	440 ft
16B	440 ft to Molalla River	440 ft	440 ft
21A	760 ft to Gawley Creek	760 ft	0.2
21B	380 ft to Gawley Creek	380 ft	0.8

Unit Number	Distance to resident cutthroat trout habitat	ESA Listed Fish Species	
		Distance to steelhead trout habitat	Distance to Chinook salmon habitat
22A	380 ft to Horse Creek	0.9	0.9
22B	0.5 to Horse Creek	1.6	1.6
22C	0.5 to Horse Creek	1.6	1.6
22D	0.5 to Gawley Creek	0.5	2.4
27B	0.5 to Gawley Creek	0.5	3.4

3.3.3.2 Environmental Effects

Proposed Action

Resident Fish and Aquatic Habitats (ACS Objectives 2, 3, 8)

Stream Channels

Proposed tree thinning would not impact channel conditions and fish habitat due to minimum no-disturbance buffers SPZs of about 380 to 440 feet on streams with Listed Fish Habitat (LFH) (Gawley Creek and the Molalla River) and streams (Horse Creek) supporting fish within 1 mile of LFH, ≥150 feet on other perennial streams, and intermittent 1st and 2nd order headwater tributaries within 1 mile of LFH. These SPZs widths are adequate to intercept and infiltrate water carrying sediment preventing its delivery to streams and aquatic habitats (*Olson and Rugger 2007, Rashin et al. 2006, CH2MHILL et al. 1999).*

Stream Shading and Temperature

Perennial streams supporting fish populations (Gawley and Horse Creeks, and the Molalla River) would have minimum 380 foot wide no-disturbance buffers, and perennial tributaries to Horse and Gawley Creeks and the Molalla River would also have minimum 150 foot wide no-entry buffers. Thus, with no disturbance to the primary shade zone (within 70 to 85 feet of channels), and retaining greater than 50 percent canopy closure in the secondary shade zone, no change in solar radiation input and stream temperature would occur (*BLM TMDL Implementation Strategy; Groom et al. 2011*). Trees would be thinned in the RR up to 100 feet from intermittent headwater tributary streams with 1 mile of LFH. These streams would not have surface flows during the summer, thus summer stream temperatures would not be altered.

Large Wood (LW)

Thinning in RR would result in faster tree growth rates and an increase in LW availability to 1st and 2nd order tributaries streams over the long term. LW availability would not be affected on Molalla River and Gawley and Horse Creeks because no trees would be thinned within no-cut buffer widths equal to, or greater than, one site potential tree height and because 1st and 2nd order tributaries are too small to move LW to the Molalla River and Gawley Creek.

Sediment and Roads

New and reconstructed roads are located >200 feet from stream channels, and would be built as to not increase the size of the stream network (*Wemple et al. 1996*). New roads (a total of approx. 1.44 miles) would be located on gentle to moderate slopes. Road surfaces of new and reconstructed roads would be constructed to drain surface water to adjacent gentle slopes where it would infiltrate into the soil and groundwater. Thus, little if any sediment produced by road surfaces would reach stream channels and would not impact aquatic habitats or fish populations.

Up to 14 cross-drain culverts may be replaced or installed on roads accessing Units 15B, 21A, 22B, 22D, 27B. This culvert work would not impact fish habitat as water draining from these culverts would be turned out into gently-sloped areas, vegetated with forest vegetation, such that no sediment would reach stream habitats.

Threatened and Endangered Species

Tree Harvest

Thinning units in Sections 15, 16, and 21 are located on or within 0.2 mile of LFH in the Molalla River and Gawley Creek (*EA Table 15*). Most units in Sections 22 and 27 are greater than 0.5 mile for LFH. Proposed tree thinning would not impact listed fish habitat due to minimum no-disturbance buffers of 380 feet on streams with LFH, >150 feet on perennial tributaries, and 100 feet on intermittent 1st and 2nd order tributaries within one mile of LFH. No trees would be thinned in the RR within the Wild and Scenic segment of the Molalla River. These buffer widths are more than adequate to intercept and infiltrate water carrying sediment preventing its delivery to streams and aquatic habitats (*Olson and Rugger 2007*, *Rashin et al. 2006, CH2MHILL et al. 1999).* No disturbance to primary shade zones (within 70 to 85 feet of the channel), and retaining >50 percent canopy closure in the secondary shade zone would result in no change in stream temperatures of perennial streams located upstream of LFH (*BLM TMDL Implementation Strategy; Groom et al. 2011*). Thinning to within 100 feet of headwater streams with intermittent flows would not alter summer stream temperatures because these streams do not have surface flow during the summer.

LW supplies in LFH in Gawley Creek and the Molalla River would not be impacted because no trees would be harvested within no-cut buffer widths equal to, or greater than, one site potential tree height on channels providing LFH, and because 1st and 2nd order tributary flows are too small to deliver LW from the areas being thinned within one tree height of channels.

Road Maintenance and Construction

About 1.44 miles of road construction would not increase the size of the stream network (*Wemple et al. 1996).* New roads are greater than 200 feet from stream channels, and constructed road surfaces would be designed to drain surface water to adjacent gentle slopes where it would infiltrate into the soil and groundwater. Thus, little sediment will be produced by the new roads and would not reach LFH.

Two culverts may possibly be replaced on intermittent stream crossings on road 7-3E-15.1 within 0.2 miles of LFH in the Molalla River. Sediment transport and turbidity would increase short term during the one to two days following the first substantial fall rains. These culvert replacements may have an insignificant effect on LFH because a small amount of turbidity may be visible or measurable in the Molalla River as it is less than 0.5 mile downstream of the culverts (*Foltz and Yanosek 2005*). However, due to the small size of the tributaries, any turbidity or sediment reaching the Molalla River would be quickly diluted by the much larger volume of water in the river and the resulting effect on LFH would be insignificant.

Up to 14 cross-drain culverts may be replaced or installed on roads accessing Units 15B, 21A, 22B, 22D, 27B. This culvert work would not impact LFH as water draining from these culverts would be turned out into gently-sloped areas, vegetated with forest vegetation, such that no sediment would reach LFH.

Hauling

Logs would be hauled on road 7-3E-16 and 7-3E-15.1 to the paved South Molalla Road. There is no mechanism for sediment delivery from log haul on the paved South Molalla Road. Road 7-3E-16 crosses LFH in the Molalla River on a cement decked bridge (Horse Creek bridge).

Most of the scuppers draining the deck of the Horse Creek bridge drain directly into the Molalla River. The northern road approach slopes gently down to the bridge deck with no evidence of sediment movement onto the bridge deck from the road surface or ditchlines. Both ditchlines turn out into forested or wetland areas 30 to 100 yards upslope of the Molalla River. The southern road approach slopes moderately steeply to the bridge deck with also no evidence of sediment movement onto the bridge deck (ditchlines are turned out into gently-sloped areas of forest vegetation). Thus, sediment movement to the bridge deck from winter season log haul, and subsequent movement to the river via water draining through the bridge scuppers, would be limited to an insignificant amount from muddy water and soil on log truck tires.

Road 7-3E-16 in the vicinity of Horse Creek crosses 4 drainages at distances 0.5 to 0.9 mile upstream of LFH in the Molalla River. The road is well graveled with short ditchlines, and ditches are vegetated, thus limiting the capacity of the ditches to transport sediment (*Luce and Black 1999*), with no evidence of sediment moving to channels at the crossings. Thus, steelhead and salmon habitat would not be impacted by log hauling during the winter on this portion of the route. Adjacent to Gawley Creek, Road 7-3E-16 is graveled and well maintained, with no evidence of sediment moving to channels at the crossings adjacent to Gawley Creek.

Overall winter season log haul on road 7-3E-16, and up to two potential stream culvert replacements on intermittent tributary streams to the Molalla River within 0.5 mile of LFH (on road 7-3E-15.1) may effect, but are not likely to adversely affect listed salmon and steelhead and their habitat. Winter haul would be restricted on road 7-3-15.1 to mitigate potential sedimentation to LFH (*EA Table 6*). BLM would complete consultation with NMFS on the potential effects of log haul and culvert replacement work on winter steelhead and spring Chinook salmon prior to initiating the project *(EA Section 5.1.2*).

Cumulative Effects

The Proposed Action would have no direct impacts to channel morphology (channel shape and form) of streams on the project areas and hence no cumulative effects to channel morphology. With no direct or cumulative impacts to channel morphology, instream fish habitat (ie. pool habitat, instream cover, stream depth, etc.) would not be affected.

No direct or cumulative impacts to peak flows are expected (*See Hole in the Road Hydrology Specialist Report*).

No Action Alternative

Aquatic Habitats

Populations of aquatic species would undergo natural increases and declines related to changes in aquatic habitat condition (ie. changes in stream temperature, sediment delivery events, and peak winter flows). Stream temperatures increase when shade from riparian canopy is lost (*Johnson 2004*). Substantial increases in stream temperatures can increase the metabolic costs of trout (*Li et al. 2004*), resulting in lower survival and recruitment, and consequently reduced population abundance (*Hicks et al. 1991*). During periods of accelerated sediment delivery (flooding), recruitment success would be lower because of fine sediment reducing intragravel oxygen levels resulting in higher embryo mortality, and reduced population abundance (*Bjornn and Reiser* 1991). High winter flows likely reduces overwinter survival of cutthroat trout in western Oregon streams (*House 1995*).

Under the No Action Alternative, canopy closure in primary and secondary shade zones along stream channels would remain similar to current levels, except for changes to tree canopy and consequently stream shade levels resulting from snow or ice break, wind storms, and wildfire. Stream temperatures would follow changes in stream shading (*Johnson 2004*). LW availability would increase over the long term as tree stands mature. Dense stands of riparian trees would self-thin over time, contributing small wood (trees greater than 24 DBH) to stream channels. Windthrow from storms would contribute LW to streams over the long term. Natural sediment inputs to streams would vary as sediment contributing events (flooding) occur within RR.

Threatened and Endangered Species

The No Action alternative would have "no effect" on UWR steelhead trout and UWR spring Chinook salmon because no actions would be taken that would affect salmon and steelhead habitat. Several project areas are adjacent to Chinook salmon and steelhead trout habitat in the Molalla River and Gawley Creek.

3.3.4 Soils

Sources: Hole in the Road Soils Specialist Report; Hawe 2105; Hole in the Road Logging Systems Report; Bernards 2015

Methodology:

- Soil maps and descriptions of the project soil characteristics are available at het Natural Resource Conservation Service web site: http://www.or.nrcs.usda.gov/pnw_soil/or_data.html
- Site specific conditions on BLM lands in the project area were mapped and field-verified in the Timber Production Capability Classification (TPCC) database (*Power and Tausch 1987*).

- BLM Resource Specialists for soil and hydrology visited the project area multiple times, performing both formal surveys and informal reconnaissance, including digging small pits, to evaluate site specific conditions.

3.3.4.1 Affected Environment

Typical soils in these project areas formed in colluvium (i.e., material rolling downhill) from basalt, andesite rock and volcanic ash. Soil series mapped in the project area are primarily Klickitat stony loams on slopes 30-60 percent, Kinney cobbly-loam on slopes 3-20 percent, Fernwood very gravelly loam on slopes 30-60 percent and Aschoff cobbly-loam on slopes 5-60 percent. Table 16 lists the soil series and selected properties in the proposed treatment units.

Table 16. **Soil Series and Characteristics**

Soil Series[1]	Limitations/Hazards	Percent Slope[2]	Percent Clay	Erosion Factor (*Kw*)[3]	Coarse Fragments[4]
Fernwood-Rock outcrop-complex (33F)	Steep, erosion hazard	80% +	N/A	N/A	N/A
Fernwood vry gravelly loam (32E)		30-60%	24	.10	10-20
Fernwood-Wilhoit complex (34D)		30-60%	24	.10	10-20
Andic cryaquepts (4E,F)	Poorly drained	50-90%	N/A	N/A	N/A
Humaquepts (43D)	High water table	2-20%	N/A	N/A	N/A
Highcamp_Rock outcrop (39F)	Portions not suitable for forest production	50-90%	10-18	.10	15-35
Aschoff cobbly loam (5D,E)		5-60%	12	.10	20-30
Aschoff-Brightwood complex (6F)	Steep, erosion hazard	60-90%	N/A	.10	0-30
Kinney cobbly loam (47C)		3-20%	19	.10	15-35
Klickitat stony loams (51E)		30-60%	28	.10	15-30
Wilhoit-Zygore gravelly-loams (85D)		5-60%	23	.15	0-15

[1] Principal soil series in Soil Data Mart data for Clackamas County Area, Oregon (USDA Natural Resources Conservation Service, 2005).

[2] Slope values estimated.

[3] Soil erodibility factor, Revised Universal Soil Loss Equation (RUSLE); 0.0-0.2 = readily infiltrated, 0.2-0.3 = intermediate infiltration and moderate structural stability, >0.3 = more easily eroded with low infiltration capacity (Brady 1996, Wischmeier and Smith 1978).

[4] Rock fragments > 3” diameter in A and B horizons.

Project soils are suited for growing Douglas fir and western hemlock. Soil maps and descriptions of project soil characteristics are available at the Natural Resource Conservation Service web site: http://websoilsurvey.nrcs.usda.gov/app/.

Timber Production Capability Classification (TPCC)

In addition to the large scale county soil mapping, BLM lands in the project area are mapped and field-verified in the Timber Production Capability Classification (TPCC) database[31] which is often more precise and accurate than county soil maps and is focused on forest productivity. "The purpose of the TPCC is to interpret soil and land characteristics to assist in timber management planning and in the application of practices which will maintain or enhance production over a long period of time".

All BLM-administered lands are classified as either s*uitable* for timber production, *suitable but fragile* for a variety of reasons (e.g., nutrient status, compacted surfaces, slope gradient, etc.) or *non-suitable*. All of the proposed treatments are within areas classified as *suitable* or *suitable but fragile*. Areas that are *suitable but fragile* would utilize design features listed in the TPCC to mitigate potential effects to soils.

Non-suitable lands in the project area are wet areas, rock outcrops and areas with slopes greater than 80 percent and areas prone to mass movement. Proposed unit boundaries were developed to appropriately avoid areas that are non-suitable. Most of the wet areas are adjacent to streams and wetlands, all of which are within SPZ and would not be treated. Fragile withdrawn areas due to high slope gradient are concentrated along inner gorges of stream canyons scattered throughout the project area; these areas are also excluded from treatment.

Among the suitable but fragile areas proposed for treatment are lands classified as FSR1 and FNR1. These sites are fragile due to low soil moisture and nutrients. Mitigation measures include utilizing full suspension logging methods and maintaining vegetative cover of 40 percent or greater, avoiding hot burns, encouraging nitrogen-fixing vegetation and applying nitrogen fertilizer.

Existing Compaction

Road Surfaces and Compaction

A second "fragile" TPCC classification in the project area is FSR2. This indicates areas that were previously harvested by ground based equipment, typically crawler tractors, and that skid roads and disturbed surface soils comprise more than 10 percent of the unit. The primary recommendation for mitigation on these sites is to till the soils at final harvest to help reduce bulk density.

Based on field review by area specialists, outside of the previous skid road network, soil surfaces generally appear to be in a non-compacted state and are covered with a moderately deep layer of surface "duff" (i.e., partially decomposed organic material, mostly needles, bark and wood, that protects the mineral soil surface). Some slight compaction (increase in bulk density of less than 10 percent relative to un-compacted soils) may persist in the area outside of the visible skid trails

[31] Power, W.E., Tausch, W.A.. 1987. *Timber Production Capability Classification. TPCC Technical Guide*. U.S.D.I. BLM Salem District. OR.

and roads as a result of previous logging that was accomplished with heavy ground based equipment. However, it is difficult to assess how much if any of this disturbance remains because it is obscured by tree growth and the surface duff layer. Random small pits dug by area specialists did not reveal any compacted soil surfaces beneath the duff and thus it is reasonable to conclude that compaction outside of road and skid trail surfaces, if it remains at all, is discontinuous and of no consequence to soil properties or fertility.

There is no existing inventory of "compacted surfaces" in this project area. Therefore, in order to provide a rough estimate of compacted surfaces in the project area, assumptions from field observation and GIS data for two project 7th field watersheds (Horse Creek and Gawley Creek). There are approximately 25.9 miles of road in the Horse Creek 7th field Watershed (5.28 square-miles, or 3382 acres). Similarly, the Gawley Creek 7th field Watershed (9.02 square-miles, or 5774 acres) has 42.7 miles of road. Assuming an average 25 foot wide road "footprint" on the soil surface, approximately 2.3 percent of the surface area in Horse Creek and 2.2 percent of Gawley Creek is road and therefore severely compacted.

A severely compacted surface is assumed to be impermeable: water that reaches the surface will not infiltrate but would be washed off or evaporated. However, based on field observation by area specialists, the condition of these road surfaces varies widely from paved roads (e.g., the Molalla access road) to barely discernible natural surface "roads" that were utilized at one point in time to haul cut trees to market. Therefore, the assumption of impermeability is a "worst case scenario" because some mapped road surfaces are being actively reclaimed by encroaching vegetation.

Moderately compacted soil surfaces (i.e., bulk density of the soil has been increased by over 10-20 percent relative to un-compacted soils) has visibly persisted in the skid trails viewed by the Cascades Field Office hydrologist during field visits, but there are very few visible skid trails. The majority of BLM lands in this area are on moderate to steep slopes (35-60 percent) that were not logged with ground based equipment. Assuming that the 10 percent of compacted surfaces due to previous entry ground based logging is representative of all the lower slope class lands in the project area (less than 35 percent gradient), approximately 30 percent of the surface has been affected (estimated from Lidar), leaving 3 percent of the watershed with "moderately compacted soil surfaces".

Based on the proceeding observations, a conservative estimate is that approximately 3 percent of the soils in the project area are moderately compacted (bulk density increase of 10-20 percent). Therefore, with the addition of road surfaces estimates from above, a rough estimate of soil surfaces with discernible compaction is between 5-6 percent of the project watersheds. This assumes, since logging methods were similarly applied, that conditions viewed on public lands are similar to those on adjacent private and holdings.

3.3.4.2 Environmental Effects

Proposed Action

Direct Effects on Soil Compaction/Disturbance/Displacement

Ground Based Logging

Following completion of the harvest, the majority of understory vegetation and root systems would remain, along with surface soil litter and slash from harvested trees. The expected extent of skid combined with the portion of landings which are outside of road prisms and subject to equipment operation would be limited to less than 10 percent of the surface in each project area unit (*RMP C-2*). The standard Salem District BLM timber sale contract provision requires that skid trails be no more than 12 feet wide and spaced an average of 150 feet apart, resulting in eight percent of the surface area included in skid trails and leaving two percent for landing areas outside of rights-of-way and skid trail junctions.

Compaction in skid trails would be concentrated under the tracks or wheels of skidders and would be confined to within the 12 feet wide skid trails. In a study of logging traffic on fine textured soils in northern Idaho, the area between wheel tracks was much less pronounced and in many of the moisture/slash/depth combinations tested there was little or no statistically significant difference between the center line and the undisturbed reference soil (*Han et al. 2006 pp. 16, 17*). This is consistent with the observations by IDT members of logging personally observed over the last three decades and of examining numerous existing skid trails from the past century of logging in this Cascades Field Office.

Han-Sup Han et al. also found that: 1/ dry soils were most resistant to compaction; 2/ moderately moist soils (21-30 percent) were near to an optimum moisture content for compaction for this fine textured soil and were most easily compacted; and 3/ soils with excessive moisture (though the surface drained to approximately 30 percent, field capacity for this soil) "did not provide support against the equipment's ground pressure and allowed the tires to penetrate into the deeper soil levels" regardless of slash mat (*p. 18*). The degree of compaction, indicated by penetration resistance, increased from pre-harvest reference levels up to the fourth pass of equipment (1 – harvester, 2 – empty forwarder, 3&4 – loaded forwarder), then generally did not consistently increase with eight additional passes with the loaded forwarder. This pattern is also consistent with multiple references cited in the RMP/FEIS, RMP and Soils Report and with field observations of IDT members as described above.

A single pass with a harvester (or by extension, other equipment with a similar tracked carriage) operating on a heavy slash mat does not compact soil to an extent which is likely to inhibit root penetration. Han et al. also noted that "a single pass of the harvester on the slash mat did not increase penetration resistance…at the 10 cm [4 inches] depth" even at the most compactable soil moisture level, but that it did increase resistance at the 20 and 30 cm depths (8 and 12 inches) (*pp. 18-20*). They noted (*p. 17*) that past studies (citation made in the original) suggest that compaction exceeding 2500 kPa of resistance would prevent root penetration. The compaction levels on the most compactable moisture level in the study show that compaction from a harvester working on a slash mat does not approach the 2500 kPa level. Sang-Kuyn Han, a co-author, notes in his Master's Thesis (*2006, p. 6, citing Han et al. 2006)* that "…one pass of a tracked machine does not significantly impact this [fine textured] soil type." This is also consistent with other studies such as those referenced in RMP/FEIS Appendix S-1, and with BLM IDT member's observations in more recent thinning operations.

Moderate-to-heavy soil compaction (>20 percent increase in bulk density) in the first 12 inches of topsoil would be indicated by ruts up to approximately 6 inches deep. Some of the impacted area would be existing skid trails from previous logging (estimated at 8 percent of the ground-based units) which are already compacted. The soils specialist estimates that the area impacted by surface disturbance and soil compaction from skid trails would be 8-9 percent of the ground based yarding area (212 acres, not including road rights-of-way; *EA Section 2.3.1; Tables 1 and 2*), or approximately 18-20 acres of disturbed and/or compacted soil in skid trails.

Heninger et al. 2002 (*pp. 234, 242, 243*) found that "most" of the skid trails on silty clay loam soils in the western Cascades which were skidded in wet, winter conditions with tracked and rubber-tired skidders "…did not approach root-limiting [bulk densities] for Douglas-fir as reported in the literature." (Literature cited in the article.)

Additional soil surface area would be disturbed to some degree as logs are cut, moved and stacked. Mechanized harvest systems using a tracked carriage move between skid trails, resulting in some disturbance on approximately 50 percent of the surface area as it cuts, limbs, bucks and stacks logs. With careful operation using an appropriate combination of low soil moisture, operating on a slash mat (usually created by limbing trees immediately in front of the harvester and/or placing additional slash in front of the harvester), single pass operations, and operating only on low (<45 percent) slope gradients soil compaction would be discountable since it is not likely to measurably affect bulk density of the soil (*Allen et al. 1999*). Han, Sup-Han et al. (*2006*) noted that "A single pass of the harvester on the slash mat did not increase penetration resistance [compaction]". Wronski and Humphreys (*1994*) found that the type of harvesters used on recent BLM timber sales and working on a slash mat "…can work with minimal impact on all soils in the region irrespective of weather conditions" and that feller-bunchers were not capable of creating slash mats for the machine to work on. These two findings are consistent with recent BLM experience.

In areas where trees are felled and bucked using chainsaws, soil surface disturbance would occur as logs are winched to skid trails because little or no suspension of the leading end of the logs is feasible. The BLM Cascades Field Office is not aware of any studies quantifying the areal extent of this disturbance. No compaction would be expected between skid trails from these operations since no heavy equipment would be used between skid trails.

Skyline Yarding

In skyline yarding areas the trailing end of the trees being yarded would usually drag on the surface in the skyline yarding corridor. Impacts usually consist of light, discontinuous compaction and surface soil and duff displacement in a strip approximately four feet wide within a 12 feet wide skyline corridor. The soils specialist estimates that 4-5 percent of the 130 acres estimated for skyline yarding in the project area would be disturbed and/or compacted in this way, a total of 5-7 acres.

