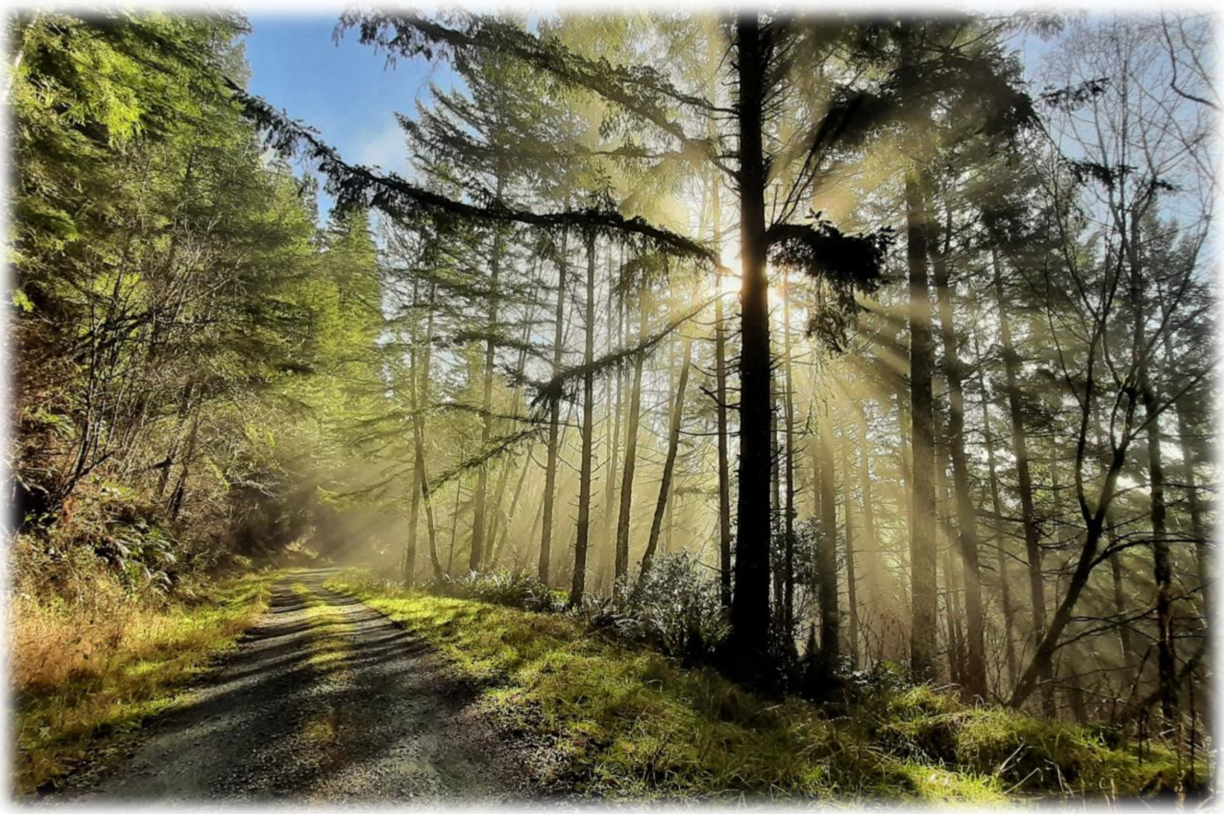
U.S, Department of the Interior
Bureau of Land Management

DOI-BLM-ORWA-C040-2019-0006-EA

Big Weekly Elk Forest Management Project

Environmental Assessment

October 2021



OR/WA Bureau of Land Management
Coos Bay District, Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
(541)756-0100
BLM_OR_CB_MAIL@BLM.GOV

1 Introduction

This environmental assessment (EA) documents the environmental analysis the Bureau of Land Management (BLM) conducted to estimate the potential site-specific effects on the human environment that would result from implementation of the Big Weekly Elk Forest Management Project (BWE). This EA provides the BLM's Decision Maker (Myrtlewood Field Office Manager) with current information to aid in the decision-making process. It will also provide the basis for determining if there are significant impacts not already analyzed in the 2016 Proposed Resource Management Plan (PRMP)/Final Environmental Impact Statement (FEIS) for Western Oregon or if a Finding of No Significant Impact (FONSI) is appropriate to which this document tiers. This EA complies with the Council on Environmental Quality's (CEQ) Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (NEPA; 40 CFR Parts 1500-1508) and the Department of the Interior's regulations on implementation of the National Environmental Policy Act of 1969 (43 CFR Part 46).

Chapter 1 provides a description of the Project Area, the purpose and need for the action, the decisions to be made, a description of how the project conforms to management direction and applicable laws and regulations, and the scope of the analysis.

1.1 Project Overview

The Myrtlewood Field Office (MFO), of the Coos Bay District BLM is proposing forest management and restoration activities in three Land Use Allocations (LUAs) described under the 2016 Northwestern and Coastal Oregon Record of Decision and Resource Management Plan (ROD/RMP) as Late-Successional Reserve (LSR), Riparian Reserve Class I watersheds (RR), and Harvest Land Base (HLB) and its sub-allocations Low Intensity Timber Area (LITA) and Moderate Intensity Timber Area (MITA) (USDI BLM, 2016b, pp. 59-74).

The MFO is also proposing transportation management actions to facilitate timber harvest and restoration activities. A more detailed description of the proposed actions is included in Chapter 2, Alternatives.

Table 1. Legal Description of the BWE Project Area.

Township	Range	Sections
28 South	10 West	17, 18, 19, 20, 21, 29, 31
28 South	11 West	02, 16, 17, 23, 27, 29, 31, 32, 33, 34, 35, 36
29 South	10 West	06, 07, 08, 09, 17, 20, 28, 29
29 South	11 West	01, 02, 03, 04, 05, 09, 10, 11, 13, 14, 15, 17, 19, 21, 22, 23, 24, 25, 26, 27, 29, 31
29 South	12 West	23, 24
30 South	12 West	01, 12
30 South	11 West	01, 04, 06, 08

1.2 Background

1.2.1 Description of Project Area

The BWE Project Area is located entirely in Coos County, Oregon, and follows the boundaries of eight sixth-field watersheds (Elk Creek, Belieu Creek-Middle Fork Coquille River, Indian Creek-Middle Fork Coquille River, Yankee Run-East Fork Coquille River, Big Creek, Sandy Creek, Dement Creek-South Fork Coquille River, Myrtle Creek). The communities of Bridge and Remote are located within the Project Area, and the town of Myrtle Point is located less than three miles from the western edge of the Project Area.

The BLM manages approximately 29,781 acres or 43 percent of the lands within the 69,635-acre[1] Project Area. BLM-administered lands are comprised of 16,354 (55 percent) acres of Oregon and California Railroad Act (O&C) land, 12,789 (43 percent) acres of Coos Bay Wagon Road Grant Lands Act (CBWR) land, and 622 (2 percent) acres of public domain land. The remainder of lands within these watersheds are owned or managed primarily by industrial landowners (36,407 acres, 52 percent), Bureau of Indian Affairs (3,241 acres, 5 percent), and local government (80.0 acres, >1 percent). Table 2 below displays the acres of each land use allocation on BLM-administered lands in the Project Area as defined in the ROD/RMP (USDI BLM, 2016b, pp. 59-74).

Table 2.. Land Use Allocation in the BWE Project Area

Land Use Allocations	Acres	Percent
Harvest Land Base	6,471	22
Late Successional Reserve	19,210	65
Riparian Reserve	3,083	10
District Designated Reserve	1,017	3
Total	29,781	100

There are three Areas of Critical Environmental Concern (ACEC) within the Project Area totaling 785 acres. The Brownson Ridge (389 acres) and Euphoria Ridge (241 acres) boundaries are both completely within the Project Boundary, and China Wall (304 acres) has 155 acres within the Project Boundary. No treatments are proposed within any of the three ACECs.