Landings

Heavy compaction at landings would be primarily within the road prism (included in this analysis as part of roads rather than logging systems) and skid trail drop-zone (included in this analysis as part of skid trails) where equipment operates. If additional excavation were to be required for setting up a skyline tower serving multiple skyline corridors, that area would also be compacted. Additional soil and duff layers would be disturbed and potentially lightly compacted where logs are sorted and stacked prior to loading and where landing slash is stacked during operations. The soils specialist estimates that landing compaction would be expected on approximately one percent of the project area, or 3.6 acres. Approximately one additional acre would be cleared for two landing areas to accommodate the skyline logging system for unit 27B, for a total of 4.6 acres.

Road construction and maintenance

Total construction of new roads would displace topsoil and compact subsoil on approximately 4.4 acres. The intensity of this disturbance would be severe with the topsoil and duff removed and/or displaced and the subsoil compacted to a bulk density where it would no longer allow for water infiltration. The roads to be constructed would be predominately on low to moderate topography (grades <35 percent), so the total width of the clearing would be expected to be around 25 feet.

Drainage structure improvements and/or replacement at several locations would improve drainage and reduce road surface erosion into the surrounding area and streams. Minor short-term roadside erosion would be expected when established vegetation in the ditch and culvert catchment areas is removed, which would be expected to return to very low levels within one or two seasons as litter-fall accumulates and vegetation regrows.

Decommissioning of roads would initiate the process of restoration of natural soil physical and biological conditions on anywhere from approximately 0.12 to acres (0.04 miles) to 4.4 acres (1.44 miles) (*EA Table 2*). Tilling of the soil surface would reduce bulk density and improve water infiltration rates allowing for plants and trees to establish and grow. Over a period of several decades these surfaces, if not re-disturbed, would gradually return to a pre-treatment condition undiscernible from adjacent soils.

Machine Piling and Pile Burning

Machine piling of slash to reduce fire risk along property boundaries and roads would be expected to disturb and compact approximately 2 percent of the ground based units or 4 acres. Limbs and other logging slash less than 8 inches diameter would be piled and burned to provide a fire break. Intensity of this disturbance would depend on soil conditions, operator and equipment. Typically, light to moderate soil displacement and compaction of the top 6 inches and duff layer would be dispersed across these surfaces. Where piles are burned, surface organic material (O-horizon) would be removed; however sediment delivery to streams is highly unlikely since burn-pile areas are outside RR, widely dispersed, and typically smaller than 20 feet in diameter. Displaced soil would be filtered and retained by the intact vegetation immediately surrounding the burn pile spot. Since burning would occur during wet soil conditions, heat damage to the upper soil layer (A-horizon) would be moderated and only occur in scattered localized sites (*See Fuels Report and EA Section 3.3.6*.)

Other, Soil Nutrient Capacity

The Proposed Action would maintain sufficient mycorrhizae populations because the root systems of most vegetation would remain undisturbed on at least 90 percent of the unit area, and there is no evidence that past disturbance of the area has affected mycorrhizae populations.

The narrow openings created by skid trails (12 feet wide), skyline corridors (14 feet wide) and natural surface road construction (approximately 25-37 feet wide) would not noticeably affect average tree spacing of 18 to 27 feet average after treatment. The listed widths of these openings are between tree trunks, tree crowns extend into the "open" area.

Many limbs and other logging slash and debris would be expected to remain scattered over the unit areas, except for the 4 acres of fuel reduction described above, because there is no economic or management reason to remove the slash. If an operator yards trees with tops intact and processes them at the landing, fewer limbs would remain scattered over the unit area, but there would be at least as much organic material on the ground as there was prior to logging. This organic material would decay over the next 1-2 decades, becoming part of the O-horizon and returning nutrients to the soil.

Stabilizing skid trails and natural surface roads by shaping (such as water bars), seeding with native species, and/or covering them with slash and debris would promote drainage and prevent water from accumulating in large quantities that could cause erosion. Accumulated litter-fall on the road surfaces would further reduce any potential for surface erosion over the next several years. Blocking skid trails with barriers and logging slash would prevent vehicle use which could cause erosion.

In general, long rotations are not expected to reduce soil productivity. The time-scale for rotations on matrix BLM lands, 70 to 110 years (*RMP p. D-1*), are also the time-scale for processes that enhance soil productivity (*Achat et. al 2015*). Bedrock weathering, atmospheric deposition and N-fixing by legumes all supplement ecosystem recycling of nutrients. The contributions of these processes though depend on the soil type and climate (*Powers 2005*). Douglas-fir forests on some soils types in the Pacific Northwest experience nitrogen deficiency and short-rotation industrial forest operations supplement with urea fertilization (*Harrison et. al 2011).* However, neither of these are concerns with the proposed project. PDFs for the Hole in the Road project are in place to minimize impacts to soils (*EA Table 5*) Coupled with long rotations, no long term loss in soil productivity is expected.

Summary of Direct Effects

There is an overall maximum increase of 36 acres (10 percent of the treatment area) in discernable compaction/disturbance of soils under the Proposed Action from all sources, including the full 12 feet width of skid trails spaced 150 feet apart (average) under standard Salem District timber sale contract provisions and machine piling. The BLM soils specialist on the IDT estimates, based on past observations, that approximately 31 percent of this disturbance (11 acres) would be of low intensity, meaning soil physical properties would likely recover to pre-disturbance conditions, without active restoration, within several years. Approximately 31 percent of this disturbance (approximately 11 acres) would be severe, meaning soil physical properties are unlikely to recover to pre-disturbance conditions without active restoration. The remaining 38 percent of the disturbed soils (approximately 14 acres) would be moderately disturbed, meaning soil physical properties would eventually recover to pre-disturbance conditions, without active restoration, following several decades without further disturbance

Indirect Effects on Site Productivity due to Soil Disturbance – Displacement and Compaction

Soil productivity is the "capacity or suitability of a soil for establishment and growth of a specified crop or plant species, primarily through nutrient availability" (*RMP/FEIS Chp. 6 p. 4*). For this project, productivity of these forest stands is indicated by the growth and yield at the stand level as indicated by changes in radial growth and the corresponding rate of increase in timber volume. The BLM accepts that differences in mean diameter growth and total stand volume and value over the rotation are the net indirect effects on site productivity due to soil disturbance from commercial thinning. General plant species richness and growth may also be a visual indicator, though not measured.

The effect of the Proposed Action on overall (stand level) site productivity caused by soil compaction and displacement is expected to be too low to measure at the stand level. Thinning results in increased rates of radial growth and understory vegetation (*EA Section 3.3.1*), and any potential reductions in growth from soil compaction and displacement would not be discernable. The BLM has observed this effect on thousands of acres of similar thinning for several decades. Thinning is a widely accepted silvicultural practice used to accelerate tree growth and is supported by decades of research, observation and practice on public and private lands.

Specifically:

- Light compaction caused by skyline yarding is expected to be too low to cause a measurable reduction in overall yield for the stands.
- Light compaction caused by mechanized harvesters operating on slash mats between yarding corridors and skid trails is expected to be too low to cause a measurable reduction in overall yield for the stands.
- Heavy compaction and displacement in heavily used skid trails and light to moderate compaction and displacement in skid trails with less use is expected to be too low to cause a measurable reduction in overall yield for the stands.

Miller et al. (*2007*) found that previously reported research showed wide differences in apparent Douglas-fir growth response to soil disturbance in thinning operations while their research found increased growth in individual trees adjacent to skid trails. Compacted skid trails affect no more than 40 percent of the rooting area of trees adjacent to a skid trail and the trees appear to positively respond to reduced competition to a higher degree than they negatively respond to skid trail compaction in the rooting zone, resulting in higher overall growth. Any potential individual tree growth rate reduction caused by compaction on no more than 10-12 percent of the forest stand is undetectable within the overall increased growth and production at the stand level.

Pile Burning

The BLM does not expect any discernable loss in site productivity because discontinuous soil disturbance from machine operations as described would not be intense enough to reduce tree growth at a stand level and the burned areas would be scattered and small, potentially impacting only a small portion (<25 percent) of the rooting area of any tree.

Cumulative Effects

Soil Disturbance – Displacement and Compaction

The soils specialist estimated the extent of existing compacted/disturbed soil surfaces in the project watersheds as a whole, including road surfaces, at 5-6 percent (approximately 550 acres of the 9,152 acres in Gawley and Horse Creek drainage). Increasing compacted surfaces by 36 acres under the Proposed Action would result in a 0.4 percent “cumulative” increase in the percentage of compacted surfaces. This magnitude of compaction on a watershed scale is unlikely to result in any discernible “cumulative effect” since the compaction is dispersed across the landscape.

At the conclusion of the project the quantity of compacted/disturbed soils (other than road surfaces) would begin to decrease over time and would approach current levels within a decade as soil surfaces recover through natural processes (e.g., freeze-thaw, animal and insect burrowing, tree fall, root growth, etc.).

Soil Erosion

The Proposed Action would not lead to any measurable increase in surface erosion, and soil erosion would remain within the range of background rates. Estimated background surface erosion rates in the project area are in the range of the assumed rate of soil formation (0.12-0.8 tons/acre/year, *Pimentel 1987*) otherwise there would be no surface soil.

Field reviews (*Hawe 2012*) of skyline and ground based logging units on BLM land during intense rainstorm events from 2007-2012 found no evidence of surface erosion or overland flow on units where erosion models had predicted surface erosion and sediment transport under similar conditions.

Mass wasting is the primary cause of soil erosion in forested regions of the Pacific Northwest and this proposal would have no effect on mass wasting processes (*EA Section 3.3.2, Hydrology; Hydrology Report).*

No Action Alternative

With no management actions, there would be no changes to natural processes affecting soil conditions and characteristics.

3.3.5 Wildlife

Sources: Hole in the Road Project EA Wildlife Report; Murphy 2015; Hole in the Road Silviculture Prescription (Sivliculture Prescription or Silviculture Report); Foster, Macalady, Ruzicka 2015 and 2016

Methodology:

Cascades Field Office Wildlife Biologists assessed potential effects to terrestrial species by using the following methodologies:

- Wildlife Biologists compiled a list of Wildlife Special Status/species of concern in the Cascades Field Office using BLM wildlife databases, BLM Special Status species lists (*BLM IM OR-2012-018*), Oregon Biodiversity Information Center lists (*ORBIC 2013*), various wildlife field guides, literature, and texts.
- The Wildlife Biologists determined the presence of special habitats, and the amount of snags and down logs present from stand exam data, aerial photos, and field review
- BLM Wildlife Biologists visited the project area during the 2013 and 2014 field seasons and examined habitats in and adjacent to proposed Hole in the Road project units.
- From the Cascades Field Office list, the Wildlife Biologists compiled a list of Special Status/species of concern documented or suspected to occur in the Hole in the Road project area based the proposal's geographic location, elevation, and knowledge of habitats present gained through air photo interpretation, stand exam data, GIS information, and field reconnaissance. For each of those species they determined habitat associations and the presence or absence of suitable habitat. The resulting list of Special Status species which are known or suspected to occur in the Hole in the Road project area and their habitat preferences are included in Table 6 of the Wildlife Report, which is incorporated by reference into this EA.
- For northern spotted owl (NSO): The Molalla Watershed areas have a long history of northern spotted owl surveys that date back to the early 1980s. There are three know spotted owl sites within the provincial home range radius (1.2 miles) of the proposed units. Additional surveys for northern spotted owls will be conducted to determine presence in the future.
- Stands proposed for treatment in the Hole in the Road area are 42 to 137 years of age. Surveys for red tree voles and Survey and Manage mollusks were conducted on units over 80 years old (*IM-OR-2011-063, "2006 Pechman Exemptions," 2011*). Surveys for red tree voles were conducted during spring 2013, 2014 and 2015. No inactive or active red tree vole nests were found in the surveys. The first survey for Bureau Sensitive and Survey and Manage mollusks was conducted in all units in the and spring 2014 and second in the fall of 2014. The Cascade axe tail slug, *Carinacauda stormi*, a Bureau Sensitive species was found at one site near Unit 22A, and is currently outside the proposed thinning unit.
- For Coarse Woody Debris (CWD) information, Stand Exams were conducted in 2009 and 2014; Additional stand information was gathered by BLM personnel.
- Cascades Field Office wildlife biologists assessed the suitability for treatment of RR stands adjacent to proposed Matrix thinning units by:
  - Field examinations of those RR stands to assess stand complexity and other habitat characteristics based on their training and professional experience.

- Consulting with the Silviculturist and examining stand exam data.
- Consulting with the Cascades Field Office Logging Systems Specialist to determine if treatment is feasible using existing roads or roads to be constructed for managing Matrix land when the Wildlife Biologist determined that silvicultural treatment could benefit habitat conditions.

3.3.5.1 Affected Environment

Description of the Project

The Proposed Action is to conduct thinning operations on approximately 348 acres in Matrix and 12 acres in RR LUAs in mid seral through mature seral stands from 42 to 137 years of age (*See EA Section 3.3.1 for Seral Stage Distribution in the Molalla Watershed*). Stands are located between 1,160 and 3,140 feet elevation and consist of varying amounts of Douglas-fir and Western hemlock with trace amounts of Western red cedar and noble fir. In most of the units, the hardwood component is minor, consisting mostly of red alder and big-leaf maple, with trace amounts of golden chinquapin. There is some advanced regeneration of Western hemlock present in most of the units (*See also EA Section 3.3.1 for vegetation description for each unit*)

Variation in forest stand conditions within stands and at the landscape level is a key factor in providing habitat for a diversity of forest organisms (*Hayes et al. 1997; Muir et al. 2002*). Certain structural and compositional aspects that are important contributors to habitat diversity and species richness include dead wood in the form of snags and down logs, remnant large live trees, and vertical and horizontal variation in tree and understory canopies. Hardwood trees and shrubs are also important contributors to forest biodiversity. All of these elements provide habitat substrate, food sources, foraging substrate, and nesting opportunities for many wildlife species. These features are generally lacking in the mid seral stands proposed for thinning. The mature and early mature stands proposed for thinning poses more of these elements.

Snags, Down Logs (CWD), Remnants and Special Habitats

Snags, down logs, and special habitats provide important ecological functions for many wildlife species. Special habitats consist of wet and dry meadows, wetlands, talus, cliffs and rock outcrops. The presence of special habitats and the amount of down logs present was based on stand exam data, aerial photos, and field review by specialists and is summarized in Table 17.

Table 17. **Summary of special habitats, remnants, and down logs by project unit**

Name/Unit	Location	Seral Stage	QMD*	Remnant trees	Special Habitats**	Down Logs***
Hole in the Road Project Area						
15A	7S-3E-15	Mature	23.5”	no	no	69.3’/144.3’
15B	7S-3E-15	Early Mature	20.9”	no	no	115.3’/0’
16A	7S-3E-16	Mid Seral	14.8”	no	no	0’/0’
16B/21A	7S-3E-16	Mid Seral	13.6”	no	no	0’/0’
21B	7S-3E-21	Mid Seral	15.2”	no	no	0’/0’

Name/Unit	Location	Seral Stage	QMD*	Remnant trees	Special Habitats**	Down Logs***
22A 22A.1 22A.2	7S-3E-22	Early Mature	18.3”	no	no	40.8’/0 0’/0’ 22.8’/0’
22B	7S-3E-22	Mature	12.5”	no	no	85.6’/0’
22C	7S-3E-22	Mature	21.9”	no	no	225’/85.6’
22D	7S-3E-22	Early Mature	20.3”	no	no	114’/57’
27B	7S-3E-27	Early Mature	13.7”	yes	yes	44.9’/87.1’

Seral Stage Age Classes (years) based on Stand Exam data: Early Seral = 0-30; Early Mid Seral = 30-40; Mid Seral = 40-60; Late Mid Seral = 60-80; Early Mature Seral = 80-120; Mature = 120-200; Old Growth =200+

* *Quadratic Mean Diameter is a measure of Central tendency which is considered more appropriate than Arithmetic mean for characterizing the group of trees which have been measured. Units highlighted are less than 20”.*

** *Special habitats within the units include: wet and dry meadows, talus, cliffs & rock outcrops.*

*** *Linear ft/acre >19” diameter & >20’ long, hard (decay classes 1-2)/soft (decay classes 3-5) logs.*

Presence of adjacent special habitat, wetland, pond adequately protected with no treatment buffer.

BLM’s management direction for down CWD in the Matrix is to leave a minimum of 240 linear feet of down logs per acre at the time of regeneration harvest. Logs should be at least 20 inches in diameter at the large end, 20 feet in length, and in hard decay classes 1 and 2 (*RMP p. 21*). The units in Hole in the Road project can be divided into two distinct groups, units that have limited ability to recruit hard down logs over 20’ and units that can recruit large diameter hard down logs. However, at this time all units are below management direction for down CWD.

Most existing hard down logs in the Units 16A, 16B/21A, 21B, 22A, 22B, and 27B are less than 20 inches in diameter. These units have quadratic mean diameters (QMD) at 14.8, 13.6, 15.2, 18.3, 12.5, and 13.7 inches respectively. Live trees in these units are small in diameter and have limited recruitment of hard down logs over 20 inches in diameter. Numerous hard logs in smaller size classes are the result of recent suppression mortality. These small logs are much less useful for forest floor-associated wildlife species because they have less volume, persist for shorter periods of time (usually less than two decades), and are less thermally stable than larger material.

Units 15A, 15B, 22C, and 22D have a QMD over 20 inches and recruitment of larger diameter hard down logs is possible. These units do not currently meet management direction of a minimum of 240 linear feet of down logs per acre. These units are close, and have 69.3, 115, 225 and 114 feet respectively.

Existing soft down logs (decay classes 3-5) are usually remnants of defective trees that were not removed after harvest or large CWD from the previous stand. There is some of this type of material in Units15A, 22C, 22D, and 27B and in adjacent stands. These logs provide valuable habitat for down CWD associated wildlife species, including various rodents, amphibians and reptiles (*O’Niell et al. 2001*), and they persist for many decades before passing through advanced decay classes to become unrecognizable as down logs.

Table 18 summarizes the number of snags necessary for five cavity-excavating woodpecker species to maintain 40 percent of potential population levels (*Neitro et al. 1985*). These quantities are used as management direction for snag retention in the Matrix (*RMP p. 21*) at the time of regeneration harvest. Table 19 summarizes the snags currently present in the project area. A diameter of 15+ inches was used because most wildlife species that utilize snags are associated with snags greater than 14.2 inches (*Rose et al. 2001*). Smaller material has less volume, thus providing less habitat, and does not persist as long in the forested environment has larger material.

Table 18. **Minimum number of snags necessary to support species of cavity nesting birds at 40 percent of potential population levels (RMP p. 21, as per Neitro et. al. 1985).**

Diameter class (inches DBH)	Snag Decay Stage Hard 2-3	 Soft 4-5	Total by diameter class (per 100 acres)
11+		Downy woodpecker (6)	6
15+	Red-breasted sapsucker (18)	Hairy woodpecker (77)	95
17+		Northern flicker (19)	19
25+	Pileated woodpecker (2)		2
Total – all diameter and decay classes			**122**

Table 19. **Summary of existing snags by project unit based on stand exam data and field review.**

Hole in the Road Project Area: Snags at least 15' tall/ 100 acres						
Unit #	Snags 15-25"		Snags greater than 25"		Total snags (15"+)	
	Hard	Soft	Hard	Soft	Hard	Soft
15A	0+	0+	0+	0+	0+	0+
15B	0+	0+	0+	0+	0+	0+
16A	0	0	0	0	0	0
16B/21A	0	0	0	0	0	0
21B	0	0	0	0	0	0
22A 22A.1 22A.2	0+ 0+ 8.5	0+ 0+ 0+	0+ 0+ 0+	0+ 0+ 0+	0+ 0+ 8.5	0+ 0+ 0+
22B	0	0	0	0.7	0	0.7
22C	5.3	0+	0+	3.8	5.3	3.8
22D	0+	0+	0+	1.7	0+	1.7
27B	0+	0.9	0+	0.9	0+	1.8

The use of 0+ in the table denotes trace numbers of snags present that did not appear in the stand exam.

The snag habitat within the proposed units consists mainly of small diameter hard snags and large diameter soft snags. Trees that could have developed into large snags and down logs were removed by past timber harvest and/or stand replacement fire. Most of the existing snags are small (less than 15 inches diameter) and the large snags that are present are in advanced decay classes.

There are rock outcroppings, cliffs and remnant trees in Unit 27B. These features will be buffered and posted outside of the unit boundaries.

Special Status, Survey and Manage, and Other Species of Management Concern

Vegetation surveys (stand exam data) indicate that stands proposed for thinning lack habitat elements that support diverse populations of wildlife species, including large legacy trees, large snags, down logs, deciduous understory and ground cover vegetation. BLM wildlife biologists developed a list of BLM Special Status/Species of Concern which are documented or suspected to occur in the Hole in the Road Project Area based on field inventories of the habitats present and a review of existing literature (*Wildlife Report Table 6*). The following species in the project vicinity are of management concern.

Federally Listed Species

Threatened – Northern Spotted Owls

None of the units are located in 2012 Critical Habitat or unmapped Late Successional Reserves (LSRs), which are 100 acre core areas for known spotted owl sites as of January 1994. None of the units meet the stand level conditions characteristic of Recovery Action (RA) 32 Habitat according to the Northern Spotted Owl Recovery Plan (*NSO 2011 pp.III-67-68*). The proposed thinning units provide 180 acres of suitable habitat in the Molalla Watershed. The suitability of the habitat for spotted owls is marginal due to a lack of down CWD, large old-growth trees and snags for nesting and prey habitat.

There are three known spotted owl sites within the provincial home range (PHR) radius (1.2 miles) of the Hole in the Road Project, known as the Gawley Creek, Shoofly Creek, and Dandelion Creek sites.

The Gawley Creek known spotted owl site was established in 1988 with a male and female response. There were pair responses in 1989, 1993, 2012, 2013 and 2015. Single responses were detected in 1990, 1994, 1995, 2007, 2010, 2011 and 2014. There were no surveys done, or protocol was not met, from 1999 to 2006. There were no spotted owl responses from 1996 through 1998, 2008 and 2009. Gawley Creek site is not considered viable because across all ownerships there is an insufficient amount of suitable habitat available. Nesting was confirmed at this owl site in 1989, with two juveniles fledged. No units are within the core area (0.5 miles) of this site. Units 22D, 22B and 27B are within the PHR of the site. There are no units or activities planned within disturbance range (0.25 miles) of the site.

The Shoofly Creek known spotted owl site was established with a male response in 2004. It was occupied by a pair in 2006 and 2014. There were no spotted owl responses in 2005, 2008, 2010, 2011 and 2013. The Shoofly Creek known spotted owl site is considered a viable site as it has a sufficient amount of suitable available habitat in both the PHR and core area. There are no units or activities planned within 0.5 miles or within disturbance range (0.25 miles) of the site.

The Dandelion known spotted owl site was established with a pair response in 1994. It was occupied by a pair in 1994 through 1999, 2003, 2004, 2008, 2011 through 2013. There were no spotted owl responses in 2000, 2002, 2005, and 2007. The Dandelion known spotted owl site is considered a viable site as it has a sufficient amount of suitable available habitat in the PHR. The core area is under the 50 percent suitable habitat threshold for a functional site, when analyzed using a circle around the nest tree. However there is adequate contiguous suitable habitat in and around the nest patch to meet the functional needs of the owl pair. Unit 16A, 16B, 15A and 15B are within the PHR of the site. There are no units or activities planned within 0.5 mile core area or within disturbance range (0.25 miles) of the site.

Survey and Manage Species

Red Tree Vole

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 *Final Supplemental to the 2007 Supplemental Environmental Impact Statement to Remove or Modify the Survey and Manage Mitigation Measure Standards and Guidelines* (*USDA and USDI July 2007*).