1.2.2 Selection of the Project Area and Proposed Treatments

In 2015, the MFO began to assess potential watershed level areas of LSR for treatment of young unthinned stands in plantation conditions. During this time, the MFO identified large continual tracts of LSR with a well-developed road infrastructure for potential treatment. The BWE project area was identified with both these criteria in mind. The amount of LSR within the sixth field watersheds mentioned in the Description of the BWE Project Area (Section 1.2.1) consists of 19,210 acres of LSR or 33 percent of the overall LSR land in the MFO (58,871 acres). The MFO also identified the BWE project has a well-developed supporting road network that would provide for cost-effective operations minimizing the amount of new road development. The MFO identified the project area contained 25 percent of inventoried roads within the MFO BLM-administered lands (1,382 miles of road[2]).

As the BLM began to implement the new ROD/RMP in 2016, the MFO decided to develop restoration efforts by reducing stand densities to promote growth and vigor which would contribute to a stable wood supply in the RR. For this project, the RR is entirely within the Class 1 subwatersheds as defined in the ROD/RMP (USDI BLM, 2016b, pp. 68-74).

Stands within the LSR:

Using Geographic Information Systems Mapping (GIS), Light Detection and Ranging (LiDAR) derived stand metrics, aerial imagery, Forest Operational Inventory (FOI), stand exams, and RA10[3] modeling, the

---

[1] This acreage is determined by the MFO GIS specialist using OR/WA BLM Corporate GIS data and may vary based on interpretation. The acreage provided includes water features which total 130.2 acres or >1 percent.
[2] Road network miles were calculated from data within the Federal Asset Management System
[3] From the recovery plan and our RA10 guidance document: The intent of RA 10 is to protect, enhance, and develop habitat in the quantity and distribution necessary to provide for the long-term recovery of spotted owls and to provide additional demographic support to the range-wide spotted owl population. It has two primary objectives:

- Prioritize known and historic spotted owl sites, using professional judgment, as to the best available site-specific data for conservation and/or maintenance of existing levels of habitat (pg. III-44) and

BLM selected a preliminary set of forest stands located within the LSR. MFO Wildlife Biologists and Silviculturists identified forest stands located within the LSR that do not meet the desired owl NRF habitat conditions described in the ROD/RMP[4].These previously managed, even aged stands do not currently function as Nesting, Roosting and Foraging (NRF) habitat for spotted owl because they lack sufficient large diameter legacy trees that provide suitable nesting structures, as well as multi-layered canopies and a diversity of tree species that make up high quality spotted owl habitat. Due to the overly dense conditions found in these stands (Relative Density (RD) greater than 50%) they are unlikely to develop into high quality Nesting Roosting and Foraging habitat without stand level disturbance such as the treatments outlined in this EA.

The MFO used direction outlined in the ROD/RMP (p. 66) to apply silviculture treatments to speed the development of spotted owl nesting-roosting habitat. The MFO defined and quantified the desired future conditions of stand complexity for nesting-roosting habitat in the LSR using field visits, stand modeling with Forest Vegetation Simulator (FVS), and recent research from Poage (2004, p. 19) in Table 3 below (Andrews, Perkins, Thrailkill, Poage, & Tappeiner II, 2005).

Table 3. Stand Complexity as a Quantifiable Measure of Structural Complexity and Biological Diversity for the Central Coast Range of Western Oregon.

Tree Species & Size	Desired Trees per Acre (TPA)*	desired percent canopy cover **
Middle story conifers 21-32” dbh	8-22	5-20
Middle story hardwoods > 9” dbh	10-19	30-60
Overstory Douglas-fir 32-48” dbh (large trees)	8-13	20-40
Overstory Douglas-fir > 48” (giant trees)	2-3	20-40
Understory deciduous shrubs, saplings, and grasses or forbs	NA	30-100 ground cover
Deadwood	A minimum of deadwood required by the ROD/RMP for the Late-Successional Reserve land use allocation (USDI BLM, 2016b, pp. 64-67)	
* Mature and old-growth data from the Oregon Coast province is used to approximate the desired conditions for complex, high-quality forest habitat. The desired quantities for live trees are based on the Late-Successional Reserve, Oregon Coast Province, Southern Portions (RO267, RO268) (USDA - USFS, UDSI - BLM 1997, pp. 55-56) (see hemlock dry, moist, and wet) and (Poage & Tappeiner II, 2004). ** Canopy cover was calculated using a BLM canopy cover estimation tool with stands data and desired future condition data from Poage 2004 (Kintop, 2009).		