In response, parties entered into settlement negotiations in April 2010, and the Court filed approval of the resulting Settlement Agreement on July 6, 2011. Projects that were within the range of the northern spotted owl were subject to the survey and management standards and guidelines in the 2001 ROD, as modified by the 2011 Settlement Agreement (*IM-OR-2011-063, July 2011*).

The Defendant-Intervener subsequently appealed the 2011 Settlement Agreement to the Ninth Circuit Court of Appeals. On April 25, 2013, the court ruled in favor of Defendant-Intervener, which remands the case back to the District Court. This means that the December 17, 2009 District Court order which found NEPA inadequacies in the 2007 analysis and ROD 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. On October 10, 2006, following the District Court's 2006 ruling, parties to the litigation entered into a stipulation exempting certain activities from the Survey and Manage standard (Pechman exemptions), including thinning projects in stands less than 80 years old (Exemption A). At the present time, the 2006 Pechman Exemptions remain in force.

The red tree vole is a Category C (uncommon pre-disturbance surveys practical) Survey and Manage species under the Northwest Forest Plan. It is an arboreal vole associated with conifer forests west of the Cascades summit, below about 3,500 feet. The project area is within the elevation range of the "Northern Mesic Zone" of the geographic distribution of this species. Units 15A, 15B, 22A, 22B, 22C, 22D, and 27B meet the stand-level criteria as described in the Red Tree Vole Protocol (*Huff et al. 2012*). Surveys for red tree voles were conducted in all of the stands originally proposed for treatment that are 80 years of age and older (*IM-OR-2011-063, "2006 Pechman Exemptions," 2011).* A total of 92 trees were climbed, confirming the presence of no active red tree vole nests and no inactive nests. As a result, no acres were dropped from the proposal due to red tree vole presence.

Mollusks and Amphibians

Surveys for Bureau Sensitive and Survey and Manage mollusks were conducted during the spring and fall of 2014. One Bureau Sensitive mollusk species was found, Cascade axe-tail slug, in Section 7S-3E-22, and is outside any proposed thinning unit.

Other Species of Concern

Migratory and Resident Bird Species

The proposed thinning is located in the Western Oregon Cascades Physiographic Province. About 125 bird species are documented or suspected to nest on BLM lands in the Cascades Field Office (*Altman and Hagar 2007, Altman 2012, Marshall et al. 2003*), of which 36 species are priority bird species of conservation concern (*PIF 2012*). There are no Bureau Sensitive bird species documented or suspected to occur in the Hole in the Road area. The Partners in Flight (PIF) conservation plan, which addresses the Western Oregon Cascades, is the *Conservation Strategy for Landbirds in Coniferous Forest of Western Oregon and Washington* (*Altman 2012*).

Some recent studies have correlated bird species richness at the stand level with habitat patchiness, densities of snags, and density by size-class of conifers (*Hagar, McComb, and Emmingham 1996, Hansen et al. 1995).* Even-aged conifer stands provide habitat for a relatively high abundance of a few bird species, many of which feed on insects gleaned from conifer foliage. The most common species include chestnut-backed chickadee, Pacific-slope flycatcher, hermit warbler, golden-crowned kinglet, varied thrush, winter wren, red-breasted nuthatch, and Swainson’s thrush.

The proposed thinning is in mid seral and mature stands which have been naturally regenerated from fire and past harvest, removing much of the large tree component and leaving a stand characterized by a lack of snags, CWD, and well-developed understories and ground cover. The understory vegetation does not provide for as diverse of a community of shrub and ground cover plant species that are important in providing insect and plant food resources for bird species (*Hagar 2004*). Although lacking in the stand proposed for treatment, adjacent stands contain hardwoods and thinned areas which provide better developed understories. Legacy trees, CWD and snags are lacking in the area, with the exception of Unit 27B which has an area with legacy trees.

Bats

There are no Bureau Sensitive bat species suspected to occur in Hole in the Road area, however four bat species of concern are suspected to occur (silver-haired bat, long-eared myotis, long-legged myotis, and Yuma myotis). These species are associated with caves and mines, bridges, buildings, and cliff habitat. Decadent live trees and large snags with bark attached that extend above the tree canopy are used as solitary roosts, maternity roosts, and hibernacula by these species and other bat species associated with Douglas-fir forests (*Christy and West 1993, Weller and Zabel 2001, Waldien et al. 2000*). None of these features are present in the project area.

Big Game

Big game species found in the vicinity include Roosevelt elk (*Cervus elaphus roosevelti*) and black-tailed deer (*Odocoileus hemionus*). The stands proposed for thinning are in mid seral and mature habitat located at middle elevations, some on southerly aspects, which provide hiding and high quality thermal cover, but lack high quality forage due to poorly developed ground cover. The Salem District Record of Decision and RMP approved May 1995 identified no critical winter or summer range in the project area (*RMP p.26*). The big game use is seasonal due to area's location at middle elevations above the seasonal snow zone.

3.3.5.2 Environmental Effects

Proposed Action

All Land Use Allocations

Stand Structure

The Proposed Action will have both short (less than five years) and long term (more than five years) effects. In the short term, thinning would result in a reduction of suppression mortality, canopy closure, and understory and ground vegetation. While thinning these stands would reduce the number of small diameter (less than 15 inches DBH) trees that would otherwise die from suppression mortality, there would be an increase in understory development, crown structure and growth of the residuals. The long-term effect of thinning would include increased canopy structure, tree diameters, spacing of the leave trees, understory and ground cover development. Stand conditions and structural complexity would improve as canopies close and thus improve habitat quality for mid to late successional wildlife species.

Research that has occurred since the 1980s has determined that it is possible to develop desired structural and compositional diversity in young, and managed stands through specific actions (*Bailey and Tappeiner 1997, Chan et al. 2006*). Thinning forest stands reduces competition between the remaining overstory trees and increases the availability of solar radiation to the forest floor (*Hayes, Weikel and Huso 2003*). Growth, size, branch diameter, and crown ratio of the remaining trees is increased, and development of understory and ground cover vegetation is stimulated. These changes effectively increase structural complexity and alter habitat quality. The increase in structural diversity would improve habitat for many species by providing more opportunities for foraging, nesting/breeding, resting, hiding and escape cover/habitat for a variety of species in the forest environment, including invertebrates, songbirds, and small mammal species.

Proposed road construction, skid trails and skyline corridors under the Proposed Action would create narrow linear openings through the vegetation. Disturbing, reducing or temporarily removing ground vegetation, while creating breaks in the canopy, would allow more light to reach the forest floor. The effects on wildlife habitat would be a short-term disturbance; Reduction in ground vegetation and canopy closure would increase access to the stand by certain wildlife species, specifically larger mammals such as big game, coyotes, and avian predators. In the long-term, ground vegetation would become re-established due to increased light to the forest floor.

The Proposed Action includes up to two, 2.5 acre low density thinning areas. These openings would increase understory layering, structural diversity and ground cover, adding complexity at both the forest stand and landscape levels. Species expected to benefit from low density thinning patches are ruffed grouse, Wilson's warbler, warbling vireo, song sparrow and big game species.

Snags, Down Logs (CWD), Remnants (legacy trees) and Special Habitats

Thinning these stands would reduce the number of small diameter (less than 15 inches DBH) snags over the next 10 to 30 years because thinning from below removes the smaller suppressed and intermediate trees that would otherwise die from suppression mortality and become snags within that time period. Also, some of the existing smaller diameter/taller snags (between 9 and 15 inches DBH and greater than 25 feet tall) would be felled for safety reasons or fall incidental to thinning operations. These smaller snags have less value for most wildlife species than the larger material over 15 inches (*Rose et al. 2001*). Within thinning units, approximately 30 to 50 percent or more of existing snags over 15 inches diameter would remain standing after treatment, retaining the best available habitat. Ten percent or less of these large snags may need to be felled to maintain safe project operations.

In unmanaged forests, the presence of cavity nesting birds has been linked to the presence of snags, particularly greater than 19.26 inches (*Carey et al. 1991, Huff and Raley 1991*). Snag associated species such as chestnut backed chickadees, red breasted nuthatches, brown creepers and hairy woodpeckers have shown selectivity to foraging habitats based on deciduous trees, large diameter conifers, and large diameter heavy decayed snags and logs (*Weikel and Hayes 1999).*

Up to two trees per acre would become snags or down logs through logging where leave tree damage occurs and reserve trees are felled and left to facilitate logging. All felled snags and reserve trees would remain on-site as down CWD, providing important habitat for dead wood associated species. Small dead wood created through suppression mortality would be abundant in adjacent untreated areas (*EA Table 21*).

Throughout the project area, approximately 54 to 94 trees per acre would be retained for green trees and recruitment of snags and down logs in the future stands (*RMP p. 25*). As a result of thinning, growth of residual live trees would accelerate, so that larger trees would be available sooner for recruitment as snags and down logs than without thinning.

Existing large diameter down logs in more advanced decay conditions would persist and contribute to forest floor wildlife habitat conditions for many decades before passing through decay class five to become unrecognizable as down logs. It is anticipated that less than 10 percent of existing down CWD would be directly impacted by logging. Less than 10 percent of the thinning area would be directly impacted by skidding/yarding, which is the operation with the highest potential impact to existing CWD. BLM oversight of skyline corridor and skid trail locations would avoid impact to high value CWD wherever feasible.

The only unit in the proposed project that has large legacy trees is Unit 27B. There are approximately 10 to 20 of these large legacy trees in the unit. Emphasis will be given to retain these trees (*EA Section 2.3.1 and Table 5 PDF #44*). This unit is planned to be logged using cable systems and up to 10 percent of these trees may be cut and left on site to create logging corridors for the cable systems to work effectively. The trees that are cut would no longer provide nesting habitat for late successional associated species. The remnants remaining would continue to have live lower limbs as crown recession would likely stop in the short term as competition from smaller trees would be reduced.

As a result of increased growth rates of retained trees and tree mortality from logging, the RMP guidelines for snags (40 percent maximum population densities) and down logs (240 plus linear feet per acre of material in decay classes 1 or 2, at least 20 inches in diameter at the large end, and 20 feet in length) in the Matrix could be met in three decades.

Special Status, Survey and Manage and Species of Management Concern

Federally Listed Species

Threatened – Northern Spotted Owl

The Hole in the Road thinning project may affect, and is not likely to adversely affect, the spotted owl due to maintaining suitable habitat as a result of thinning. The Proposed Action is to thin 172 acres of suitable habitat in the Molalla Watershed. The units are not located in 2012 Critical Habitat or unmapped LSRs, which are 100 acre core areas for known spotted owl sites as of January 1994.

The Hole in the Road proposal is consistent with the Revised Northern Spotted Owl Recovery Plan (NSO 2011) and conforms to RAs 10 and 32. RA 10 recommends conserving existing known spotted owl sites with high value habitat (*NSO 2011 p. III-43).* Harvest would occur within the provincial home range radius (1.2 miles) of three known active spotted owl sites. Spotted owl habitat will be maintained by keeping at least 60 percent canopy cover, in a light to moderate thin. RA 32 recommends land managers maintain high quality suitable habitat. The proposed units do not meet the stand level conditions characteristic of RA 32 Habitat (*NSO p. III-67*), therefore no RA32 habitat would be altered.

The short-term effect of thinning will be maintaining 172 acres of suitable and 188 acres of dispersal habitat. "Maintaining" habitat can include thinning in which forest stand characteristics are altered, but the habitat components that support spotted owl life history requirements remain. For maintaining spotted owl habitat in areas considered "suitable" and "dispersal", a canopy cover of over 60 percent in suitable habitat and over 40 percent in dispersal habitat, along with other habitat elements (e.g. including snags, down wood, tree-height class-diversity, and older hardwoods), will be left post- treatment to adequately provide for spotted owl suitable and dispersal habitats.

The effects of thinning is anticipated to have a negative short term effect to spotted owl prey species, but expected to have long term benefits. Northern flying squirrels are tied to complex mid-story canopies. Thinning from below will remove much of this canopy layer in the short term. The length of time between thinning and recovery of flying squirrel habitat suitability in young stands is about 30 to as much as 100 years (*Wilson 2010*). Thinning should in the long term create a shade tolerant understory layer that would benefit flying squirrels. The habitat is considered suitable for red tree voles. Surveys were conducted and no red tree voles were found (*EA p. 121*).

As the thinned stand grows, habitat conditions would improve. Canopy closures would increase and the stand could improve suitable habitat conditions within 10 to 30 years. Subsequent treatments to create snags and down logs would help move these stands toward suitable habitat conditions.

Unit 27B may have one to two 0.5 acre landings to facilitate logging. The majority of this landing area will be in capable habitat. Less than 0.25 acres will be in suitable habitat. The post-harvest canopy cover in the suitable habitat of the unit should still be above 60%, and would not have an effect on spotted owl habitat due to the small area affected.

Table 20. **Spotted Owl Habitat Modification by Treatment Type, Land Use Allocation, Pre/Post Treatment Habitat type, Habitat Modification and Effect.**

5th Field Watershed	Project	Township-Range-Section#	Proposed Treatment[1]	Acres	LUA	Pre/Post Treatment Habitat Type[2]	Habitat Modification[3]	Effect[4]
Molalla	Hole in the Road	7S-3E-15	moderate thin	35	Matrix	Suitable/Suitable	Maintain	NLAA
Molalla	Hole in the Road	7S-3E-16	moderate thin	100	Matrix/RR	Dispersal/Dispersal	Maintain	NLAA
Molalla	Hole in the Road	7S-3E-21	moderate thin	63	Matrix/RR	Dispersal/Dispersal	Maintain	NLAA
Molalla	Hole in the Road	7S-3E-21	moderate thin	10	Matrix	Suitable/Suitable	Maintain	NLAA
Molalla	Hole in the Road	7S-3E-22[32]	moderate thin	25	Matrix	Dispersal/Dispersal	Maintain	NLAA
Molalla	Hole in the Road	7S-3E-22	moderate thin	71	Matrix	Suitable/Suitable	Maintain	NLAA
Molalla	Hole in the Road	7S-3E-26	moderate thin	14	Matrix	Suitable/Suitable	Maintain	NLAA
Molalla	Hole in the Road	7S-3E-27	moderate thin	36	Matrix/RR	Suitable/Suitable	Maintain	NLAA
TOTAL				**354 ac**				

Notes and definitions for Table 4 (BA pp. 2-3, 4; BO pp. 9-10, 17-19).

1 Treatment Type:

Moderate thinning in dispersal or suitable habitat can be for forest health, to improve the structural characteristics of a stand, or to provide commodity. Such treatments may be described as commercial thinning, density management, selective cut, partial cut, or mortality (standing) salvage. Such thinnings maintain a minimum of 40 percent average canopy cover. Light to moderate thinnings can have long-term benefits to spotted owls by encouraging late-successional characteristics to occur more rapidly.

2 Habitat Types:

Suitable habitat is conifer-dominated, 80 years old or older and multi-storied in structure, and has sufficient snags and downed wood to provide opportunities for owl nesting, roosting and foraging. The canopy cover generally exceeds 60 percent.

Dispersal habitat consists of conifer and mixed mature conifer-hardwood habitats with a canopy cover greater than or equal to 40 percent and conifer trees greater than or equal to 11 inches average diameter at breast height (DBH). Generally, spotted owls use dispersal habitat to move between blocks of suitable habitat, roost, forage and survive until they can establish a nest territory.

[32] Despite being over 80 years, this unit is considered dispersal habitat primarily due to its small average diameter (12.5”) of established trees.

Juvenile owls also use dispersal habitat to move from natal areas. Dispersal habitat lacks the optimal structural characteristics needed for nesting.

3 Habitat Modifications:

Maintain habitat means to alter forest stand characteristics but maintain the components of spotted owl habitat within the stand such that spotted owl life history requirements are supported (i.e. the functionality of the habitat used by spotted owls remains intact post treatment). For spotted owl dispersal-only habitat a canopy cover of >40 percent along with other habitat elements (e.g. including snags, down wood, tree-height class-diversity, and older hardwoods) will be maintained post treatment to adequately provide for spotted owl dispersal.

Downgrade: Refers to silvicultural activities that change spotted owl suitable habitat to dispersal habitat.

4 Effect: **NE**=No effect; **NLAA**=May affect, but not likely to adversely affect; **LAA**=May affect and likely to adversely affect.

Survey and Manage Species

Red Tree Vole

No red tree voles were found in the BLM surveys in and around the proposed units. Past surveys have found red tree voles 1.5 miles to the North and 2.5 miles to the North West of Unit16A. The habitat is considered suitable and it's possible there were undetected nests. In the short-term, undetected nests could be destroyed or disturbed during thinning. Thinning can temporarily inhibit dispersal and make habitat less suitable because of wider spacing between crowns (*Hayes et al. 1997*). After thinning, stand conditions would improve over time as canopies close.

Mollusk Species

Surveys for Bureau Sensitive and Survey and Manage mollusks were conducted during the spring and fall of 2014. One Bureau Sensitive mollusk species was found, Cascade axe-tail slug, in Section 7S-3E-22. There is no anticipated effect on this mollusk site, as it is currently outside any proposed thinning unit.

Other Species of Concern

Migratory and Resident Birds

Unintentional take of nests, eggs, nestlings and nesting failure could occur if harvest operations occur during active nesting periods. In the western Oregon Cascades there is temporal variability of breeding bird species and individuals of the same species in forested habitats. For example, some owls and woodpeckers begin breeding in February or March, while some flycatchers do not finish breeding until August. The majority of birds in the Pacific Northwest complete their breeding cycle within the April 15 to July 31 time period (*Altman, Hagar 2007*). This is the critical breeding period for over 90 percent of individuals and over 90 percent of the bird species, and the greatest amount of take would occur if habitat modification occurs during these times (*Altman, Hagar 2007).*

The effects of thinning would be short term, and would not reduce the persistence of any bird species in the watershed or populations at the regional scale. Some individual birds may be displaced due to disturbance during harvest operations in the project area. Adjacent untreated areas and areas where active operations are not occurring would provide refuge, which would minimize short-term disturbance.

Changes in habitat structure would have immediate effects on bird communities in thinned stands. Thinning would immediately enhance habitat suitability for species which prefer a less dense conifer canopy, and reduce habitat suitability for species that prefer more continuous conifer canopies. Reducing the canopy closure and opening up stands is expected to have short term negative effects on the brown creeper, golden-crowned kinglet, hermit warbler, Pacific-slope flycatcher and varied thrush. Thinning would have positive long-term effects on this same set of species as understories develop and habitat quality improves.

Overall bird species richness (a combination of species diversity and abundance) would gradually increase as hardwood components develop, plant species composition becomes more complex, and hardwood shrub layers, epiphyte cover, and snag density become more prominent within the stands. The future development of hardwood/deciduous tree/bush components and canopy layers would favor species such as the band-tailed pigeon, ruffed grouse, red-breasted sapsucker, Wilson's warbler, Hutton's Vireo and black-throated gray warbler. The low density thinning patches would encourage the development of hardwood/deciduous tree/shrub components and canopy layers more rapidly and would further benefit this same set of species.

Bats

Adverse impacts to bat species would be low. Old-growth forests provide higher quality roost sites than younger forests, and many species prefer older forests (*Thomas and West 1991, Perkins and Cross 1988*). Bat activity appears to be higher in thinned versus unthinned stands. Structural changes in stands caused by thinning may benefit bats by creating habitat structure in young stands that bats are able to use more effectively (*Humes, Hayes, Collopy 1999*). Bat species are also associated with buildings, bridges, mines, cliff crevices and caves. None of these features are present in the project area.

Big Game

Big game species would be temporarily disturbed during the implementation of the Proposed Action. Logging equipment noise and human presence may cause animals to avoid or disperse from the project area during times of operation. Thermal and hiding cover quality would decrease in the short-term as a result of thinning, opening new roads, renovating roads and road improvements (*Cole et al. 1997, Trombulak and Frissell 1999*). Saplings and vegetative forage such as shrubs, grasses and forbs would increase because of thinning and road closures after thinning. As a result of increased light, forage quantity would increase and attract early successional species such as elk and deer to the thinned areas. This response of early seral plant species would be especially evident in the low density thinning areas.

In the long term (five plus years), thermal and hiding cover quality would increase and vegetative forage would gradually decrease as a result of canopy closure, decreasing the amount of light reaching the forest floor. Vegetative forage would persist longer in low density thinning areas.

Cumulative Effects

Hole in the Road Project Area is located in the Upper Molalla 5th field Watershed (*EA Section 3.3.1 Tables 9,10 and 11*), and the Pine Creek 6th field Watershed. Table 21 illustrates Seral stages of forest lands within the Pine Creek 6th field Watershed;

Table 21. **Age Class Distribution of Forest Stands within Pine Creek 6th Field Watershed**

Seral Stages*	Age Class of forest stands	Pine Creek 6th field Watershed: Total 23,949 acres			
		BLM	Private and State**	All ownership	% of Watershed
Non-forest	Non-Forest[33]	211	1,100	1,311	5%
Early Seral[34]	0-29 years	905	4,459	5,364	22%
Early Mid-Seral	30-39 years	961	3,653	4,614	19%
Mid-Seral	40-59 years	3,272	1107	4,379	18%
Late Mid-Seral	60-79 years	244	425	669	3%
Early Mature Seral	80-119 years	1807	3,653	5,460	23%
Mature	120-199 years	1,953	197	2,150	9%
Old Growth	200+ years	2	0	2	0%
Total		9,357	14,592	23,949	100%

Data complied from BLM Forest Operations Inventory Data and LIDAR vegetation data, January, 2014.

**Seral Stage definitions based on RMP/FEIS glossary, p 6-13. By using LIDAR first return to analyze vegetation height, BLM wildlife biologist estimated the amount of each seral stage on non-federal land in the SWB.*

The Pine Creek 6th field Watershed is 23,949 acres and BLM manages about 9,357 acres (39 percent) of the watershed. The state manages 2,887 acres (12 percent), and the remaining 49 percent of the 6th field watershed is managed primarily by private industry. Most of the thinning that has occurred or is planned for the foreseeable future is targeted for mid seral, early mature and mature stands.

Currently, early mature and mature forests comprise approximately 3,760 acres (40 percent) of the BLM ownership in the watershed. The Hole in the Road Project is currently the only BLM timber management project proposed in the Pine Creek sixth field Watershed, which includes thinning 197 acres (3 percent) of early mature and mature forests. This equates to approximately 5 percent of this forest type on BLM in this 6th field watershed. BLM has had several commercial thinning projects in the last 10 to 15 years in the watershed including Annie's Cabin, B-Cubed, Pine Rock and Good Gawley (*EA Section 3.2*). With the current proposal and past projects approximately 1,416 acres (45 percent) of early mature and mature stands in the Pine Creek 6th field Watershed on BLM ownership have been thinned. Most of the early mature and mature stands on non-federal managed lands are on State land, of which approximately 80

[33] "Non-Forest" acres are calculated in this instance as areas with little to no vegetation, including but not limited to: rock outcrops, brushy areas, water or roads.
[34] "Early seral" and "early-successional" are used interchangeably in this document.

percent has been commercially thinned[35]. In the Pine Creek 6th field Watershed, 41 percent of the late mid and early mature stands will not be treated with this project, or have been treated in previous projects.

Snags and Down Logs (CWD)

Thinning the stands proposed in the Hole in the road project would reduce the number of small diameter (less than 15 inches DBH) snags over the next 10 to 30 years that would otherwise die from suppression mortality and become snags. Small dead wood would still be present and available in adjacent untreated areas. Design features would retain existing down logs 20+ inches and snags 15+ inches diameter. Any snag that falls for any reason as a result of thinning operations would remain on-site to become down CWD, providing important habitat for dead-wood associated species (*Aubry 2000, Bowman et al. 2000, Butts and McComb 2000*).