Within the RR:

A GIS-based analysis of LiDAR imagery conducted by the BLM as well as timber stand investigations confirm that identified RR areas are overstocked based on RD (see Appendix E) and Quadratic Mean

- Identify areas where vegetation management and silvicultural treatment would enhance habitat conditions based on criteria/conditions described in RA 10 (pg. III-45)

[4] Conditions include: conifer stands with multi-layered, multispecies canopy dominated by large (>30" DBH) conifer overstory trees, and an understory of shade tolerant conifers or hardwoods, ≥ 60 percent canopy cover, substantial decadence in the form of large, live conifer trees with deformities (such as cavities, broken tops, and dwarf mistletoe infections; numerous large snags), ground cover characterized by large accumulations of logs and other woody debris, and a canopy that is open enough to allow northern spotted owls to fly within and beneath it. (RMP p. 64)

Diameter (QMD). Within the project area's RR, overly dense stands (72 to 97 percent RD, based on FOI data) are prevalent, and less likely to contribute stable wood in nearby creeks and rivers.

The National Marine Fisheries Service (NMFS) estimates that if the strategies and actions identified in the Oregon Coast (OC) Coho Recovery Plan (2016), such as improvements to aquatic habitat driven by RR treatments, such as outer RR thinning to promote the development and delivery of stable wood and individual tree cutting or tipping to invigorate wood supply (USDI BLM, 2016b, pp. 68-74) are implemented in a timely manner, and marine survival is not too low, Oregon Coast Coho salmon may be delisted within the next ten years (USDC NMFS 2016b, p. S-10)

According to Oregon Department of Fish and Wildlife (ODFW) Stream Channel and Riparian Habitat Benchmarks (Moore 1997), all streams surveyed from 2014-2020 (~4.8 miles) in the Project Area are categorized as either "Undesirable" or less than "Desirable" (defined as less than 3 Key pieces per 100 meters) in parameters associated with Large Woody Debris (ODFW 2014-2020), specifically "Key" pieces. This includes key Coho salmon spawning and rearing streams such as King Creek, Weekly Creek, Brownson Creek and Elk Creek, as well as tributaries. The lack of large wood and disassociation from the floodplain has caused increased stream velocities to continually scour stream channels and remove substrate during high flows. Large wood serves an important role in creating and maintaining stable and functional stream channels by reducing stream energy, retaining stream sediments, maintaining lower width/depth ratios, and allowing floodplain development. Surveys also indicate that stream morphology has been altered (greater stream incision, altered substrate, less floodplain connectivity) in characteristics associated with the presence (or absence) of aquatic and riparian wood supply.

The MFO's future desired conditions in the RR stand conditions mimic a pre-disturbance form. Large, open grown conifers, middle story component of both deciduous and coniferous trees, and an understory containing a variety of species is beneficial to animals dependent on riparian areas, and likely to contribute stable wood to streams. The following is a description of the RR that would benefit from thinning and individual tree tipping/falling:

- Age class between 40 and 59 years of age (includes only 40- and 50-year-old age classes).
- RD of trees over 45%
- Quadratic Mean Diameter of less than 19.5" dbh
- Even-aged stand condition,
- Composed largely of one overstory species,
- Lacking a secondary canopy development and deciduous component.

Sites chosen for tree tipping exhibit features that would result in a higher likelihood of improved watershed function. Selected sites are overly dense, which limits stable wood development and contribution to neighboring streams. In overstocked RR areas: trees die, break, and fall in place without reaching streams due to excessive interference from neighboring tree canopies; are stunted by a lack of resources such as sunlight and nutrients; and take longer to reach a diameter considered to be stable. By contrast, more open-grown RR trees: can directionally fall and reach streams from a distance; are less likely to be stunted by a lack of resources; and are more likely to express growth as diameter, thus attain a size of in-stream stability quicker. The BLM selected RR locations using the following considerations: (1) the potential of streams and stream reaches to provide habitat for different fish species (Burnett et al. 2007); (2) the potential erosion of streams-adjacent areas; (3) the potential of a stream to warm if stream side vegetation is modified; and (4) the potential of headwater streams to deliver wood to fish-bearing streams (Reeves et al. 2003). The project locations were analyzed with respect to the above factors using NetMap (Benda et al. 2015), a GIS enabling platform that integrates multiple modeling and analysis tools to provide landscape wide insight. NetMap employs models that are available in the published scientific literature to identify select watershed features (channel gradient, valley configuration, channel orientation, and landslide susceptibility) to establish the context of a location of interest (Reeves, 2016).

Stands within the HLB:

BLM Forestry specialists evaluated each HLB stand within the Project Area using a combination of LiDAR derived stand metrics, BLM's Micro*Storms data, walkthrough assessments, aerial photography, and common stand exams. Using direction from the ROD/RMP (pp. 59-63), forestry specialists then decided whether the stands currently meet one of two stand conditions: a stand that would help to adjust age class distribution through a regeneration harvest prescription, or 2) a young stand that would benefit from commercial thinning to improve future stand merchantability and value.

When selecting units for harvest within the HLB, the MFO first selected older stands beyond the modeled rotation age (≥ 90-110 years old) for regeneration harvest to fill the 0-10-year age class void. Remaining stands that were between the ages of 50-90 would undergo regeneration harvest to provide age classes in the currently deficit 0-10-year age class across the Sustainable Yield Unit (SYU). The forest planner removed stands from harvest consideration if they were thinned within 15 years to capitalize on the increasing growth and marketability (increased volume and log grade).

Transportation Management

As part of the selection process, the MFO chose this project area location based on the presence of a well-developed supporting road network providing cost-effective operations. Transportation Management for the project consists of developing and maintaining a transportation system that serves resource management needs in an environmentally sound manner, as directed by the ROD/RMP (p. 81) and the Western Oregon Districts Transportation Management Plan (USDI BLM, 2010). Timber sales play an integral role in maintaining and improving the districts road infrastructure.

1.3 Purpose and Need for Action

1.3.1 Need for Action

The MFO intends to address the following needs by implementing actions designed to be in conformance with the management direction for each LUA defined in the ROD/RMP.

In the LSR

Within the LSR in the proposed project area, stands were established at high densities and may have missed a pre-commercial or commercial thinning entry. As a result, they exhibit poor height to diameter ratios, small live crown ratios, and/or appear to be at high risk for wind throw due to prolonged high-density growing conditions. As a result, the MFO identified a need to apply silviculture treatments to speed the development of spotted owl nesting-roosting habitat (USDI BLM, 2016b, p. 66). Silvicultural treatment such as thinning, single tree selection, and group selection harvest provide the opportunity to reduce tree density, improve stand vigor and growth, increase tree species diversity, improve forest canopy structural characteristics, and snag creation, all of which promote the development of NRF habitat for the spotted owl.

In the RR

The MFO identified a need within the middle and outer zones of RR areas located near both the proposed LSR and HLB units of the BWE project area to promote the development of stable wood. Within the inner zone RR, the MFO has also identified a need to conduct fish habitat restoration through individual tree cutting or tipping in selected stands with high Intrinsic Potential[5], adjacent to ecologically sensitive stream reaches, and within the range of anadromous fish as designated by ODFW and BLM fish distribution information. The MFO fish biologist intersected these three polyline models, and where all three models met identified stream reaches that were selected for tree tipping.

In the HLB

The MFO has a need to conduct timber harvest in the HLB to contribute to the District's annual and decadal Allowable Sale Quantity (ASQ) volume, and to adjust the age class distribution at the Sustained Yield Unit (SYU) scale to provide a predictable even flow of timber (USDI BLM, 2016b, p. 59).