Up to two trees per acre would become snags or down logs through logging where leave tree damage occurs and reserve trees are felled and left to facilitate logging.

Beneficial long term cumulative effects to larger CWD and associated wildlife species would occur as a result of implementing the project, since larger trees would be available sooner than without thinning to contribute additional large snags and CWD recruitment in future stands. As larger trees develop in the residual stands, they would provide source material for girdling and topping.

Federally Listed Species

Threatened – Northern Spotted Owl

Cumulative effects to Northern spotted owl prey species was analyzed at the 6th field watershed scale. In the Pine Creek 6th field Watershed, 23 percent of the late mid and early mature stands will not be treated with this project, or were treated in past projects. The amount of untreated late mid and early mature stands should be sufficient to maintain dispersal and travel corridors between stands for both Northern flying squirrels and red tree voles. These areas can act as refugia, maintaining understory layering and interlocking crowns in the interim while surrounding thinned stands become more suitable.

The scale for cumulative effects for the northern spotted owl is the home range of known spotted owl sites (*BA pp. 3-4; BO pp. 17-18*) and the location of the project in relationship to adjacent known spotted owl sites and LSRs. This scale was chosen because the Northwest Forest Plan for conservation and recovery for spotted owls prescribes maintaining suitable owl habitat within LSRs and the provincial home range of known owl sites and dispersal habitat between LSRs and known owl sites. The Proposed Action would maintain dispersal habitat within and between known owl sites, and no harvest would occur in LSRs, RA10 or RA32 habitat.

Harvest would occur within the provincial home range of a known spotted owl sites and suitable and dispersal habitat would be maintained in these known sites. Therefore, the Proposed Action would not contribute to cumulative effects to spotted owls.

[35] Compiled from BLM GIS Lidar data, 2014

Special Status, Survey and Manage Species

Thinning in the project areas would not be expected to contribute to the need to list any Bureau Sensitive species or species of concern under the ESA (*BLM 6840).* Habitat for the species that are known to occur in the watershed would be maintained, habitat connectivity would not be changed, any habitat alteration would have only short-term negative effects, and long-term effects could be beneficial.

The Proposed Action would not contribute to cumulative effects to any Special Status or Survey and Manage Wildlife species. Bureau Special Status and Survey and Manage species have been found during surveys of the area. The sites will be buffered to create skips where these species were found to be present. A high percentage of similar habitat in the watershed would remain untreated and high quality suitable habitat for Special Status and Survey and Manage species would remain intact. Implementation of the project would not eliminate connectivity between adjacent untreated stands under BLM management.

Other Species of Concern

Migratory and Resident Birds

No cumulative effects to birds are expected. The Proposed Action would not reduce the persistence of any bird species in the watershed or populations at the regional scale. Habitat changes resulting from the Proposed Action would not change seral stage habitat or change any patch size, and therefore would not contribute to fragmentation of bird habitat. Thinning would not contribute to a fundamental change in the species composition of existing bird communities within the watershed. In the long term, the thinning could have the potential to improve habitat for bird species as this stand continues to mature, resulting in greater bird species diversity.

Bats

Cumulative effects to bats would be low and follow closely the cumulative effects to snag and late successional habitat. Habitat quality for bats is poor due to the lack of suitable snags and other primary habitat features for bats.

Big Game

No adverse cumulative effects to big game species populations are expected. The Proposed Action would not change any forest cover type or change any habitat patch size. Therefore, thermal and hiding cover present before treatment would be maintained after harvest. Variable density thinning, including low density thinning areas, is expected to improve the quality of forage and cover both in the short and long term.

No Action Alternative

Snags and Down Logs (CWD)

Self-thinning would occur, but snags and down logs created by suppression mortality would not be large enough to meet RMP standards until later in the life of the stand (approximately 20 to 60 years) when suppressed co-dominates achieve these diameters before dying. In Units 15A, 15B, 22C, and 22D, all have a QMD over 20” DBH and it is likely that some of the suppression mortality would be large enough to meet RMP standards. No snag or CWD creation would occur, and CWD development would occur over a longer period through self-thinning.

Understory and ground cover development would establish more slowly as self-thinning occurs, or until a disturbance such as fire or wind throw removes overstory trees, allowing light to reach the forest floor. Late successional habitat conditions would continue to develop slowly; these stands would maintain current species composition and vertical diversity where present.

Federally Listed Species

Threatened – Northern Spotted Owl

There would be no immediate change in spotted owl habitat and no effect to spotted owls under the No Action Alternative. Habitat conditions would remain as described in the Affected Environment and would be maintained and develop slowly for the reasons stated above. Currently, the stands are considered marginal suitable, and dispersal habitat which would slowly improve under the No Action Alternative. Spotted owl prey species would be unaffected.

Special Status, Survey and Manage Species

In the short term, there would be no immediate change in current habitat conditions for Survey and Manage and BLM Special Status species. In the long term, trees would grow slowly, and material available for CWD recruitment would average smaller in diameter than if thinning were to occur. Since no new disturbance to the conifer canopy would occur, no undetected red tree vole nests would be affected. In the long term, optimal habitat for the red tree vole would develop more slowly without thinning.

Mollusk habitat conditions would remain as described in the Affected Environment and would be maintained. Survey and Manage and Bureau Sensitive mollusk species would be unaffected.

Other Species of Concern

Migratory and Resident Birds

Habitat conditions would remain as described in the Affected Environment and would continue to develop slowly.

Species richness of bird communities would reflect mid to early mature for a longer period of time, and overall bird species richness would be less than if these stands were thinned. Bird species richness may not noticeably increase, and legacy features in the future stand would likely be smaller and less persistent, especially those that provide habitat for cavity-nesting species. Habitat would remain the same for migratory and resident birds.

Bats

Habitat conditions would remain as described in the Affected Environment and would continue to develop slowly. Stand mortality would allow for some large snags over 20 to 40 years.

Big Game

In the short term, there would be no disturbance effects due to the Proposed Action. Thermal and hiding cover quality would remain the same as current conditions. There would be no increase in vegetative forage due to increased light to the forest floor. In the long term, thermal and hiding cover quality would remain about the same as this overstocked stand matures. Forage quantity would continue to decrease as less light reaches the forest floor.

3.3.6 Air Quality and Fire Hazard/Risk

Sources: Hole in the road Fuels Specialist Report; Macalady 2015; Hole in the Road Silviculture Prescription (Sivliculture Prescription or Silviculture Report); Foster, Macalady, Ruzicka 2015 and 2016

Methodology:

The Cascades Field Office Fuels Management Specialist assessed air quality and fire hazard and risk by using the following methodologies:

- The modeling predictions for slash pile tonnage come from "Piled Fuels Biomass and Emissions Calculator": http://depts.washington.edu/nwfire/piles/
- For CWD information, Stand Exams were conducted in 2009 and 2014. Additional stand information was gathered in 2015 by BLM personnel.
- Fire Regime and Condition Class descriptions to determine fire frequency and vegetation characteristics are located at: http://a123.g.akamai.net/7/123/11558/abc123/forestservic.download.akamai.com/11558/www/nepa/11349_FSPLT1_008431.pdf
- The modeling predictions for fire regime and condition class come from the LANDFIRE Rapid Assessment Vegetation Models: http://www.fs.fed.us/database/feis/fire_regime_table/fire_regime_table.html#PacificNorthwest
- Wildfire frequency information was gathered from the Oregon Dept. of Forestry web site and is available at: http://www.odf.state.or.us/DIVISIONS/protection/fire_protection/fires/SeasonFireStats.asp (*referenced in document as ODF 2015*)
- Fuel models were determined by using the "Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model" General Technical Report RMRS-GTR-153: Rocky Mountain Research Station, Fort Collins, CO: U.S. Department of Agriculture, Forest Service (*Burgan and Scott*, *2005*) and is available at: *Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model*
- Current and potential logging slash residues were determined by conducting a visual "walk through" and by consulting the Stereo Photo Series for Quantifying Forest Residues in Coastal Oregon Forests: Second-Growth Douglas-Fir---Western Hemlock Type**,** Western Hemlock---Sitka Spruce Type, and Red Alder Type. General Technical Report PNW-GTR-231 U.S. Department of Agriculture - Forest Service, Pacific Northwest Research Station, Siuslaw National Forest (*Ottmar, Hardy 1989*), and the Stereo Photo Series for Quantifying Forest Residues in Douglas-fir hemlock Type of the Willamette National Forest. General Technical Report PNW-GTR-258 U.S. Department of Agriculture - Forest Service, Pacific Northwest Research Station, Siuslaw National Forest (*Ottmar*, *Hardy*, *Vihnanek 1989*).

3.3.6.1 Affected Environment

Air Quality

The major source of air pollutants within the Hole in the Road analysis area is smoke associated with resource management activities including prescribed burning, machine and landing piles, fossil fuel combustion and dust from the use of natural-surfaced roads.

The State of Oregon has designated the Willamette Valley as a Smoke Sensitive Receptor Area. The Willamette Valley experiences periods of air stagnation where cold air often becomes trapped near the valley floor with slightly warmer air aloft. These conditions create the phenomenon known as temperature inversion. These conditions result in trapping and concentrating air pollutants near the ground. Wintertime temperature inversions contribute to high particulate levels, often due to wood burning for home heating and fossil fuel combustion. Stagnant periods contribute to increases in ozone levels, causing the local air quality to deteriorate.

Fire Hazard/Risk

The climate in Northwest Oregon is considered mild and wet in late fall, winter and early spring. In the Oregon Cascade Mountains, snowfall accumulation remains at higher elevations (~2,500^{+} feet) for an extended period of time, but does not persist for long periods at lower elevations. Summers are warm with periods of dry weather during the months of July, August, and September. Summer mean temperatures during this period average approximately 55°- 60°F for lows and highs of 75° - 80° F. Extreme high temperatures reaching into the mid to upper 90's, and occasionally topping 100° F are common, but infrequent and occur for short durations. During average weather years, the conditions under the forest canopy remain relatively moist.

Fire is a natural disturbance process in the analysis area, especially on the southern slopes located within the Molalla River Watershed. Fire effects are influenced by habitat type, fire frequency, fire duration, and fire intensity (*Van Wagner 1965*). These effects vary with forest type, depending on fuel type, structure, topography, and weather. Fire can influence; vegetation composition, age, and structure, successional pathways; nutrient cycling; fish and wildlife habitat and insect and disease vulnerability.

Wildfires within the project area have been primarily human-caused. Wildfire risk from humans within the project area is higher than compared to lightning. Dry lightning (lightning that that has no accompanying moisture) is uncommon in Northwest Oregon. The project area is located within the Oregon Department of Forestry's North Cascades District (Molalla Unit). Over the last ten years an average of two fires per year are attributed to lightning while five fires per year are human caused. The average size of lightning fires is approximately one half of an acre while the average size of human caused fires is approximately 31 acres in size (*ODF 2015*).

The overstocked stands in the project area could sustain a high intensity crown fire because of the amount of potential ladder fuels and the available fuel density in the canopy (canopy bulk density). Relative density above 35-45 percent is associated with a canopy bulk density which could sustain a high intensity crown fire (*Agee 1996*). The average relative density of the forest stands within the project area is approximately 65 percent (*EA Section 3.3.1*).

Fire Regime and Condition Class (FRCC)

The Hole in the Road project vicinity occurs within the Pacific Northwest Forested landscape and potential natural vegetation groups in the area are Douglas-fir-western hemlock (dry mesic), and Douglas-fir-western hemlock (wet mesic). The Fire Regime classifies the role fire would play across the landscape in the absence of recent human intervention. The area falls within two different Fire Regimes:

> Fire Regime III is characterized by a moderate to low fire return interval with a mixed severity and is associated with south and west facing slopes. More than 75 percent of fires are characterized as mixed or low severity.
>
> Fire Regime V is characterized by a low fire return interval with a high severity and is associated with north facing slopes. More than 70 percent of fires are characterized as stand replacement.

The Condition Class classifies the degree of departure from the natural fire regime. The timber stands in the analysis area generally fall within Condition Class 2 or 3. Forest management on both public and private lands in the Hole in the Road area has altered the natural forest composition and structure and created large tracts of even-aged, overstocked stands, young plantations and clearcuts.

> Condition Class 2 indicates that fire regimes have been moderately altered from their historical range.
>
> Condition Class 3 indicates that fire regimes have been substantially36 altered from their historical range.

Timber Stand and Fire History

Fire plays a major role as a natural disturbance agent, as do people. The pre-settlement fire history of the Hole in the Road analysis area is not well documented. Although it is known that Native Americans burned within the Willamette Valley, to what extent this burning extended into the Cascade foothills and up the river corridors is not specifically known. Post-settlement fire history in the analysis area does not document any wildfire occurrence. However, the relatively frequent occurrence of Decay Class 4 & 5 down woody material and snags with char at the base in Units 15A, 15B, 22D and 27B indicates this stand regenerated after a stand replacing wildfire event likely occurring during the first two decades of the 20th Century.

Past forest management has shaped the analysis area. According to BLM records portions of Unit 22B and 22C were thinned in the 1971 Cest La Guerre Timber Sale and again in 1973 in the Lower Horse Creek Sale Timber Sale. Additionally, the portion of Unit 22C east of the 7-3E-22 Road was thinned again in 1981.

Many areas adjacent to the analysis area on private timber land have also been harvested during this time to the present. Harvest areas on BLM managed land during this period often had been

[36] The original description for condition class 3 uses "significantly", which has a specific meaning in NEPA that is not intended in the context of the model.

broadcast burned or had spot burning associated with them. Burning primarily occurred for site preparation prior to tree planting but also to reduce the fuel load and limit the potential of a future wildfire.

The average fire return interval has increased following the advent of fire suppression in 1910. It has been decades since the most recent man-caused disturbance (logging) occurred within the analysis area. Although fire has been excluded from the landscape by aggressive fire suppression the analysis area is still within the range of a normal fire return.

3.3.6.2 Environmental Effects

Proposed Action

Air Quality

An increase in vehicle traffic would occur over access roads during the implementation of this project. The increases would be considered short-term while the project is implemented. Fossil fuel combustion and dust created from vehicle traffic from proposed project activities on gravel or natural-surface roads would contribute short-term (during project work) effects to air quality. These effects would be localized to the immediate vicinity of the operations.

The overall effects of smoke on air quality is predicted to be local and of short duration. Activities associated with the Proposed Action would comply with the provisions of the Clean Air Act. All prescribed fire burning would be done in accordance with the Oregon State Implementation Plan and Oregon Smoke Management Plan. The potential for smoke from prescribed fire to intrude into Smoke Sensitive Receptor Areas (SSRA) is low because burning would be done when the prevailing winds are blowing away from the SSRA and under atmospheric conditions that favor good vertical mixing so that smoke and particulate matter is dispersed by upper level atmospheric winds.

Prescribed burning would cause short-term impacts to air quality that would persist for one to three days within one-quarter to one mile of the project units. None of the proposed treatment units are close enough to public highways to affect motorist safety.

Fire Hazard and Risk

All treatment areas would see a short-term (0-5 year) increase in fire ignition potential because of the increase in fine dead fuels. Following thinning the fuel load and risk of a fire start would increase and would be greatest during the first year following treatment when needles dry but remain attached to tree limbs. In the event of a fire start, the elevated fuel load resulting from the Proposed Action would produce higher flame lengths, rates of spread and decrease the ability to control a fire.

The modeling predictions for fire behavior based on “Standard Fire Behavior Fuel Models” (*Scott, Joe H., Burgan, Robert E. 2005*), fuel models would move the commercial thinning and low density thinning areas from Fuel Models 161 and 165 (TU1: Low Load Dry Climate Timber-Grass-Shrub (Dynamic) and TU5: Very High Load, Dry Climate Timber-Shrub) to Fuel Models 201and 203 (SB1: Low Load Activity Fuel and SB3: High Load Activity Fuel or Moderate Load Blowdown).

Thinning trees would decrease both the amount of potential ladder fuels and the canopy bulk density in the project area because the silvicultural prescription would lower the relative density to approximately 36 percent. A relative density of 35 - 45 percent or lower has been identified as the point where canopy bulk density is unlikely to sustain a high intensity crown fire (*Agee 1996*). The silvicultural prescription for all of the units in the analysis area falls within or below this range.

Following treatment, containment of wildfires at less than 10 acres in size should continue to be attainable and the ability to successfully control wildfires in the fuels treatment areas would remain high. For the short-term (0-5 years), the fire risk would increase in all of the thinned areas. However, due to decreased crown density and reduction in ladder fuels, fires would be expected to remain as ground fires which can be successfully controlled. Decreasing fuel loading in strategic locations, such as along roads and property lines, would reduce the potential for human caused fire starts and would provide fuel breaks with lower fire intensity, rates of spread and flame lengths where fire can be successfully controlled by initial attack resources.

Cumulative Effects - Proposed Action

Air Quality

There would be no cumulative effects to air resources, as the direct and indirect effects from the projects would be local and of short duration. No other effects in the project areas affecting this resource are anticipated. Based on past experience with pile burning within this habitat type and adherence to smoke management plans, there are no expected cumulative effects on air quality from the planned fuels treatment under this proposal.

Fire Hazard and Risk

There would be an increase in fuel loading and resultant fire hazard in the short-term (0-5 years). In the commercial thinning area, along roads and property lines and in gaps, the hazard and risk of fire would be minimized by the use of fuels reduction treatments. The localized increase in fire risk would diminish over time as slash decomposes. There would be positive benefits to the thinned stands in the longer term due to the wider spacing between tree crowns and the removal of most of the ladder fuels that are conducive to the spread of fire into the tree canopy. At a watershed scale, the commercial thinning of approximately 354 acres of forest habitat would have very little effect on fire intensity or starts. However, due to reduced canopy density and ladder fuels, the potential for the stand to carry a crown fire would be reduced in the long term (greater than 5 years).

No Action Alternative

Air Quality

Effects of vehicle exhaust and dust from vehicle traffic on gravel and natural-surface roads in the Hole in the Road area would continue at approximately the current levels since current traffic patterns would likely continue. These effects would be minor and localized to the immediate vicinity from harvest operations on adjacent Private and State lands.

No commercial thinning, density management, road construction or road renovation, log hauling or prescribed burning would occur so there would be no additional localized effects to air quality from management operations.

High stocking density would cause forest stands to become more susceptible to a stand replacement fire event due to fuel loading and ladder fuels. In the event of a wildfire, poor air quality would be expected due to the high volume of smoke produced, potentially for several days to weeks.

Fire Risk

There would be no direct effects with the No Action alternative. Vegetation growth in the analysis area would continue on its current trajectory. The current risk of a fire start would remain low. There would be a slow increase in the coarse woody fuel load (1000 hour fuel class) and in the smaller size fuel classes (1, 10, and 100 hour fuels) in these timber stands as mortality within the stands increases. Ladder fuel densities would increase as additional trees become suppressed and die in the understory, shade tolerant species become established, and dominant trees increase in size. The potential for these stands to eventually succumb to a wildfire would continue to increase as they near the maximum fire return interval and the Condition Class departs further from the natural fire regime.

Cumulative Effects – No Action

Air Quality

There are no expected cumulative effects on air quality No Action Alternative.

Fire Risk

There would be no direct effects with the No Action alternative. Vegetation growth in the analysis area would continue on its current trajectory. The current risk of a fire start would remain low. There would be a slow increase in the coarse woody fuel load (1000 hour fuel class) and in the smaller size fuel classes (1, 10, and 100 hour fuels) in these timber stands as mortality within the stands increases. Ladder fuel densities would increase as additional trees become suppressed and die in the understory, shade tolerant species become established, and dominant trees increase in size. The potential for these stands to eventually succumb to a wildfire would continue to increase as they near the maximum fire return interval and the Condition Class departs further from the natural fire regime.

3.3.7 Carbon Storage and Carbon Emissions

Sources: Hole in the road Carbon Sequestration (Storage) and Climate Change report, Ruzicka2016; Hole in the Road Silviculture Prescription (Sivliculture Prescription or Silviculture Report); Foster, Macalady, Ruzicka 2015 and 2016;

Methodology:

Cascades Field Office Silvicultralist assessed potential effects to carbon sequestration and climate change by using the following methodologies:

- The BLM calculated estimates of existing carbon stores, the amount of carbon to be removed by the proposed action, storage of removed carbon, and of future carbon storage in the remaining and regenerated trees in the stand. The estimates are based on data from BLM stand exams modeled with the ORGANON (*Hann et. al. 2006*) program, analysis of carbon storage in the FEIS for the Revision of the Resource Management Plans of the Western Oregon Bureau of Land Management (*WOPR Ch. 3 p.220-224 and Ch. 3, p.537-543, Appendix C p. 30)*, and literature review.

- On July 16, 2009, the U.S. Department of the Interior withdrew the Records of Decision (*2008 ROD*) for the Western Oregon Plan Revision. The information contained in the Final Environmental Impact Statement for the Revision of the Resource Management Plans of the Western Oregon Bureau of Land Management (*2008 FEIS*) is relevant since it examined recent and applicable science regarding climate change and carbon storage. That analysis concluded that effects of forest management on carbon storage could be analyzed by quantifying the change in carbon storage in live trees, storage in forests other than live trees, and storage in harvested wood. The discussion on Volume I, Pages 220-224; Volume II, Pages 537-543, and Volume III, Appendices, Pages 28-30 are relevant to the effects analysis for this project and are incorporated by reference.

Context

Greenhouse Gases, Climate Change and the Spatial Scale for Analysis

Uncertainty about the nature, effects and magnitude of the greenhouse gases and global climate change interrelationship is evident in a wide range of conclusions and recommendations in the literature reviewed. However, Forster et. al. 2007 (*pp. 129-234*), which is incorporated here by reference, concluded that human-caused increases in greenhouse gases are extremely likely to have exerted a substantial effect on global climate. Additionally, the Intergovernmental Panel on Climate Change (IPCC) fifth assessment report has concluded that climate change has already caused impacts on both natural and human systems (*IPCC 2014*).

The U.S. Geological Survey, in a May 14, 2008 memorandum to the U.S. Fish and Wildlife Service, summarized the latest science on greenhouse gases 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. This defines the spatial scale for analysis as global, not local, regional or continental. That memorandum is incorporated here by reference. Additionally, the BLM Instruction Memorandum OR-2010-012, issued January 13, 2010 and incorporated by reference, states that the incremental effects of project actions should be addressed in the context of cumulative effects at multiple spatial scales.

The assumption of climate stability is inherent in the carbon calculator used by the BLM in this analysis. However, climate change is likely to substantially alter future growing conditions for forests in the Pacific Northwest. Temperatures are expected to increase, especially in the spring as summer, while predicted changes to seasonal precipitation vary, but are generally expected to slightly decrease in the summer and slightly increase in the winter (*Chmura et al. 2011* and references therein). Also, increased atmospheric CO2 may increase tree growth through increased water use efficiency but this will depend on the local factors limiting tree growth

(*Penuelas et al. 2011*). Changing climate will also alter disturbance regimes, likely increasing the potential for fire and insect outbreaks (*Chmura et al. 2011*) or have a synergistic effect between them (*Raffa et al 2008*). The effects of these changes have a variety of consequences for modeling carbon storage in the Pacific Northwest (*Law and Waring 2015*).

However, the assumption of stability is valid for this analysis by the BLM as climate change will likely affect all alternatives in a similar fashion. It may even underestimate the carbon storage under the Proposed Action because in general less dense forests are thought to be more resistant to water limitations and stand-replacing fire (*Chmura et al. 2011*). For this analysis, the BLM assumes that while the absolute values for carbon storage would likely change under the effects of climate change on forest growth, the relative values for comparing alternatives will not.