Silviculture Treatments in the HLB

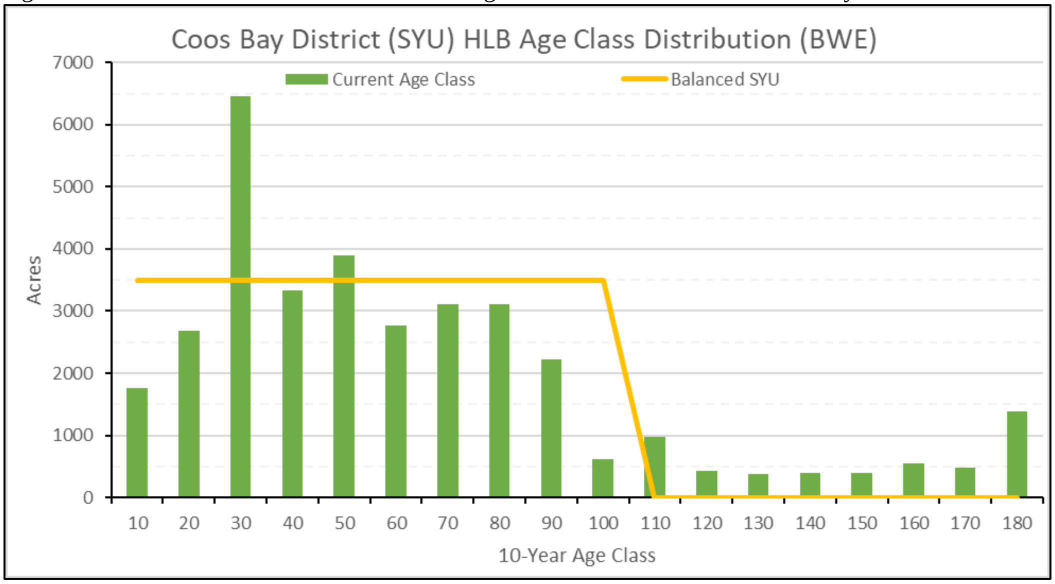
The units proposed for silviculture treatments are in the MITA and LITA subdivisions of the HLB LUA. The HLB are those lands on which the determination and declaration of the ASQ is based. The declared ASQ for the BLM Coos Bay District SYU is 12 million board feet (MMbf) of timber per year with as much as 40 percent variation (7-17 MMbf) annually (USDI BLM, 2016b, p. 6).

The ROD/RMP provides management direction for the HLB to "Adjust the age class distribution in each sustained-yield unit" (USDI BLM, 2016b, p. 59). Adjusting the age class distribution is accomplished by resetting stands to a 0-age class through regeneration harvest. The ROD/RMP is designed to incrementally distribute stand age classes on the HLB to provide predictable and sustainable ASQ volume. Currently not all the age classes are equally represented in the Coos Bay District SYU and to obtain an incrementally equal distribution of the 10-year age classes Coos Bay BLM will need to do so by not depleting any age class ≤ 110 years old and applying regeneration harvest across multiple age classes.

BLM foresters analyzed the current distribution of stand age classes within the HLB across the SYU and found that fewer than two percent of the HLB stands are in the 0- to 10-year age class; this is a noticeable deficit relative to the other available age classes. Figure 1 shows the distribution of forest age class currently (pre-harvest) and desired future condition (Balanced SYU).

[5] Intrinsic Potential (fish bearing streams): Intrinsic potential (Burnett et al. 2007) is an estimate of the capability of a given stream reach to provide suitable habitat for a given species. Metrics considered in the calculation of IP include stream size (mean annual flow), stream gradient, and the ratio of valley width to active channel width. IP was used to access the potential productivity for streams producing Coho salmon and steelhead, and stream reaches with IP > 0.5 considered as "most ecologically sensitive" (Reeves et al. 2016).

Figure 1. Pre- and Future Condition of the HLB Age Class Distribution for the Coos Bay District.