Carbon accounting for a particular project is difficult as climate change is a cumulative, global process and CO2 is well mixed in the atmosphere. For this reason, it is important to correctly identify the system boundary (i.e. Proposed Action), but to also acknowledge potential "leakage" effects where actions in one area affect carbon storage in others (*McKinley et al. 2011*). For example, substituting wood products instead of more carbon intensive alternatives (e.g. using wood in construction instead of steal or concrete) is a potential way to reduce carbon emissions. Other potential leakage effects include regional shifts in production to make up for shortfalls due to regulations or other market factors (*McKinley et al. 2011*). These effects are beyond the scope of the Hole in the Road project and would need to be analyzed at regional or national scales.

Based on the BLM's review of statutes, regulations, policy, plans and literature, the BLM presents the conclusions above as appropriate context for a reasoned choice among alternatives.

Temporal Scale for Analysis

The BLM has selected fifty years as the time frame for analysis of carbon storage and climate change for this project. Thinning is an intermediate stand treatment before a final harvest in rotation lengths of 70-110 years as directed (*RMP p. D-1*). Although some stands may be harvested before 50 years, this time frame provides a clear difference in the magnitude between the full cycle of carbon storage and release for this project and would likely be similar for future rotations. The stands in the RR and those within the potential WSR designation would likely never have a final regeneration harvest. Additionally, due to the age of many stands in the project, uncertainty within the ORGANON model increases for stand simulations past 120 years of age. Using 50 years of analysis minimizes model uncertainty for some stands.

Calculations of Carbon Storage, Project Area

The BLM used site specific data from stand exams as input to the ORGANON model to calculate carbon flow on the project area and the direct effects of the Proposed and No Action alternatives. Volume changes were used with calculations from Smith et. al, 2006 and DOE 2007 cited in WOPR Appendix C to obtain carbon figures. Greenhouse gas emission from harvest operations were calculated based on equipment production rates from appraisal estimates for the Salem District and Hole in the Road Timber Sale. The purpose of the calculations is to provide a basis for determining significance of carbon storage relative to the temporal and spatial scale.

3.3.7.1 Affected Environment

The Proposed Action is to commercially thin approximately 354 acres of 42-137 year old forest stands. Under average historic conditions (*WOPR p. 3-211*), BLM-managed lands in western Oregon stored 576 million tonnes of carbon, 35 percent more than is currently stored in forests and harvested wood in these forests today. This is due to the greater proportion of younger stand structural stages in BLM-managed lands in western Oregon today (*WOPR p. 3-224*).

The following shows quantities of carbon in forest ecosystem vegetation worldwide, in the United States, and in the Hole in the Road project area.

- Total carbon, forest ecosystem vegetation, Worldwide = 132-457 Gt (*Matthews et al. 2000, p. 58*).
- Total carbon, forest ecosystem vegetation, United States = 27 Gt (*US EPA 2009*).
- Total carbon, forest ecosystem vegetation, Pacific Northwest, Western Cascade Range 1.5-1.7 Gt (*Hudiburg et al. 2009*).
- Total current carbon, forest ecosystem vegetation, Hole in the Road~ 49,7223 tonnes or 0.00005 Gt. This represents .000001% of the United States total or .000029% of the Western Cascade Range total.
- The annual accumulation of carbon from forest management in the United States is 191 million tonnes. Implementation of current management on BLM-managed lands in western Oregon would result in an average annual accumulation of 16,900 tonnes over the next 100 years, or 0.9% of the current U.S. accumulation (*WOPR p. 4-537*).

3.3.7.2 Environmental Effects

Proposed Action

Total carbon in forest ecosystem vegetation can be divided into three pools: live trees (foliage, branches, stems, bark and live roots of trees), forest carbon other than live trees (dead wood and roots, non-tree vegetation, litter and soil organic matter) and harvested wood products. The major changes in carbon storage caused by the Proposed Action would be in the live tree pool, by moving carbon from the live tree pool to the other than live trees and harvested wood products pools. Modeling used by the BLM assumes that inputs (logging slash) and reductions (fuel treatments, breakage) to the "other than live trees" pool approximately balance each other, so only changes to live tree and harvested wood pools are calculated.

Other aspects of the “other than live tree pool” such as soil carbon flux and decomposition have the potential to be different among alternatives. Forest vegetation can increase carbon storage in soils through afforestation of agricultural lands, but harvest effects on soil carbon fluxes are generally non-significant (*McKinley et al. 2011*). Decomposition of organic matter is also assumed to be similar for all action alternatives. This assumption likely slightly increases the estimate of carbon stored in the No Action alternative.

In summary, the Proposed Action would cause short term direct effects on greenhouse gas levels by emitting greenhouse gases (specifically, carbon dioxide) from harvest operations and fuel treatment which are calculated in this report. At the end of the modeling period, all alternatives show an increase in carbon storage over current levels with relative amounts inverse to harvest intensity.

Live Trees

Live trees would be removed, moving carbon to the other two pools. Harvest and fuel treatment would reduce total forest ecosystem vegetation carbon in the project area from 49,723 tonnes to 33,314 tonnes in the Proposed Action directly after treatment.

Forest Carbon other than Live Trees

Some carbon would be converted to forest carbon other than live trees - dead material that would store carbon and slowly release it through decay. Pile burning after harvest will result in 687 tonnes of carbon dioxide in the Proposed Action.

Harvested Wood

After harvest, some carbon in live trees is stored as harvested wood. Harvested saw log gross carbon for the Proposed Action equals 16,408 tonnes (1 Mbf = 1.3 tonnes carbon). Over the 50 year analysis period, approximately 1,821 tonnes would be emitted without energy capture. Approximately 5,475 tonnes of the carbon would remain stored in products still in use and in landfills, or emitted with energy capture (based on regional averages, *Smith, et al. 2006, WOPR Appendix C:30*).

Harvest Operations

Harvest operations would emit greenhouse gases. In the Proposed Action, equipment use necessary to harvest and transport the timber to the nearest mill (Mill City, Oregon) was estimated at approximately 3.5 gallons/ Mbf (Salem District Fuel Use Appraisal for Carbon Calculations, on file at Salem District Office). Fuel consumption would result in total emissions of 78 tonnes of greenhouse gases in the Proposed Action.

Greenhouse Gas Emissions

To summarize, total greenhouse gas emissions resulting from harvest, fuel treatment and harvested wood for each alternative would include the following:

Proposed Action: 2,587 tonnes
Harvest operations emissions totaling about 78 tonnes
Fuel treatment (burning) emissions totaling 687 tonnes
Emissions from harvested wood, over 50 years of 1822 tonnes.

Future Carbon Storage

Following thinning from below under the Proposed Action, the largest trees would remain but would have increased growing space. These trees would store carbon as they grow. Carbon emissions resulting from the Proposed Action (3,263tonnes) would be offset by carbon storage in tree growth approximately 10 years after harvest. Live tree carbon would equal the pre-treatment level after approximately 21 years of growth (*EA Figure 19*).

After 50 years of growth, carbon stored in live trees would be 67,962 tonnes, an increase of 18,239 tonnes from the current (pre-harvest) level of 49,723 tonnes. In addition, 5476 tons would remain stored in harvested wood. Net storage is calculated at 18,492 tonnes over the 50 year analysis.

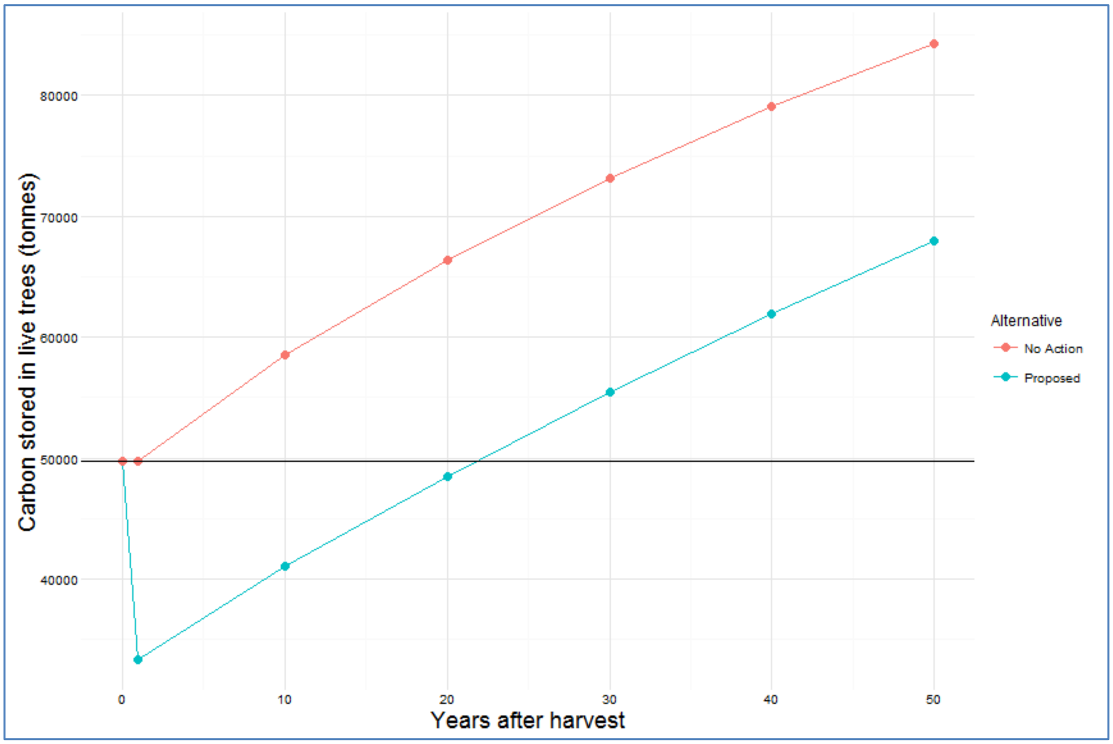


Figure 19: Live tree carbon storage over 50 year analysis period in the Hole in the Road project area.

Greenhouse gas emissions and carbon storage over the 50 year analysis period resulting from all alternatives are displayed in Table 22.

Table 22. **Greenhouse Gas Emissions and Carbon Storage, Hole in the Road**

Source	**Proposed Action**	**No Action**	**Notes**
	TonnesC	**Tonnes C**	
Live tree storage, 2015[37] (current conditions)	49723	49723	76-134 year old stand
Live tree storage, 2065[38]	67962	84239	50 years stand growth
Net increase, live trees	18239	34516	Tree growth 2015 to 2085
Harvested wood storage, 2065	5476	0	66% of harvested wood carbon, 50 years
Total storage increase	**23715**	**34516**	**Storage: live trees and harvested wood**
Emissions, 2015-2065	3263	0[2]	Logging/fuel treatments harvested wood emissions
Net Carbon Storage Total	**20431**	**34516**	**Storage minus emissions, 2015-2065**

Cumulative Effects

Proposed Action

Greenhouse gases resulting from the Proposed Action would total 3,283 tonnes of carbon dioxide. Current global emissions (2010) of carbon dioxide total 49 Gigatonnes of CO2-equivelent (*IPCC 2014*), and current U.S. emissions of carbon dioxide total 6.7 billion tonnes (*EPA 2014*). Therefore, the emissions from the Proposed Action would constitute at most 0.00000007 percent of current global emissions and 0.0000005 percent of current U.S. emissions. This is less than half the daily emissions in 2013 (6,871 tonnes) from vehicle use in Portland, Oregon (data acquired from the City of Portland Bureau of Planning and Sustainability, available on file, BLM Salem).

Tree growth following harvest would offset greenhouse gases and result in net storage of 20,431 carbon. This would contribute an annual average of 409 tonnes to the U.S. annual accumulation of carbon from forest management of 191 million tonnes. The WOPR (*p. 4-538*), states that by 2106, the No Action alternative (management under the 1995 RMP) would result in a total carbon storage of approximately 628 million tonnes for all western Oregon BLM-administered

---

[37] Approximate: stand exams conducted in 2009 and 2010 and ORGANON operates in 5 year periods

[38] Assumes emissions from seasonal changes and decay of dead matter is balanced to net flux to storage through growth

lands, 9 percent higher than average historic conditions (576 million tonnes, *WOPR 3-224*). The incremental effect of the Proposed Action and No Action alternative, over time, would be net storage of carbon.

No Action Alternative

Under the No Action alternative, no greenhouse gases would be emitted from harvest operations or fuels treatments. Carbon stored in live trees would not be converted to the harvested wood carbon pool. A portion would be converted to the forest carbon other than live trees pool through ongoing processes of tree mortality. The BLM did not estimate the carbon flux due to decay from this pool but it is not expected to change the relative magnitude of difference between the alternatives.

After 50 years of growth, live tree carbon would increase to 84,239 tonnes, an increase of 35,516 tonnes from the current level of 49,723 tonnes. The No Action alternative would result in greater net carbon storage over the 50 year analysis period than the Proposed Action by approximately 14,085 tonnes.

Cumulative Effects

No Action Alternative

The 50 year increase of 34,516 tonnes of live tree carbon would contribute to an annual average of 690 tonnes, to the U.S. annual accumulation of carbon from forest management of 191 million tonnes. The WOPR (*p. 4-538*) found that by 2056, the No Harvest benchmark analysis (no future harvest of BLM-managed lands in the analysis area) would result in a total carbon storage of approximately 588 million tonnes, 2 percent higher than average historic conditions (576 million tonnes, *WOPR 3-224*).

Comparison of Alternatives

Table 22 shows fifty years after harvest:

- The Proposed Action stores 41 percent less carbon than the No Action alternative. The difference in carbon storage after 50 years between the Proposed Action and the No Action alternative is approximately 14,084, or less than a third of the 2012 daily carbon emissions by vehicles (65,479 – data from ODEQ) in Oregon.
- Reasons for the differences include carbon emissions under the Proposed Action that do not occur under the No Action alternative and less cumulative carbon stored under the Proposed Action.
- The difference in carbon storage between the alternatives is not significant at regional, continental, or global scales.

3.3.8 Recreation, Visual Resources and Rural Interface

Sources: Hole in the Road Recreation and Rural Interface Area Specialist Report; Meredith 2016; Hole in the Road Visual Resources Management Analysis Report; Moore 2016

Methodology:

- Visual resources consist of the land, water, vegetation, structures and other features that make up the scenery and physical features visible on a landscape. All Salem District BLM-administered lands have been classified under a Visual Resource Management (VRM) class system that was established by BLM during the last planning effort in the early 1990s.
- In 2014 the BLM Salem District re-inventoried for current scenic values and categorized BLM lands into Visual Resource Inventory (VRI) classes derived from individual visual resource components. A VRI class is determined by overlaying the ratings of scenic quality (A, B or C), public sensitivity to changes in visual character (H, M or L), and distance zones as seen from major viewing platforms or travel routes (foreground-middle ground, background, or seldom seen). The foreground-middle ground zone includes areas seen from less than 3 miles away. Visible areas beyond 3 miles but usually less than 15 miles away are in the background zone. Areas either hidden from view or beyond 15 miles are in the seldom-seen zone (*BLM Handbook H-8410*).

3.3.8.1 Affected Environment

Recreation Use

The project area is accessed by paved and gravel roads within a forest setting. Evidence of man-made modifications (roads, timber harvest activities, gates and bridges) are visible from both private and public lands within or in the vicinity of the project areas. Recreational activities that occur in the area include hiking, biking, horseback riding, hunting, target shooting, driving for pleasure, OHV riding, camping, picnicking, water play, and viewing scenery. Dispersed recreation day use activities occur in areas along the South Molalla Road, Copper Creek Road, and on lands accessed through the Horse Creek Road system within the Molalla River-Table Rock Special Recreation Management Area (SRMA). Attempts have been made to reduce recreational user impacts along the river corridor, specifically in Units 16A and 16B. Spur roads have been blocked and rehabilitation has occurred to reduce recreational impacts in this corridor.

A large, 25-mile non-motorized shared use trail system is to the north of the project area. No designated non-motorized trails exist in the project area. Any trail is unauthorized and would be obliterated through the proposed project implementation. The immediate project area has dispersed recreation with no developed recreation sites. The nearest developed recreation area is Aquila Vista approximately 2 miles to the northwest of Unit 16A. Cedar Grove, Three Bears, Ivor Davies wayside, and Hardy Creek Trailhead are additional developed sites along the South Molalla Road, however multiple graveled turnouts and trailhead access points scatter the length of the Molalla River recreation corridor. Timber harvest activities would occur along approximately 0.64 miles of the highly used South Molalla Road.

While the upper wilderness section of the Molalla River is characterized as having steep gradients, the lower thirteen mile area is less steep as it flows through a series of pools, riffles, and rapids. In some sections, the river narrows as it crosses through rock outcrops with interesting rock formations, including a dramatic basalt rosette. The steep hill slopes, canyon walls, and stream terraces of the Molalla River support a variety of riparian and upland vegetation characteristic of the botanically interesting and diverse Klamath Mountains Ecoregion.

OHV Designation and Use

Off-highway vehicle (OHV) usage of the project areas are restricted to existing roads and designated trails; no designated OHV trails are within the project areas. Any trail within the project areas are considered unauthorized and would be obliterated through the proposed project implementation. Roads off the South Molalla Road are blocked or gated thereby restricting traffic and concentrating use along the Molalla River, within the SRMA. Blocked roads are continually being used for OHVs and are damaging vegetation and soil productivity.

Rural Interface Areas (RIAs)

The proposed project areas are not within a rural interface zone as defined in the Salem District Resource Management Plan, page 39. Rural interface zones are BLM-administered lands that intersect a BLM created half-mile buffer around county zoning. The closest rural interface zones include an area over 6.7 miles to the south of the project areas near the North Santiam River, Scotts Mills to the northeast over 10 miles, and the City of Molalla, which is over 12 miles north of Unit 16A. However, the BLM must take into account homes located near proposed projects. The haul route would pass residential houses along the lower South Molalla and Dickey Prairie roads and pass through rural interface zones.

In general, the concerns of property owners near timber harvest and hauling activities tend to be associated with noise, traffic, and dust from logging and hauling activities. Effects to scenic, water and wildlife values, increased public access that may lead to problems with fire hazard, garbage, dumping, and vandalism are additional concerns. Roads surrounding these proposed units have historically experienced log truck traffic. The project would have no effect on rural interface zones other than increased log truck traffic.

Other Designations

Wild and Scenic Rivers (WSR)

There are no designated WSR's within the project areas. The Molalla River Segment B is a Suitable Recreational WSR segment with a quarter mile buffer on each side of the river to maintain river related values. The proposed timber sale contains approximately 64 acres within the suitable river boundary.

A 13.2 mile section of the mainstem Molalla was found 'suitable' for inclusion into the WSR System. A 'suitable' finding is made only after a detailed assessment by the BLM and constitutes a recommendation that the river be designated under the 1968 WSR Act.

The segment, referred to as Molalla River Segment B, extends from the confluence of the mainstem Molalla with the Table Rock Fork of the Molalla River downstream to Glen Avon Bridge. It includes 2,988 acres of BLM-administered lands within both sides of the river, most of which were brought into public ownership through the exchange described previously (*See EA 3.2).*

Molalla River Segment B has been given a preliminary classification of Recreational. This indicates the river is readily accessible by road, has some shoreline development and may have undergone some impoundment or diversion. Outstandingly Remarkable Values were identified as Scenery, Recreation and Geology as described in the 1992 Resource Assessment. A resource assessment for this segment was completed during the land use planning process and contained an analysis of the river's suitability for WSR designation (it is available for review at the Salem District Office).

Until such time as the river is designated under the National WSR Act or released from consideration, the BLM is required to provide interim protection of the river's free flowing characteristics, water quality and identified Outstandingly Remarkable Values.

Oregon Scenic Waterway

The portion of the Molalla River passing through the project area was established as an Oregon State Scenic Waterway in March of 2016 under the Scenic Waterways Act (*See EA Section 3.2*). The Oregon Scenic Waterway Program, established by a ballot initiative in 1970, is administered under the authority of the Oregon State Parks and Recreation Commission through the Oregon Parks and Recreation Department (*ORS 390.805 to ORS 390.925*).

The river is managed in cooperation with Oregon State Parks in three segments, a Scenic River Area from the Confluence with the Table Rock Fork to Pine Creek, a Recreational River Area from the Pine Creek Confluence to Trout Creek and a River Community Area from the Trout Creek Confluence to Glen Avon Bridge (designations are those established under Scenic Waterways Act).

Wilderness and Wilderness Characteristics

There is no designated wilderness or lands with wilderness characteristics within the project area. The Table Rock Wilderness is approximately 0.82 miles to the east in Township 7 South, Range 3 East, Section 14. No effect to the Table Rock Wilderness is anticipated except for the potential for hikers in the area to hear logging activities.

Visual Resources

Proposed thinning area

Lands within the project area fall under VRM Classes II and III, as assigned in the existing RMP. Approximately 50 percent of the proposed harvest area falls within Class II with the remainder within Class III. With Class III, changes should repeat the basic elements found in the predominant natural features; for Class II, management activities may be seen, but should not attract the attention of the casual observer. Class III activities may attract the attention, but should not dominate the view of the casual observer (*RMP p. 37*). With these objectives in mind, mitigation of visual impacts would be necessary with this project (*EA Section 2.3.1., Project Design Features*).

Views of the project area are primarily available when traveling north or south on South Molalla Road and along Road 7-3E-16. The viewable landscape from this area covers approximately 354 acres in scattered patches on the northern portion of the Hole in the Road timber sale; however, roadside trees, curves, dips, ridge angles and rises in the canyon bottom can hide the majority of the harvest site from view, other than those the roads pass directly through.

The foreground -middle ground (road side) is predominately timber stands sparsely bordered by deciduous trees and shrubs that immediately transition into conifer species. The background landscape consists of forest lands managed for timber harvest and is only visible as such from Table Rock Wilderness, other backcountry high points or from the Willamette Valley.

The background landscape could be described as a patchwork quilt-like pattern with each parcel consisting of a different-aged stand defined by straight lines that may run vertically on facing slopes creating unnatural contrast of color and texture or may create horizontal patterns that flow with the landforms. The varying stand ages and heights provide various textures and colors to the landscape from browns of freshly harvested units to a wide range of greens as planted parcels age. This project is in the Seldom-seen Zone for Molalla and other population centers in the Willamette Valley.

3.3.8.2 Environmental Effects

Proposed Action – Recreation Use

Thinning and Connected Actions

Dispersed recreation use within the proposed units would be restricted approximately three to five years during timber management activities and return to prior usage upon completion of harvest. Other BLM lands nearby, the Molalla-Table Rock SRMA, would remain available for recreational opportunities. Recreational users in the vicinity would likely hear the noises of the timber sale operations and may experience traffic delays of minutes to hours.

Recreationalists passing along the South Molalla Road through Units 16A and 16B would experience temporary delays for safety during logging operations of those units. Pull outs along this section would also be closed for parking and recreational use. Users nearby may choose to occupy alternative locations along the river corridor, which may increase crowding in highly used locations like Ivor Davies Wayside.

Tree removal from the proposed units would leave the undergrowth vegetation crushed. Most undergrowth vegetation would return within five years. Harvest activities would obliterate any unauthorized trails. No reconstruction of unauthorized trails would be allowed and any currently closed road systems would be blocked after operations are completed (*EA Section 2.3.1*). Passing vehicles and OHVs could create a fire ignition source for stumps and logging debris from vehicle sparks (from lack of proper spark arrestor or catalytic converter in the muffler system), heating grasses (fine fuels) from idle vehicles, or tossing out burning materials such as cigarettes.

Proposed Action - Rural Interface Areas (RIAs)

Thinning and Connected Actions

Rural interface areas are not present within the project area. Residences along the haul route may hear equipment harvesting trees, noise from log truck traffic, experience dust from gravel road traffic, and experience delays for safety. Disturbance from this proposed timber harvest would be short-term lasting a few weeks to months. The project would have no effect on rural interface zones other than increased log truck traffic.

In general, the concerns of property owners near timber harvest and hauling activities tend to be associated with noise, traffic, and dust from logging and hauling activities, effect to scenic, water and wildlife values, increased public access that may lead to problems with fire hazard, garbage, dumping, and vandalism.

Proposed Action - Other Designations

Wild and Scenic Rivers

Thinning

Timber management activities are at least 440 feet from the Molalla River and would not affect river related outstandingly remarkable values, which are recreational, scenic, and geologic values. The proposed thinning action would not diminish the tentative recreational classification, the river's free-flowing character, and water quality to the Molalla River. The 64 acres within the interim WSR boundary would open up stands that are dense and dark allowing a greater amount of light to reach the forest floor increasing vegetative growth of groundcover, and potentially enhancing the long-term scenic character of the stand.

Connected Actions

The proposed road renovation, maintenance, culvert work and construction is not expected to affect river related outstanding remarkable values. Approximately 480 feet of new construction is proposed within the Suitable WSR boundary in the Hole in the Road project to access Unit 15B (*EA Figure 2*). This new construction is not expected to be visible from the Molalla River according to Lidar visual analysis completed by the BLM and the State of Oregon (*EA Section 7.0*). Road construction, or road maintenance or renovation of existing roads would not diminish the WSR suitable classification or the river's free-flowing character.

Oregon Scenic Waterway

Thinning and Connected Actions

Scenic values would experience short-term adverse impacts as a result of the harvest operations however these impacts would diminish with ground cover revegetation over time to provide neutral to positive effects on the scenic values. Adverse impacts to recreational resources are minimal and limited to cross-country pedestrian access with no designated river access corridors through the project areas.

Proposed Action – Visual Resources

Methods

The BLM identified 8 Key Observation Points (KOPs), where the project area is viewable to the casual observer, primarily along the South Molalla Road, to analyze the potential effect of the project on the characteristic landscape (*Table 23, EA Section 7.0*). The BLM determined that KOPs 1 and 5 provided good duration and representative direct views of the project area. With the exception of KOP 3, the project area was located outside the travelers' field of view and not substantially noticeable from the remaining KOPs. The BLM completed visual contrast rating worksheets for KOPs 1 and 5 (*See Visual Resources Report*). These worksheets document the basic elements of color, form, line, and texture that characterize the view of a landscape, and are used to describe impacts and plan mitigation measures. Table 23 gives the overall summary of the KOPs, and any distance between these KOPs and some of the units in the proposed project area. A map in EA Section 7.0 shows the location of these KOPs in relation to the project area.

Table 23. **Key Observation Point Summary**

KOP Number	Distance Between KOP & Project	Notes
1	0ft	Initial view of the paved S. Molalla Rd and roadside deciduous trees giving way to conifer canopies and trunks, primarily Douglas Fir. Ground cover vegetation includes ferns and salal. Colors include browns of dead leaves and tree trunks, shades of green and light gray of moss and lichen and the dark gray of the roadway. 360 degrees off of both travel path directions in direct view-scape of traveler. Traveler passes through harvest area within 30-60 seconds.
2	0ft	Initial view of the paved S. Molalla Rd and roadside grasses giving way to conifer canopies and trunks, primarily Douglas Fir. Ground cover vegetation includes ferns and salal. Colors include browns of dead leaves and tree trunks, shades of green and light gray of moss and lichen and the dark gray of the roadway. 360 degrees off of both travel path directions in direct view-scape of traveler. Traveler passes through harvest area within 30-60 seconds.
3	20ft	Initial view of the paved S. Molalla Rd and roadside deciduous trees giving way to conifer canopies and trunks, primarily Douglas Fir. Ground cover vegetation includes ferns and salal. Colors include browns of dead leaves and tree trunks, shades of green and light gray of moss and lichen and the dark gray of the roadway. 360 degrees off of both travel path directions in direct view-scape of traveler. Traveler passes through harvest area within 30-60 seconds.
4	800ft	Initial view of the paved S. Molalla Rd and roadside deciduous trees giving way to conifer canopies and trunks, primarily Douglas Fir. Ground cover vegetation includes ferns and salal. Colors include browns of dead leaves and tree trunks, shades of green and light gray of moss and lichen and the dark gray of the roadway. 90 degrees off of both travel

KOP Number	Distance Between KOP & Project	Notes
		path directions to the south. Harvest area is located on hill through diffused view. Traveler passes through interrupted view area within 3-5 seconds.
5	1600ft	Initial view of the paved road and bridge railings giving way to main body of the Molalla River with small tributary waterfall on south bank and roadside deciduous trees giving way to conifer canopies and trunks, primarily Douglas Fir. Ground cover vegetation includes moss, salmonberry, ferns and salal. Colors include browns of dead leaves and tree trunks, shades of green and light gray of moss and lichen and the dark gray of the roadway and river rock. 90 degrees off of both travel path directions to the west in direct view-scape of traveler. Traveler passes through view area within 2-4 seconds.
6	500	Initial view of the graveled Road 7-3E-16 and cut-bank giving way to conifer canopies and trunks, primarily Douglas Fir. Ground cover vegetation includes 2-3 year old conifer, ferns and salal. Colors include browns of dead leaves and tree trunks, shades of green and light gray of moss and lichen and the dark gray of the roadway. 90 degrees off of both travel path directions to the east hidden from view of traveler by non-harvest forest stand. Traveler passes near harvest area within 5-10 seconds.
7	0ft	Initial view of the graveled Road 7-3E-16 and roadside deciduous trees giving way to conifer canopies and trunks, primarily Douglas Fir. Ground cover vegetation includes ferns and salal. Colors include browns of dead leaves and tree trunks, shades of green and light gray of moss and lichen and the dark gray of the roadway. 360 degrees off of both travel path directions in direct view-scape of traveler. Traveler passes through harvest area within 2-4 seconds.
8	12 Miles	East-bound along S. Dickey Prairie Rd, just before Dickey Prairie Store. Initial view of agricultural field bordered by highway fencing and road signs. Colors include shades of green, roadway grays and browns and yellows of homes and businesses. Project site lies approximately 40-60 degrees from travel pathway. Intermittent views due to vegetation and topography for approximately 30 seconds. Residents and businesses may have views depending on house/building position in comparison to vegetation and topography.

Within 5 years after harvest

Immediately after harvest, landscape appearance would consist of green tree retention of approximately 54-95 trees per acre (*EA Section 2.3.1, and Table 12)* within the harvest units. The ridge lines would continue their current appearance due to the significant green tree retention over the entire project area, with brown stems (tree trunks) still mostly blocked from view by tree canopies. A slight change in texture and color may be present on steeper slopes with greater vertical distance between tree tops providing more area for brown stems to show. There would be treatment on approximately 354 viewable acres, though only a few acres are visible at a time at any given KOP.

The Proposed Action would not cause any change in the overall VRI Class rating or any of its components. The area would retain the features of the surrounding landscape which is comprised of a patchwork pattern with harvested and intact conifer stands of varying stand ages. The majority of the project area has been previously graded as possessing high visual quality. The Proposed Action would not contribute to heightened sensitivity levels or cause the scenic quality of the overall landscape to change.

Renovation and any culvert replacement/maintenance on existing roads that is proposed within the project area would not cause any change in the overall VRI class rating or any of its components. New construction is expected to occur within the areas graded as possessing high visual quality. Landscape appearance would be expected to be low in areas with new road construction, as the new roads would be less visible with the canopy retention in the adjacent thinning areas, and are not likely to be visible from the Molalla River (*EA Section 7.0*). Renovation of existing roads would not contribute to heightened sensitivity levels or cause the scenic quality of the overall landscape to change also due to remaining canopy cover of adjacent thinned stands.

Approximately 480 feet if new road is proposed to be built within the suitable WSR corridor to extend an already existing road to access unit 15B (*EA Figure 2*). Extension of this existing road is not expected of be visible from the river, and would not cause any change in the overall VRI class rating (*See Proposed Action – Other Designations in this EA Section, and EA Section7.0*).

5 years after harvest

Over time, tree canopies would be expected to fill in any post-harvest gaps and brown stems would be hidden, with ground cover vegetation recovering, returning the area to a pre-harvest color and texture. Existing road segments would persist, and some would be blocked and/or decommissioned after operations, returning the roads to similar conditions before project implementation. New roads would be blocked and stabilized or decommissioned to prevent further vehicle use. Re-vegetation of these areas is expected to occur naturally or by artificial means (*EA Section 2.3.1*). New roads proposed are not likely visible from the river (*See previous paragraph, and Proposed Action – Other Designations in this EA Section, and EA Section 7.0*).

Cumulative Effects - Recreation Use

Timber harvest would interrupt recreation activities for approximately three to five years which would return to pre-implementation levels after harvest. Additional road closures may occur upon completion of harvest activities. This project would have minimal to no impact on recreational uses due to the fact there are other opportunities available and any road closure of a main travel road would be temporary.

Residential development along haul routes routinely receives log truck traffic from timber management activities on private and public lands.

Looking at aerial photos it is evident that timber management has occurred for many years and will continue to occur in the watershed, both thinning and regeneration harvest activities.

Timber management activities are likely to continue on both private and public lands in the watershed. Vegetation would green up and return five years post-harvest, leaving the units less noticeable from roads and residences

Visual Resources

Thinning and Connected Actions

The area analyzed for cumulative effects includes the slopes and forest visible from KOPs 1 and 5. These two KOPs were chosen to represent the overall visual analysis and are representative of all KOPs. Approximately 80 acres of the proposed harvest area would be visible from these KOPs. With the exception of KOP 8, the entire view-shed from all KOPs repeats the same elements as those present in KOP 1 and 5 and did not provide a meaningful scale for comparison of cumulative visual effects (*Table 23, and additional map in EA Section 7.0*).

The cumulative effect would be a minor change in the color and texture of the entire treated area. The cumulative effects to the form of the landscape would be minimal and likely go unnoticed. Various landowners with varying land management objectives (e.g., timber harvest and agriculture) and natural events such as fires and high winds will maintain the ever-changing, patchwork pattern on the landscape over time, maintaining the overall VRI Class ratings.

Past, present and reasonably foreseeable future actions across the landscape consist of extensive forest management and agricultural practices, creating a mosaic of colors, patterns, and textures on hillsides and the valley floor. The Hole in the Road timber sale is a forest management activity that fits within this mosaic pattern. The project would not substantially change the appearance of the larger landscape because it is similar to the type and size of forest management activities that occur in the area. Many of these hillsides have been harvested and/or replanted to varying degrees.

The project would not cause any change in the overall VRI Class rating or any of its components. The area would retain the features of the surrounding landscape which is comprised of a patchwork pattern with harvested and intact conifer stands of varying stand ages. The project area has been previously graded as possessing high visual quality. The project would not contribute to heightened sensitivity levels or cause the scenic quality of the overall landscape to change.

No Action Alternative - Recreation Use

Thinning and Connected Actions

With the exception of unexpected changes (i.e. wildfire or disease), the proposed units would continue to provide a forest setting for dispersed recreation opportunities and local residents. A three to five year increase in log truck traffic, noise and other disturbances related to the harvest of the proposed units would not occur. Timber management activities and log truck traffic would continue on both private and public lands in the vicinity. No modifications to the landscape character of the project areas would be expected to occur. Modifications to the landscape character in the area around the projects would still be expected, as a result of activities on other lands

Visual Resources

Thinning and Connected Actions

Visual effects associated with the No Action alternative would include the continuance of existing BLM management activities in the project area. The BLM would expect the project area to remain in the current condition of continued stand progression unless natural or catastrophic events were to occur. The BLM anticipates landscape changes which may affect visual qualities within the greater project area to persist following timber management activities on patchwork, privately owned adjacent forest lands.

3.3.9 Cultural Resources

Sources: Hole in the Road Cultural Resources Report; Greatorex 2015

Methodology:

The Salem District Archeologist assessed potential effects to cultural resources by using the following methodologies:

- Background research included reviewing Salem District and State Historic Preservation Office (SHPO) Geographic Information System data, Salem District Culture Resource records and the draft EA and GLO Maps.
- Surveys were performed in proposed harvest units identified April 2nd, 2015 and modified to conform to the updated thinning units in August 2015.
- Surveys were accomplished by clearing away vegetative matter to mineral soil (sand) in a 25 meter by 25 meter grid pattern (in the area of the proposed compound) or at 25 meter intervals along and to either side of proposed trails and roads. Each area cleared was observed for artifacts or indications of cultural properties.

3.3.9.1 Affected Environment

Two cultural properties were located during the survey. One appears to be an old Logging Deck and the other is a Logging Sled. Both cultural properties have been avoided through project re-design. No other cultural artifacts or properties were located within survey areas of the remaining thinning units.

3.3.9.2 Environmental Effects

On the basis of this investigation, it is considered unlikely that any cultural resources eligible for nomination to the National Register of Historic Places would be affected by this project. Since the closest known site to the Hole in the Road area is outside of the proposed unit boundaries, no additional protection is needed. There are no anticipated effects to cultural resources as a result of this project.

Ground and cable timber harvest would only be likely to impact above-ground, historical properties such as cabins, logging sleds, or other sites associated with historic logging activities, none of which were located during survey. However, given the long history of use of the Molalla River Corridor, it is possible that cultural properties would be discovered during timber harvest operations or during road construction / rehabilitation.

New road construction may expose prehistoric sites, in which case, culture resource staff would be notified (*EA Table 5*). If any cultural and/or paleontological resource (historic or prehistoric site or object) is discovered during project activities, all operations in the immediate area of such discovery shall be suspended until an evaluation of the discovery can be made by a professional archaeologist to determine appropriate actions to prevent the loss of significant cultural or scientific values.

Cumulative Effects

No direct effects to cultural resources would be expected; therefore no cumulative effects would be expected.

No Action Alternative

The current status and trends in the project areas for cultural resources would continue.

3.3.10 Review of Elements of the Environment Based on Authorities and management Direction

Table 24. **Elements of the Environment Review based on Authorities and Management Direction**

Element of the Environment /Authority	Remarks/Effects
Aquatic Conservation Strategy	In compliance with PCFFA IV (Civ. No. 04-1299RSM), this project complies with the Aquatic Conservation Strategy described in the Northwest Forest Plan and RMP. This project also complies with the PCFFA II (*265 F.3d 1028 (9th Cir. 2001))* by analyzing the site scale effects on the Aquatic Conservation Strategy. EA Section 3.3.11 shows how the Hole in the Road project meets the Aquatic Conservation Strategy in the context of the PCFFA cases. EA Chapter 3 analyzes specific effects of the Proposed Action.
Air Quality (Clean Air Act as amended (42 USC 7401 et seq.)	This project is in compliance with this direction because air quality impacts would be of short duration (one burn period during implementation of prescribed fire). Addressed in Text (*EA Section 3.3.6*).
Cultural Resources (National Historic Preservation Act, as amended (16 USC 470) [40 CFR 1508.27(b)(3)], [40 CFR	This project is in compliance with this direction and the project would have no effect on this element because cultural resource inventories of the affected area have been conducted and management actions will avoid

Element of the Environment /Authority	Remarks/Effects
1508.27(b)(8)]	damage to cultural resources (*EA Section 3.3.9*).
Ecologically critical areas [40 CFR 1508.27(b)(3)]	The project would have no effect on this element because there are no ecologically critical areas present within the project areas. Addressed throughout the EA, see table of contents.
Energy Policy (Executive Order 13212)	This project is in compliance with this direction because this project would not interfere with the Energy Policy (*Executive Order 13212*).
Environmental Justice (E.O. 12898, "Environmental Justice" February 11, 1994)	This project is in compliance with this direction because project would have no effect on low income populations.
Fish Habitat, Essential (Magnuson-Stevens Act Provision: Essential Fish Habitat (EFH): Final Rule (50 CFR Part 600; 67 FR 2376, January 17, 2002)	No fish species with Bureau Status are found within the project area. Timber harvest and connected actions in the project area effects on Essential Fish Habitat (EFH) as designated under Magnuson-Stevens Fishery Management Act are discussed in the text and in EA Section 5.1.2.
Farm Lands, Prime [40 CFR 1508.27(b)(3)]	The project would have no effect on this element because no prime farm lands are present on BLM land within the Cascades Field Office.
Floodplains (E.O. 11988, as amended, Floodplain Management, 5/24/77)	This project is in compliance with this direction because the proposed treatments would not change or affect floodplain functions.
Hazardous or Solid Wastes (Resource Conservation and Recovery Act of 1976 (43 USC 6901 et seq.) Comprehensive Environmental Repose Compensation, and Liability Act of 1980, as amended (43 USC 9615)	This project would have no effect on this element because no Hazardous or Solid Waste would be stored or disposed of on BLM lands as a result of this project.
Healthy Forests Restoration Act (Healthy Forests Restoration Act of 2003 (P.L. 108-148)	This project is in compliance with this direction because treatments would decrease the risk of stand replacement fire and help restore forests to healthy functioning condition (*EA Section 3.3.1, 3.3.5, 3.3.6*).
Migratory Birds (Migratory Bird	This project is in compliance with this direction because

Element of the Environment /Authority	Remarks/Effects
Act of 1918, as amended (16 USC 703 et seq)	treatments provide a variety of habitat for migratory birds. Addressed in text (*EA Section 3.3.1, 3.3.5*).
Native American Religious Concerns (American Indian Religious Freedom Act of 1978 (42 USC 1996)	This project is in compliance with this direction because no Native American religious concerns were identified during the scoping period (*EA Section 1.8.1*).
Noxious weed or non-Invasive, Species (Federal Noxious Weed Control Act and Executive Order 13112)	This project is in compliance with this direction because Project Design Features would prevent establishment of new populations of invasive plant species and because vegetation development would result in decline in both number and vigor of invasive plant populations in the project area. Addressed in text (*EA Sections 2.3, 3.3.1*).
Park lands [40 CFR 1508.27(b)(3)]	The project would have no effect on this element because there are no parks within or adjacent to the project area.
The Oregon Scenic Waterway Program, 1969 – [ORS 390.805 to ORS 390.925]	The project would be in compliance with state direction regarding Oregon Scenic Waterways because the units proposed for thinning in the Oregon Scenic Waterway would be managed to meet VRM II and suitable WSR guidelines and direction, and which provide similar restrictions to maintain scenic and recreational values (*EA Sections 3.2, 3.3.8*).
Public Health and Safety [40 CFR 1508.27(b)(2)]	The project would have no effect on this element because the public would be restricted from the active parts of the project area during operations, and the projects would not create hazards lasting beyond project operations (*EA Sections 2.3, 3.3.6*).
Threatened or Endangered Species (Endangered Species Act of 1983, as amended (16 USC 1531)	This project is in compliance with this direction because the actions comply with direction in the RMP/FEIS with regard to Threatened or Endangered Species (*EA Sections 3.3.1, 3.3.3, 3.3.5, 5.1*).
Water Quality –Drinking, Ground (Safe Drinking Water Act, as amended (43 USC 300f et seq.) Clean Water Act of 1977 (33 USC 1251 et seq.)	This project is in compliance with this direction because Oregon State water quality standards would be adhered to and the area hydrology would not be changed measurably. Addressed in text (*EA Section 3.3.2*).

Element of the Environment /Authority	Remarks/Effects
Wetlands (E.O. 11990 Protection of Wetlands 5/24/77) [40 CFR 1508.27(b)(3)]	This project is in compliance with this direction because no wetlands are within the project area and any adjacent wetlands would be protected. (*EA Section 3.3.2)*
Wilderness (Federal Land Policy and Management Act of 1976 (43 USC 1701 et seq.); Wilderness Act of 1964 (16 USC 1131 et seq.)	This project is in compliance with this direction because there are no Wilderness Areas or areas being considered for Wilderness Area status in the project area (*EA Section 3.3.8*).

3.3.11 Compliance with Aquatic Conservation Strategy

Based on the environmental analysis described in the previous sections of the EA, Cascades Field Office Staff have determined that the project complies with the ACS on the project (site) scale. The project complies with the four components of the ACS, as follows:

ACS Component 1 - Riparian Reserves

The project would comply with Component 1 by maintaining canopy closure along all streams and wetlands, which protect stream bank stability and water temperature. Stream Protection Zones (SPZ) would protect streams from direct disturbance from logging. Road and landing locations have been minimized in Riparian Reserves (RR). Timber management proposed in the RR complies with the exception: "Apply silvicultural practices for Riparian Reserves to control stocking…and acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy objectives." (*RMP p. 11*). Addressed in text (*EA Sections 1.3.1.1., 2.3.1., 3.3.1*).

ACS Component 2 - Key Watershed

This project would comply with Component 2 by establishing that the Hole in the Road project is not within a Key watershed (*RMP p. 7*).

ACS Component 3 – Watershed Analysis

The project would comply with Component 3 by incorporating the following recommendations when thinning in the RR from the Molalla Watershed Analysis (*U.S.D.I. 1999 p. 195*):

- Maintain an average crown closure as recommended to meet spotted owl dispersal and suitable habitat goals;
- Manage density to encourage initiation or further enhancement of exiting understory growth;
- Maintain a component of minor species and trees with desirable wildlife characteristics, including hardwoods; and
- Leave green trees to ensure future standing/down dead wood recruitment.

ACS Component 4 – Watershed Restoration

The project would comply with Component 4 by the combination of thinning and unthinned areas in RRs, which would further enhance terrestrial habitat complexity in the long and short term. Thinning in all LUAs would be expected to result in long-term restoration and continuation of large conifers and the potential for material that would contribute to in-stream habitat complexity in the long-term.

1. ACSO 1: Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted. Addressed in Text (*EA Sections 3.3.1, and 3.3.5*). In summary:

No Action Alternative: The No Action alternative would maintain the development of the existing vegetation and associated stand structure at its present rate. The current distribution, diversity and complexity of watershed and landscape-scale features would be maintained. Faster restoration of distribution, diversity, and complexity of watershed and landscape features would not occur.

Proposed Action: The proposed combination of thinning from below and unthinned areas in the RR LUA would result in forest stands that exhibit attributes typically associated with stands of a more advanced age and stand structural development (larger trees, a more developed understory, and an increase in the number, size and quality of snags and down logs) sooner than would result from the No Action alternative.

Since the RR provides travel corridors and resources for aquatic, riparian dependent and other late-successional associated plants and animals, the increased structural and plant diversity would ensure protection of aquatic systems by maintaining and restoring the distribution, diversity and complexity of watershed and landscape features.

2. ACSO 2: Maintain and restore spatial and temporal connectivity within and between watersheds. Addressed in Text (*EA Sections 3.3.1., 3.3.3., and 3.3.5.*) In summary:

No Action Alternative: The No Action alternative would have little effect on connectivity within the affected watershed except in the long term.

Proposed Action: Long term connectivity of terrestrial watershed features would be improved by enhancing conditions for stand structure development. In time, the RR LUA would improve in functioning as refugia for late successional, aquatic and riparian associated and dependent species. Both terrestrial and aquatic connectivity would be maintained, and over the long-term, as the RR LUA develops late successional characteristics, lateral, longitudinal and drainage connectivity would be restored.

3. ACSO 3: Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations. Addressed in Text (*EA Sections 3.3.2 and 3.3.3*). In summary:

No Action Alternative: The current condition of physical integrity would be maintained.

Proposed Action: Physical integrity of channels at existing stream crossings would be altered for one to several years following maintenance and/or installation of stream crossings. Within the road prism (estimated at 30 feet maximum width), the channel surface, banks, bed and vegetation would be disturbed by the removal of fill material and culverts. The bed/banks would be reshaped and stabilized with woody debris and vegetation when the crossing is permanently removed and/or re-buried with the installation of a new culvert. Disturbance would be limited to the original "footprint" at the site. Due to the stable nature of channels at these locations, little to no additional disturbance to channel morphology would be expected either upstream or downstream from the proposed culvert work.

4. ACSO 4: Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Addressed in Text (*EA Sections 3.3.2, and 3.3.3*). In summary:

No Action Alternative: It is assumed that the current condition of the water quality would be maintained.

Proposed Action: SPZs in the RR LUA would be maintained. The proposed new roads are on ridge top or upper-slope locations with no hydrologic connections to streams. Overall, the Proposed Action would have no measurable effect on stream temperatures, pH, or dissolved oxygen. Sediment transport and turbidity in the affected watersheds is likely to increase over the short term as a direct result of road renovation/culverts at stream crossings. Turbidity increases would not be visible beyond 800 meters (0.5 mile) downstream from road/stream intersections and would not be expected to affect beneficial uses. Over the long-term (beyond 3-5 years), current conditions and trends in turbidity and sediment yield would likely be maintained under the Proposed Action.

5. ACSO 5: Maintain and restore the sediment regime under which aquatic ecosystems evolved. Addressed in Text (*EA Sections 3.3.2, 3.3.3, and 3.3.4*). In summary:

No Action Alternative: It is assumed that the current sediment regime would be maintained.

Proposed Action: SPZs in RRs would be a *minimum* of 65 feet wide on perennial streams and 30 feet on intermittent streams in treatment areas, and within 1 mile of listed fish habitat SPZs would be a *minimum* of 150 feet on perennial streams, and 100 feet on intermittent streams. Most no-harvest buffers along stream channels are wider than these minimum requirements. Hauling restrictions and best management practices would maintain the sediment delivery within its natural range.

6. ACSO 6: Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. Addressed in Text (*EA Sections 3.3.2, and 3.3.3*). In summary:

No Action Alternative: No change in in-streams flows would be anticipated.

Proposed Action: A preliminary analysis for the risk of increases in peak flow as a result of forest harvest was conducted using the Oregon Watershed Assessment Manual watershed analysis methods for forest hydrology (*OWEB 1997*). Because the proposed project would maintain canopy closure greater than 50-60 percent and improve failing culverts, it is unlikely to produce any measurable effect on stream flows.

7. ACSO 7: Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands. Addressed in Text (*EA Section 3.3.2*). In summary:

No Action Alternative: The current condition of flood plains and their ability to sustain inundation and the water table elevations in meadows and wetlands is expected to be maintained.

Proposed Action: With the exception of road renovation at stream crossings, all operations, equipment and disturbances would be kept a *minimum* of 65 feet from all perennial stream channels, and 30 feet from all intermittent stream channels. Most no-harvest buffers within the project area are greater than these minimum requirements. The Proposed Action would maintain the current condition of floodplain inundation and water tables.

8. ACSO 8: Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability. Addressed in Text (*EA Sections 3.3.1, 3.3.2, and 3.3.3*). In summary:

No Action Alternative: The current species composition and structural diversity of plant communities would continue along the current trajectory. Diversification would occur over a longer period of time.

Proposed Action: Biological and physical riparian areas would be contained entirely within SPZ. SPZ and other untreated areas would maintain the current species composition and structural diversity of plant communities in riparian areas and wetlands from a minimum of 30 feet (intermittent streams) to 65 feet (perennial streams) in treatment areas. (*EA Section 2.3.1, Table 5*).

9. ACSO 9: Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species. Addressed in Text (*EA Sections 3.3.1, 3.3.2, 3.3.3, and 3.3.5*). In summary:

No Action Alternative: Habitats would be maintained over the short-term and continue to develop over the long-term with no known impacts on species currently present.

Proposed Action: The Proposed Action would have no adverse effect on riparian depended species. Although thinning activities in the short term may affect some species within the treatment areas, adjacent non-thinned or untreated areas should provide adequate refugia for these species. In the long term, the treatments would restore elements of structural diversity to treatment areas in the RR LUA. These attributes would help to provide resources currently lacking or of low quality, and over the long-term would benefit both aquatic and terrestrial species.

Chapter 4: Preparers

Resource	Name	Reviewed By (initials)	Date
Writer/Editor	Alisa Tanner	[illegible]	11/16/16
NEPA Review	Whitney Wirthlin	[illegible]	11/16/16
Botany	Terry Fennell	[illegible]	11/17/16
Carbon Storage and Carbon Emissions	Kenny Ruzicka	[illegible]	11-16-16
Cultural Resources	Fred Greatorex	[illegible]	11-16-16
Engineering	Amy Herburger	[illegible]	11/16/16
Fire/Fuels	Seth Macalady	[illegible]	11/16/16
Fisheries	Bruce Zoellick	[illegible]	11/16/16
Hydrology/Water Quality	Patrick Hawe	[illegible]	11/16/16
Logging Systems/Layout	Jay Bernards	[illegible]	11/16/2016
Recreation and Rural Interface	Traci Meredith	[illegible]	11/17/2016
Silviculture	Clint Foster, Seth Macalady, Kenny Ruzicka	[illegible]	11/16/16 11-16-16
Soils	Patrick Hawe	[illegible]	11/16/16
State Scenic Waterway, Visual Resources, and Wild and Scenic Rivers	David Moore	[illegible]	11/21/16
Wildlife	Corbin Murphy	[illegible]	11/16/2016

DOI-BLM-OR-S040-2014-0004-EA Page 165 of 179

Chapter 5: Contacts and Consultation

5.1 Consultation

5.1.1 US Fish and Wildlife Service (USFWS)

The Hole in the Road project proposal was submitted for formal consultation with U.S. Fish and Wildlife Service (USFWS) as provided in Section 7 of the Endangered Species Act (ESA) of 1973 (16U.S.C. 1536 (a)(2) and (a)(4) as amended) during the FY2016 consultation process.

The *Biological Assessment of Not Likely to Adversely Affect Projects with the Potential to Modify the Habitat of Northern Spotted Owls, or Oregon Spotted Frogs and their Proposed Critical Habitat Willamette Planning Province – FY2016* (BA) was submitted in June 2015. Using effect determination guidelines, the BA concluded that the Hole in the Road proposal may affect and is not likely to adversely affect the northern spotted owl due to modification of suitable habitat (*BA p. 35*) but would have no effect on spotted owl Critical Habitat.

The *Letter of Concurrence (LOC) Regarding the Effects of Habitat Modification Activities within the Willamette Province, FY2016* associated with the Hole in the Road Project was issued in July 2015 (*FWS reference #01EOFW00-2015-I-0251*). The LOC concurred that the habitat modification activities described in the BA, including the Hole in the Road Project, are not likely to jeopardize the continued existence of the spotted owl and are not likely to adversely modify spotted owl critical habitat (*LOC p. 127*). Furthermore, the proposed action is not likely to diminish the effectiveness of the conservation program established under the NWFP to protect the spotted owl and its habitat on federal lands within its range (*LOC p. 137*).

The proposed thinning and connected actions described in this EA have incorporated the applicable General Standards that were described in the BA (*p. 11*) and LOC (*LOC, p. 26-28*); and comply with all reasonable and prudent measures outlined in the LOC (*LOC, p. 137-138*). This includes delaying proposed activities to avoid disrupting owls at known owl sites until after the critical nesting season, and monitoring/reporting on the implementation of this project to the U.S. Fish and Wildlife Service.

5.1.2 National Marine Fisheries Service

BLM initiated consultation with the National Marine Fisheries Service in August 2016 on the potential effects of the proposed project on UWR spring Chinook salmon and UWR steelhead trout in the Molalla River. Winter season log haul on road 7-3E-16, and up to two potential culvert replacements on intermittent tributary streams to the Molalla River on road 7-3-15.1 have the potential to "*may affect, not likely to adversely affect*" (NLAA) UWR winter steelhead and spring Chinook salmon and their critical habitat, by contributing insignificant amounts of sediment to the Molalla River. Consultation will be completed (letter of concurrence obtained) prior to the Field Manager selecting an alternative and implementing the decision, likely by February 2017.

Proposed tree thinning would not impact listed fish habitat due to minimum no-disturbance buffers of 380 feet on streams with Listed Fish Habitat (LFH), 150 feet on perennial tributaries, and 100 feet on intermittent 1st and 2nd order tributaries within 1 mile of LFH. These buffer widths are more than adequate to intercept and infiltrate water carrying sediment preventing its delivery to streams and aquatic.

No thinning within 150 feet of perennial streams within 1 mile of LFH would result in no change to stream temperatures. Thinning to within 100 feet of headwater streams with intermittent flows, within 1 mile of LFH, would not alter summer stream temperatures because these streams do not have surface flow during the summer. LW supplies in LFH in Gawley Creek and the Molalla River would not be impacted because no trees would be harvested within no-cut buffer widths equal to one site potential tree height on channels providing LFH, and because 1st and 2nd order tributary flows are too small to deliver LW from the areas being thinned within one tree height of channels.

5.1.3 Cultural Resources: Section 106 Consultation with State Historical Preservation Office

Cultural resource surveys were conducted throughout the sale area during 2015 (*EA Section 3.3.9*). Cultural resource inventories did not identify any pre-contact archaeological sites within the analyzed project area. A summary report of the cultural resource inventory will be sent to the State Historic Preservation Office.

5.2 Scoping

See EA Section 1.8 for a description of scoping methods and the issues identified through scoping.

5.3 EA Public Comment Period

The EA and draft FONSI will be made available for public review and comment from November 30th, 2016 to December 29th, 2016. On or before the first day of the public review and comment period, letters announcing the public review and comment period will be mailed to persons and organizations on the Scoping Letter mailing list, those who submitted Scoping Comments and other interested parties. The letter, the EA and the draft FONSI will be posted on the Salem District ePlanning project website at http://tinyurl.com/HoleInTheRoadand the notice for public comment will be published in a legal notice in the Molalla Pioneer. Written comments should be addressed to Chris Papen, Natural Resources Staff Administrator, Cascades Field Office, 1717 Fabry Road SE, Salem, Oregon 97306. Emailed comments may be sent to cpapen@blm.gov or submitted via the project ePlanning page above.

Chapter 6: List of Interdisciplinary Team Reports Incorporated by Reference

The Interdisciplinary team reports can be found in the Hole in the Road EA project file and are available for review at the Salem District Office:

Hole in the Road Silviculture Prescription (Sivliculture Prescription or Silviculture Report); Foster, Macalady, Ruzicka 2015 and 2016

Hole in the Road Hydrology/Channels/Water Quality Specialist Report (Hydrology Report); Hawe, 2015

Hole in the Road Fisheries Report Zoellick 2016

Hole in the Road Soils Specialist Report; Hawe 2105

Hole in the Road Project EA Wildlife Report; Murphy 2015

Hole in the road Fuels Specialist Report; Macalady 2015

Hole in the Road Carbon Storage and Carbon Emissions Report; Ruzicka 2016

Hole in the Road Recreation and Rural Interface Area Specialist Report; Meredith 2016

Hole in the Road Visual Resources Management Analysis Report; Moore 2016

Hole in the Road Cultural Resources Report; Greatorex 2015

Hole in the Road Logging Systems Report; Bernards 2015

Chapter 7: Additional Maps

Figure 20: Known Observation Points (KOP) for Visual Analysis

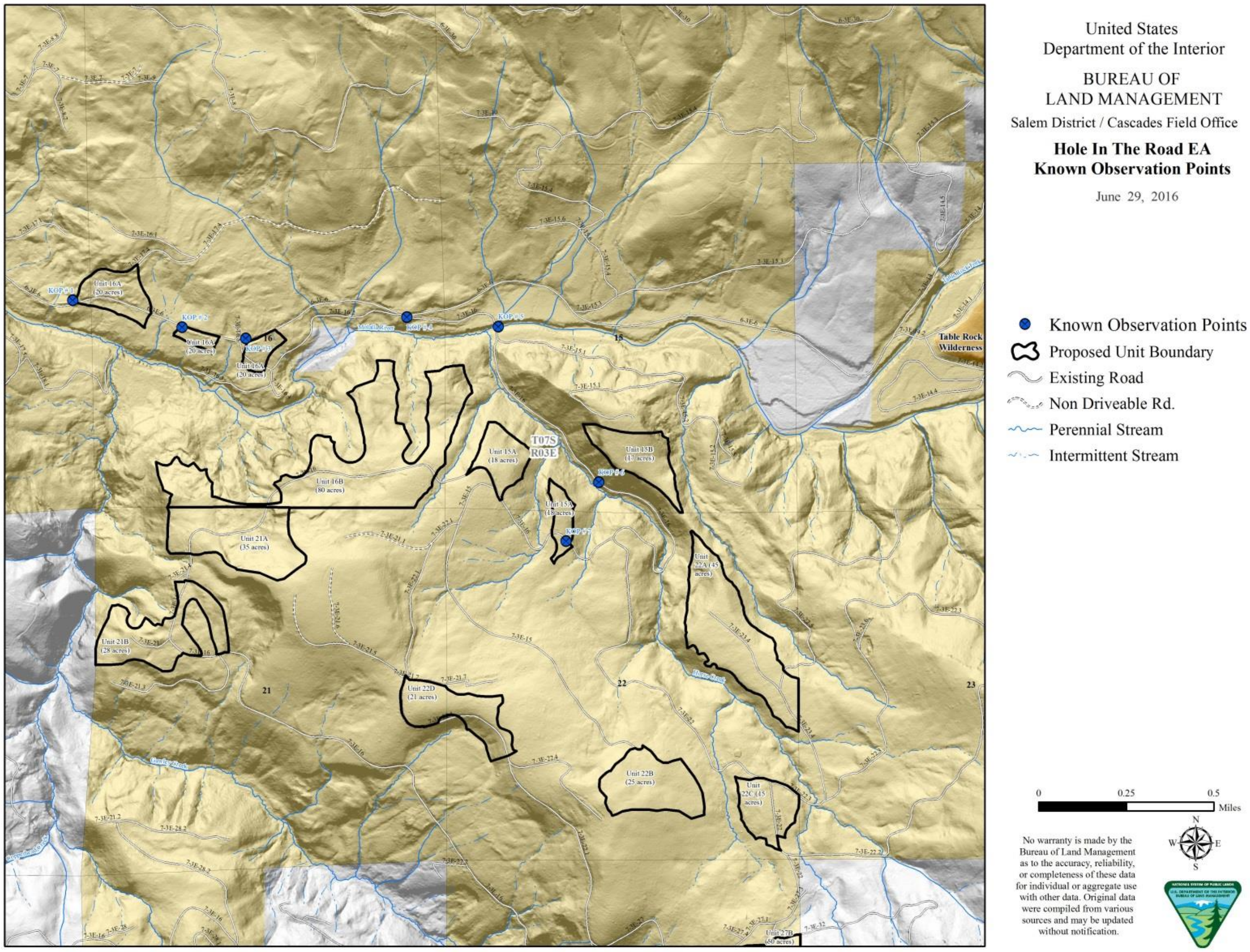
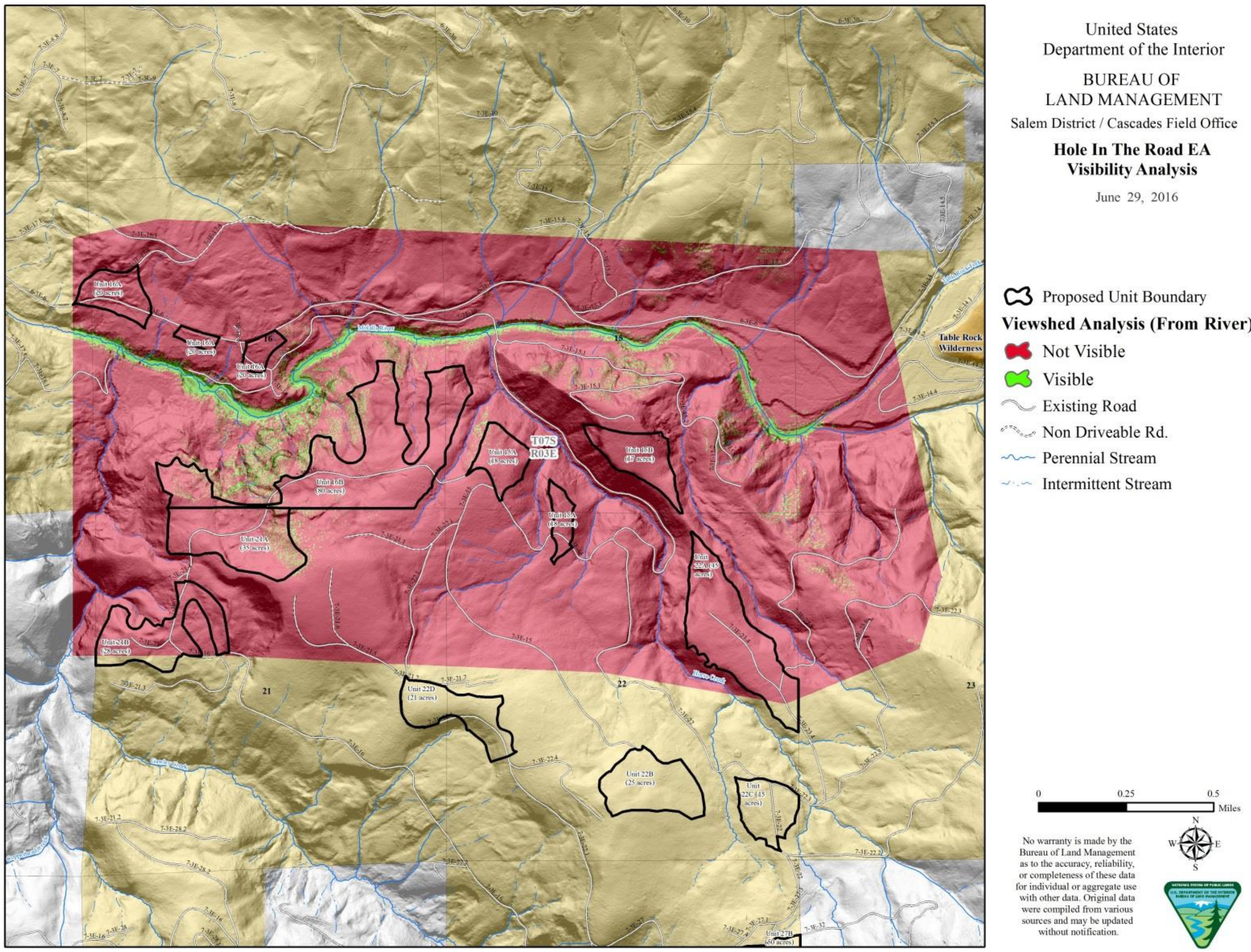


Figure 21: Lidar Map showing what is visible from the Molalla River within the Hole in the Road project area



Chapter 8: Literature Cited

Government Documents

BLM Manual H-1790-1 – National Environmental Policy Act Handbook
BLM Manual 6400 – Wild and Scenic Rivers – Policy and Program Direction for Identification, Evaluation, Planning and Management
BLM Manual 6840 – Special Status Species Management
BLM Manual H-8410-1 – Visual Resource Inventory
BLM Manual 9015 – Integrated Weed Management
Endangered Species Act of 1973. Available at: http://www.nmfs.noaa.gov/pr/pdfs/laws/esa.pdf
NOAA. 2005. Endangered and threatened species; designation of critical habitat for 12 evolutionarily significant units of west coast salmon and steelhead in Washington, Oregon, and Idaho; Final Rule. Federal Register 70(170):52630-52858.
Oregon Biodiversity Information Center. 2013. Rare, Threatened, and Endangered Species of Oregon. Oregon Biodiversity Information Center, Oregon State University, Portland, OR (ORBIC 2013).
OR OSHA. Oregon Occupational Safety and Health Administrative Rules, Publications, and Technical Information CD1. May, 2008. Division 7, Forest Activities.
OR. Oregon Parks and Recreation Department. 2015. Draft Molalla Management Plan;
OR. Oregon Parks and Recreation Department OR 390.805 and ORS 390.925
OR. Oregon Watershed Enhancement Board (OWEB). 1997. Oregon Watershed Assessment Manual. Page IV-11. Salem, Oregon. Available at: http://www.oweb.state.or.us/publications/wa_manual99.shtml
The Oregon and California and Coos Bay Wagon Road Grant Lands Act of 1937 (O&C act) as amended, (43 U.S. C. 1181a, *et seq*)
The Federal Land Policy and Management Act of 1976 (FLPMA) as amended (43 U.S.C. 1701 *et seq*)
The Wild and Scenic Rivers Act of 1968, as amended (16 U.S.C. 703 *et seq*)
Timber Production Capability Classification Handbook. 1986. BLM Manual Supplement Oregon State Office Handbook 5251-1 with Salem District Supplement. Portland, Oregon.
US EPA, Environmental Protection Agency, Region 10. EPA 910/9-91-001, 1991. Monitoring Guidelines to Evaluate Effects of Forestry Activities on Streams in the Pacific Northwest and Alaska. Seattle, Washington. p.52-53.
U.S. EPA Environmental Protection Agency. 2009. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2007. U.S. EPA, Washington, D.C. http://www.epa.gov/climatechange/emissions/usinventoryreport.html
USDA and USDI. June 2015. Biological Assessment of Not Likely to Adversely Affect (NLAA) Projects with the Potential to Modify the Habitat of Northern Spotted Owls Willamette Planning Province - FY 2016 (BA).
USDA Natural Resources Conservation Service. 2005. Soil Data Mart. Accessed

http://soildatamart.nrcs.usda.gov/ December 2005-June 2006.

USDA, Forest Service; USDI Bureau of Land Management. July 2011. 2011 Settlement Agreement in Litigation over the Survey and Manage Mitigation Measure in *Conservation Northwest et al. v. Sherman et al.*, Case No. 08-1067-JCC. BLM Instruction Memorandum No. OR-2011-063. Oregon State Office, Portland, Oregon (IM-OR-2011-063, "2006 Pechman Exemptions," 2011)

USDA, Forest Service; USDI Bureau of Land Management. January 2001. Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage Mitigation Measures Standards and Guidelines, Forest Service National Forests and Bureau of Land Management Districts Within the Range of the Northern Spotted Owl (ROD 2001).

USDA, Forest Service; USDI Bureau of Land Management. January 2004. Final Environmental Impact Statement to Remove the Survey and Manage Mitigation Measure Standards and Guidelines from Forest Service National Forests and Bureau of Land Management Districts Within the Range of the Northern Spotted Owl (SEIS 2004).

USDA, Forest Service; USDI Bureau of Land Management. July 2007. Record of Decision to Remove the Survey and Manage Mitigation Measure Standards and Guidelines from Forest Service National Forests and Bureau of Land Management Districts Within the Range of the Northern Spotted Owl (EIS 2007) and (July 2007 ROD).

USDA. Forest Service, USDI Bureau of Land Management. 1993. Final Supplemental Environmental Impact Statement on Management of Habitat for Late Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl. Portland, Oregon.

USDA. Forest Service, USDI Bureau of Land Management. 1994. Record of Decision for Amendments to Forest Service and Bureau of Land Management Documents Within the Range of the Northern Spotted Owl. Portland, Oregon.

USDI Bureau of Land Management. Salem District Cultural Resource maps and files, aerial photos, USGS topographical maps.

USDI Bureau of Land Management. BLM Archival Records Metzger's Atlas

USDI, Bureau of Land Management, Salem District; 1999. Molalla Watershed Analysis

USDI. Bureau of Land Management. 1998. Riparian Area Management. A User Guide to Assessing Proper Functional Condition and the Supporting Science for Lotic Areas. TR1737-15. National Applied Resource Science Center. Denver, CO.

USDI, Bureau of Land Management. 1999. Revision of Timber Sale E-4 Special Provision for Protection of Threatened and Endangered Species, and Suspension, Modification, and Termination of Timber Sale Contracts. BLM Instruction Memorandum No. OR-1999-036. Oregon State Office, Portland, Oregon.

USDI, Bureau of Land Management. 2003. Oregon and Washington Bureau of Land Management Special Status Species Policy. BLM Instruction Memorandum No. OR-2003-054. Oregon State Office, Portland, Oregon.

USDI, Bureau of Land Management. 2008. Special Status Species Management, BLM Manual Section 6840 (BLM 6840).

USDI – Bureau of Land Management, 2008. Final Environmental Impact Statement for the Revision of the Resource Management Plans of the Western Oregon Bureau of Land Management. Vol. I-III.

USDI, Bureau of Land Management. December 18, 2007. Migratory Bird Treaty Act – Interim Management Guidance. Instruction Memorandum No. WO-2008-050, (BLM WO-2008-050).

USDI, Bureau of Land Management. November 14, 2011. Special Status Species (SSS). Instruction Memorandum No. OR-2012-018, (BLM IM OR-2012-018).

USDI, U.S. Fish and Wildlife Service. 1991. Protocol for Surveying Proposed Management Activities that May Impact Northern Spotted Owls. Revised March 1992.

USDI, U.S. Fish and Wildlife Service. 2007c. Draft: What are the Effects of Habitat Thinning on Northern Spotted Owls? Literature Summarized through 2005. Portland, OR.

USDI, U.S. Fish and Wildlife Service. February 2011. Protocol for Surveying Proposed Management Activities That May Impact Northern Spotted Owls. Region One U.S. Fish and Wildlife Service, Portland, OR.

USDI, U.S. Fish and Wildlife Service. January 2013. Revised Critical Habitat for the Northern Spotted Owl. Portland, OR.

USDI, U.S. Fish and Wildlife Service. June 2011. Revised Recovery Plan for the Northern Spotted Owl. Region One U.S. Fish and Wildlife Service, Portland, OR (NSO 2011).

USDI. Bureau of Land Management. 1994. Salem District Proposed Resource Management Plan/Final Environmental Impact Statement. Salem, Oregon (FEIS).

USDI. Bureau of Land Management. 1995. Salem District Record of Decision and Resource Management Plan. Salem, Oregon (RMP).

USFWS, U.S. Fish and Wildlife Service. July 2015. Letter of Concurrence Regarding the Effects of Habitat Modification Activities within the Willamette Province, FY 2016, Proposed by the Eugene District, Bureau of Land Management; Salem District, Bureau of Land Management; Mt. Hood National Forest; Willamette National Forest; Columbia River Gorge National Scenic Area on the Northern Spotted Owl and its Critical Habitat (LOC); FWS Reference #01EOFW00-2015-I-0251

All Other Resources - Alphabetical

Achat DL, Deleuze C, Landmann G, Pousse N, Ranger J, Augusto L. 2015. Quantifying consequences of removing harvesting residues on forest soils and tree growth–A meta-analysis. *Forest Ecology and Management*. 15;348:124-41.

Agee, J. K. 1996. The influence of forest structure on fire behavior. In: Proceedings of the 17th annual forest vegetation management conference;1996 January 16-18; Redding, CA: 52-68.

Allen M., M. Taratoot and P. Adams. 1999. Soil Compaction and Disturbance From Skyline and Mechanized Partial Cuttings for Multiple Resource Objectives in Western and Northeastern Oregon, USA. Proceedings of the International Mountain Logging and 10th Pacific Northwest Skyline Symposium. Corvallis, Oregon.

Altman, B., and J. Hagar. 2007. Rainforest Birds: A Land Manager's Guide to Breeding Bird Habitat in Young Conifer Forests in the Pacific Northwest. U.S. Geological Survey, Scientific Investigations Report, 2006-5304. 60 p.

Altman, Bob. 2012. Conservation Strategy for Landbirds in Coniferous Forests of Western Oregon and Washington, Version 2. American Bird Conservancy, Oregon-Washington Partners In Flight.

Aubry, K. 2000. Amphibians in Managed, Second-Growth Douglas-fir Forests. Journal of Wildlife Management. 64(4): 1041-1052.

Bark v. US Bureau of Land Management, 643 F. Supp. 2d 1214 (D. Or. 2009)

Bailey, J., and Tappeiner, J. 1997. Effects of Thinning on Structural Development in 40 to 100 Year-old Douglas-fir Stands in Western Oregon. Forest Ecology and Management, 108 (1998) 99-113.

Benda, Lee, R.D., M.A. Hassan, M. Church, and C.L. May. 2005. Geomorphology of Steepland Headwaters: The Transition From Hillslopes to Channels. Journal of the American Water Resources Association. August, 2005. Pp. 835-851.

Beschta, R. L. 1978. Long-term patterns of sediment production following road construction and logging in the Oregon Coast Range. Water Resources Research 14(6):1011-1016.

Binkley, D., and T.C. Brown. 1993. Forest practices as nonpoint sources of pollution in North America. Journal of the American Water Resources Association 29(5):729-740.

Bjornn, T.C. and D.W. Reiser. 1991. Habitat requirements of salmonids in streams. pp. 83-138 in Influences of forest and rangeland management on salmonid fishes and their habitats, Meehan, W.R., editor. American Fisheries Society Special Publication 19.

Borg, H., Hordace, A., and Batini, F., 1988. Effects of logging in stream and river buffers on water courses and water quality in southern forests of Western Australia. Australian Forestry 51(2), 98-105.

Bosch, J.M., and J.D. Hewlett. 1982. A Review of Catchment Experiments to Determine the Effect of Vegetation Changes on Water Yield and Evaporation. Journal of Hydrology, 55:3-23.

Bowman, J., Sleep, D., Forbes, G., and Edwards, M. 2000. The Association of Small Mammals with Coarse Woody Debris at Log and Stand Scales. Forest Ecology and Management, 129(1-3): 119-124.

Butts, S., and McComb, W. 2000. Associations of Forest-Floor Vertebrates with Coarse Woody Debris in Managed Forests of Western Oregon. Journal of Wildlife Management. 64(1): 95-104.

Carey, A., Hardt, M., Horton, S. and Biswell, L. 1991. Spring Bird Communities in the Oregon Coast Range. U.S. Forest Service Pacific Northwest Research Station, Olympia, WA.

Cederholm, C.J., L.M.. Reid, and E.O. Salo. 1980. Cumulative Effects of Logging Road Sediment on Salmonid Populations in the Clearwater River, Jefferson County, Washington. In Proceedings of a conference on Salmon-spawning Gravel: a renewable resource in the Pacific Northwest? Seattle, WA. October 6-7, 1980

CH2MHILL and Western Watershed Analysts. 1999. FEMAT Riparian Process Effectiveness Curves: What is Science-Based and What is Subjective Judgment? Oregon Forest Industries Council. Salem, OR.

Chan, S., Larson, D., Maas-Hebner, K., Emmingham, W., Johnston, S., and Mikowski, D. 2006. Overstory and Understory Development in Thinned and Underplanted Oregon Coast Range Douglas-fir

Stands. Canadian Journal of Forest Research. 36: 2696-2711.

Chmura, D. J., P. D. Anderson, G. T. Howe, C. A. Harrington, J. E. Halofsky, D. L. Peterson, D. C. Shaw, and J. Brad St.Clair. 2011. Forest responses to climate change in the northwestern United States: Ecophysiological foundations for adaptive management. Forest Ecology and Management 261:1121-1142.

Christy, R.E., and S.D. West. 1993. Biology of bats in Douglas-fir forests. PNW-GTR-308. U.S.D.A. Forest Service, Pacific Northwest Research Station.

Cole, E., Pope, M., and Anothony G. 1997. Effects of Road Management on Movement and Survival of Roosevelt Elk. Journal of Wildlife Management. 61(4): 1115-1126

Curtis, R.O. 1982. A simple index of stand density for Douglas-fir. Forest Science. 28(1): 92-94

Foltz, R.B. and Yanosek, K.A.. 2005. Effects of Road Obliteration on Stream Water Quality. Managing Watersheds for Human and Natural Impacts Engineering, Ecological, and Economic Challenges Watershed 2005 Glenn E. Moglen - Editor, July 19–22, 2005, Williamsburg, Virginia, USA.

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

Groom, J.D., L. Dent, L.J. Madsen and J. Fleuret. 2011. Response of western Oregon (USA) stream temperatures to contemporary forest management. Forest Ecology and Management 262:1618-1629.

Hagar, J., 2004. Research Synthesis: Trophic Relations Among Birds, Arthropods, and Shrubs, in: CFER News, winter issue 2004. Cooperative Forest Ecosystem Research Program, Oregon State University, Corvallis, OR.

Hagar, J., McComb, W., and Emmingham, W. 1996. Bird Communities in Commercially Thinned and Unthinned Douglas-fir stands of Western Oregon. Wildlife Society Bulletin. 24(2).

Han, Han-Sup; Page-Dumroese, D.S.; Han, S-K; Tirocke, J. 2006. Effects of slash, machine passes, and soil moisture on penetration resistance in a cut-to-length harvesting. International Journal of Forest Engineering 17(2):11-17.

Hann, Ritchie, Wang, Zumrawi. 2006. Oregon Growth Analysis and Projection System, Growth and Yield Project for Northwest Oregon Forests (ORGANON), NW Oregon Version Edition 8.2 and 9.1, College of Forestry, Oregon State University.

Hann, David W., Chao-huan Wang. 1990. Mortality equations for individual trees in the mixed-conifer zone of southwest Oregon. Corvallis, OR: Forest Research Lab, College of Forestry, Oregon State University

Hansen, H., McComb, W., Vega, R., Raphael, M., and Hunter, M. 1995. Bird Habitat Relationships in Natural and Managed Forests in the West Cascades of Oregon. Ecological Applications. 5:3. Ecological Society of America.

Harr, R.D., R.L. Fredriksen, and J. Rothacher, 1979. Changes in stream flow following timber harvest in Southwestern Oregon. USDA For. Ser. Pap. PNW-249. 22p.

Harrison RB, Maguire DA, Page-Dumroese DS, 2011. Maintaining adequate nutrient supply – principles, decisions-support tools, and best management practices. *in* Angima SD, Terry TA, editors *Best* *management practices for maintaining soil productivity in the douglas-fir region.* Corvallis, Or.: Extension Service, Oregon State University

Hassan, M.A., M. Church, T.E. Lisle, F. Brardinoni, L. Benda and G.E. Grant. 2005. Sediment Transport and Channel Morphology of Small Forested Streams. Journal of the American Water Resources Association. August, 2005. Pps. 853-876.

Hawe, W.P., 2012. Round Mountain Sale Monitoring. Internal working document available in specialist file for Round Mountain Timber Sale.

Hayes, J., Chan, S., Emmingham, W., Tappeiner, J., Kellog, L., and Bailey, J. 1997. Wildlife Response to Thinning Young Forests in the Pacific Northwest. Journal of Forestry, August 1997.

Hayes, Weikel, J., and Huso, M. 2003. Response of Birds to Thinning Young Douglas-Fir Forests. Department of Forest Science, Oregon State University, Corvallis, OR.

Heninger, Ronald; Scott, William; Dobkowski, Alex; Miller, Richard; Anderson, Harry and Duke, Steve 2002. Soil Disturbande and 10-Year Growth Response of Coast Douglas-fir on Nontilled and Tilled Skid Trails in the Oregon Cascades. Canadian Journal of Forest Resources 32:233-246.

Hicks, B.J., J. D. Hall, P.A. Bisson, and J.R. Sedell. 1991. Responses of salmonids to habitat changes. pp. 483-518 *in* Influences of forest and rangeland management on salmonid fishes and their habitats, Meehan, W.R., editor. American Fisheries Society Special Publication 19.

House, R. 1995. Temporal variation in abundance of an isolated population of cutthroat trout in western Oregon, 1981-1991. North American Journal of Fisheries Management 15:33-41.

Hudiburg, T. Law, B. Turner, D. Campbel, J. Danato, D. and Duane, M. 2009. Carbon dynamics of Oregon and Northern California forests and potential land-based carbon storage. Ecological Applications, 2009: 163-180.

Huff, M., Raley, C. 1991. Regional Patterns of Diurnal Breeding Bird Communities in Oregon and Washington. U.S. Dept. Agric. Gen. Tech. Rep. PNW-GTR-285 pages 177-205.

Huff, R., K. Van Norman, C. Hughes, R. Davis and K. Mellen-Mclean. 2012. Survey Protocol for the Red Tree Vole, Version 3.0. Portland, OR. U.S. Department of the Interior, Bureau of Land Management, Oregon/Washington, and U.S. Department of Agriculture, Forest Service Regions 5 and 6. 52 p.

Humes, M., Hayes, J., and Collopy, M. 1999. Bat Activity in Thinned, Unthinned, and Old-growth Forests in Western Oregon. Journal of Wildlife Management 63(2): 553-561.

IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.

Johnson, S.L. 2004. Factors influencing stream temperatures in small streams: substrate effects and a shading experiment. Canadian J. Fisheries and Aquatic Science 61:913-923.

Law, B.E., Turner, D., Campbell, J., Sun, O.J., Van Tuyl, S., Ritts, W.D. and Cohen, W.B., 2004. Disturbance and climate effects on carbon stocks and fluxes across Western Oregon USA. Global Change Biology, 10(9), pp.1429-1444.

Law, B.E. and Waring, R.H., 2015. Carbon implications of current and future effects of drought, fire and management on Pacific Northwest forests. Forest Ecology and Management. 355 pp. 4-14

Leopold, L.B. 1997. Water, rivers and creeks. University Science Books. Sausalito, CA. Page 40-41.

Li, H. W., G. A. Lamberti, T. N. Pearsons, C. K. Tait, J. L. Li, and J. C. Buckhouse. 1994. Cumulative effects of riparian disturbances along high desert trout streams of the John Day basin, Oregon. Transactions of the American Fisheries Society 123:627–640.

Luce, C.H., and T.A. Black. 1999. Sediment production from forest roads in western Oregon. Water Resources Research 35(8):2561-2570.

Matthews, E., Payne, R., Rohweder, M. and Murray, S., 2000. Pilot analysis of global ecosystems: forest ecosystems. World Resources Institute. 200pp. http://www.wri.org/publication/pilot-analysis-global-ecosystems-1

MacDonald, Lee H. 1991. Monitoring Guidelines to Evaluate Effects of Forestry Activities on Streams in the Pacific Northwest and Alaska. Page 95. EPA/910/9-91-001

Marshall, D., Hunter, M., and Contreras, A. 2003. Birds of Oregon: A General reference. Oregon State University Press, Corvallis, OR.

McKinley, D.C., Ryan, M.G., Birdsey, R.A., Giardina, C.P., Harmon, M.E., Heath, L.S., Houghton, R.A., Jackson, R.B., Morrison, J.F., Murray, B.C. and Pataki, D.E., 2011. A synthesis of current knowledge on forests and carbon storage in the United States. Ecological Applications, 21(6), pp.1902-1924.

Miller, Richard E.; Smith, Jim; Adams, Paul W.; Anderson, Harry W. 2007. Growth of Douglas-fir near equipment trails used for commercial thinning in the Oregon Coast Range. Res. Pap. PNW-RP-574. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 33 p.

Montgomery, David R., and John M. Buffington. 1997. Channel-reach morphology in mountain drainage basins. Geologic Society of America Bulletin, May 1997. Pps. 596-611.

Muir, P., Mattingly, R., Tappeiner II, J., Bailey, J., Elliot, W., Hagar, J., Miller, J., Peterson, E., and Starkey, E. 2002. Managing for Biodiversity in Young Douglas-fir Forests of Western Oregon. U.S. Geological Survey, Biological Resources Division, Biological Sciences Report USGS/BRD/BSR-2002-0006.

Neitro, W., Binkley, V., Cline, S., Mannan, R., Marcot, B., Taylor, D., and Wagner, F. 1985. Snags (Wildlife Trees), in: Management of Wildlife and Fish Habitats in Forests of Western Oregon and Washington, Part 1, Chapter Narratives. U.S.D.A. Forest Service, Pacific Northwest Region.

Norris, Vol. 1993. The Use of Buffer Zones to Protect Water Quality: A Review. Water Resources Management 7: 257-272.

Olson, D.H. and Rugger, C. 2007. Preliminary study of the effects of headwater riparian reserves with upslope thinning on stream habitats and amphibians in western Oregon. Forest Science. Vol. 53 p. 331-342.

O'Neil, T., Johnson, D., (Manag. Dirs.); and Barrett, C., Trevithick, M., Bettinger, K., Kiilsgaard, C., Vander Heyden, M., Greda, L., Stinson, D., Marcot, B., Doran, P., Tank, S., Wunder, L. 2001. Wildlife-Habitat Relationships in Oregon and Washington (and Matrices). Northwest Habitat Institute. 2001. Oregon State University Press, Corvallis, OR.

Oregon Watershed Enhancement Board (OWEB). Oregon Watershed Assessment Manual. Page IV-11. Salem, Oregon. (http://www.oweb.state.or.us/publications/wa_manual99.shtml).

Ottmar, R.D., C.C. Hardy, R.E. Vihnanek. May, 1990 Stereo Photo Series for Quantifying Forest Residues in the Douglas-fir hemlock Type of the Willamette National Forest. USDA Forest Service

PNW-GTR-258.

Ottmar, Roger D., and Hardy, Colin C., 1989. Stereo Photo Series for Quantifying Forest Residues in Coastal Oregon Forests: Second-Growth Douglas-Fir---Western Hemlock Type**,** Western Hemlock---Sitka Spruce Type, and Red Alder Type. General Technical Report PNW-GTR-231 U.S. Department of Agriculture - Forest Service, Pacific Northwest Research Station. Siuslaw National Forest.

Penuelas, J., Hunt, J.M., Ogaya, R. and Jump, A.S., 2008. Twentieth century changes of tree-ring δ13C at the southern range-edge of Fagus sylvatica: increasing water-use efficiency does not avoid the growth decline induced by warming at low altitudes. Global Change Biology, 14(5), pp.1076-1088.

Perkins, M., and Cross, S. 1988. Differential Use of Some Coniferous Forest Habitats by Hoary and Silver-haired Bats in Oregon. Murrelet. 69: 21-24.

Perry, D.A., 1994. Forest Ecosystems. John Hopkins University Press, Baltimore, MD, 649 pp.

Pimental, D. et al. 1987. World Agriculture and Soil Erosion. BioScience. Vol. 37. No.4. p.277-283.

Power, W.E., Tausch, W.A.. 1987. Timber Production Capability Classification. TPCC Technical Guide. U.S.D.I. BLM Salem District. OR.

Powers RF, Scott DA, Sanchez FG, Voldseth RA, Page-Dumroese D, Elioff JD, Stone DM. 2005. The North American long-term soil productivity experiment: findings from the first decade of research. *Forest Ecology and Management*. 220(1):31-50.

Raffa, K. F., B. H. Aukema, B. J. Bentz, A. L. Carroll, J. A. Hicke, M. G. Turner, and W. H. Romme. 2008. Cross-scale Drivers of Natural Disturbances Prone to Anthropogenic Amplification: The Dynamics of Bark Beetle Eruptions. BioScience 58:501-517

Rashin, E.B., C.J. Clishe, A.T. Loch, and J.M. Bell. 2006. Effectiveness of timber harvest practices for controlling sediment related water quality impacts. J. American Water Resources Association 42(5): 1307-1327.

Rose, C., Marcot, B., Mellen, T., Ohmann, J., Waddell, K., Lindley, D., and B. Schreiber. 2001. Decaying Wood in Pacific Northwest Forests: Concepts and Tools for Habitat Management. Chapter 24 In Wildlife Habitat Relationships in Oregon and Washington, OSU Press, Corvallis, OR.

Rosgen, D.L. 1994. A classification of natural rivers. Catena 22:169-199.

Smith, J.E. Heath L.S. Skog, K.E., and Birdsey, R.A. 2006. Methods for calculating forest ecosystem and harvested carbon with standard estimates for forest types in the United States. Gen. Tech. Rep. NE-343. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station. 216 p. http://www.treesearch.fs.fed.us/pubs/22954

Scott, Joe H.; Burgan, Robert E. 2005. Standard fire behavior fuel models: a comprehensive set for use with Rothermel's surface fire spread model. General Technical Report RMRS-GTR-153. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 72 p.

Streamnet. 2014. Gladstone, Oregon. On-line map. Welcome to StreamNet On-line! http://map.streamnet.org

Takashi, Gomi, R.D. Moore and M.A. Hassan. 2005. Suspended Sediment Dynamics in Small Forest Streams of the Pacific Northwest. Journal of the American Water Resources Association. August, 2005. Pps. 877-898.

Tappeiner, J.C., D.A. Maguire, and T.A. Harrington. 2007. Silviculture and Ecology of western U.S. Forests. Oregon State University Press, Corvallis, OR. 440 pages (p 212).

Thomas, D., and West, S. 1991. Forest Age Associations for Bats in the Washington Cascades and Oregon Coast Ranges. In: Ruggeiero, L., Carey, A., Aubry, K. (tech coords). Wildlife and Vegetation of

Unmanaged Douglas-fir Forests. Gen. Tech. Rep. PNW-285, Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station: 295-303.
Toman, E. T. 2004. Forest road hydrology: the influence of forest roads on stream flow at stream crossings. M.S. thesis. Forest Engineering Department, Oregon State University. Corvallis, Oregon. pp78
Troendle, C.A., L.H. MacDonald, and C.H. Luce. May, 2006. Chapter 7 Fuels Management and Water Yield. from Cumulative Watershed Effects of Fuels Management: A Western Synthesis**.** Available at http://www.wy.blm.gov/fireuse/pubs/FuelsMgmt_WaterYield.pdf
Trombulak, S., and Frissell, C. 1999. Review of Ecological Effects of Roads on Terrestrial and Aquatic Communities. Conservation Biology. 14 (1): 18-30
Van Wagner, C.E. 1965 Describing Forest Fires - old ways and new. Forestry Chronicle 41:301-305
Waldien, D., Hayes, J., and Arnett, E. 2000. Day Roosts of Female Long-eared Myotis in Western Oregon. Journal of Wildlife Management 64(3):785-796.
Weikel, J. and Hayes, J. 1999. Foraging Ecology of Cavity Nesting Birds in Young Forests of the Northern Coast Range of Oregon. University of California on behalf of the Cooper Ornithological Society, The Condor Vol. 101, No. 1 (February 1999), pp. 58-66.
Weller, T., and Zabel, C. 2001. Characteristics of Fringed Myotis Day Roosts in Northern California. Journal of Wildlife Management 65(3):489-497.
Wemple, B.C., J.A. Jones, and G.E. Grant. 1996. Channel network extension by logging roads in two basins, Western Cascades, Oregon. Water Resources Bulletin 32(6):1195-1207.
Wemple, B.C., Jones, J.A. 2003. Runoff production on forest roads in a steep, mountain catchment. Water Resources Research, Vol. 39, No. 8, p. 1220.
Wilson, Todd M. 2010. Limiting Factors for Northern Flying Squirrels in the Pacific Northwest: A Spatio-Temporal Analysis. PhD Thesis. Union Institute & University.
Wronski, E.B. and N. Humphreys, 1994: A Method for Evaluating the Cumulative Impact of Ground-Based Logging Systems on Soils International Journal of Forest Engineering, 5(2):9-20.