Additionally, there are approximately 12 acres of HLB that are overstocked. This stand is approximately a 40-year-old plantation that exhibits high BA per acre, trees per acre, and RD (See Issue 3.1.3 for further information). Research indicates that stands that develop at prolonged high densities have a limited variation in tree size, reduce diameter growth, and become more unstable over time (Wilson, 2000). With the finite site resources being divided among many trees, the individual trees would have slower growth rates, and therefore would be smaller than trees growing in the more open areas of a stand (Oliver and Larson 1996, pp. 211-217). Timely treatment to reduce density would promote stand health and increase growth rates increasing stand merchantability and value for future harvests.

1.3.2 Project Objectives (Purpose)

The BLM intends to address these needs by implementing the management direction of ROD/RMP, which describes the desired future conditions for resource programs and land use allocations for lands that fall under BLM jurisdiction.

- In stands within the LSR, that are not spotted owl nesting-roosting habitat, the MFO would apply silvicultural treatments to speed the development or improve the quality of spotted owl nesting-roosting habitat in the stand or in the adjacent stand in the long term. Limit such silvicultural treatments (other than forest pathogen treatments) to those that do not preclude or delay by 20 years or more the development of spotted owl nesting-roosting habitat in the stand and in adjacent stands, as compared to development without treatment. Allow silvicultural treatments that do not meet the above criteria if needed to treat infestations or reduce the spread of forest pathogens (USDI BLM, 2016b, p. 66).
- The purpose for implementing RR thinning treatments is to ensure stands are able to provide trees that would function as stable wood in streams in the Outer Zone of fish-bearing and perennial streams, and in the Middle and Outer Zone non-fish-bearing intermittent streams in Class 1 subwatersheds (USDI BLM, 2016b, pp. 71-72.).
- The MFO would also implement Inner Zone (fish-bearing, and perennial streams) individual tree cutting or tipping for fish habitat restoration and to meet the tree-tipping management direction associated with outer zone commercial thinning (USDI BLM, 2016b, pp. 69-71).

- The purpose of the action in the HLB is to conduct regeneration harvest to contribute timber volume to the Allowable Sale Quantity (ASQ) and adjust the age class distribution in each sustained yield unit through regeneration harvests (USDI BLM, 2016b, pp. 5-8, 59-60).
- The MFO would also apply commercial thinning treatments in the HLB to 12 acres of overstocked stands in unit 106 (Small Sandy) to improve stand merchantability and value for future harvest (USDI BLM, 2016b, p. 60).

1.4 Decisions to be Made

The BLM will decide whether to implement restorative actions through stand thinning in the LSR and RR, implement timber harvest activities in the HLB, whether to implement related actions including transportation management actions and site preparation/fuels treatments. The Coos Bay District typically considers and issues a single sample tree falling decision for the relevant analysis areas before timber sale decisions. Timber sale decisions would include harvest areas, roadwork, and fuels treatments.

1.5 Conformance with Land Use Plan

The BLM signed the ROD/RMP on August 5, 2016. The BWE Forest Management Project is in conformance with the ROD/RMP which addresses how the BLM will comply with applicable laws, regulations, and policies in western Oregon, including, but not limited to the: O&C and CBWR Act of 1937, Federal Land Policy and Management Act (FLPMA), Endangered Species Act (ESA), National Environmental Policy Act (NEPA), Archaeological Resources Protection Act, Clean Air Act, and Clean Water Act.

1.6 Public Input and Issue Development

The MFO posted a 30-day scoping period for the BWE Forest Management Project on June 7, 2019, to the BLM's ePlanning website. A scoping notice was also sent to adjacent landowners, permittees, agencies, local tribes, and other interested citizens of proposed activities on lands managed by the MFO. The BWE interdisciplinary team (IDT) received comments from three organizations. All scoping comment letters and emails are available in the project record.

1.6.1 Issues

Issues raised by the public or in IDT meetings were considered and either analyzed as a part of this EA (Chapter 3), or as an issue considered but not analyzed in detail addressed in Appendix B. The IDT identified relevant issues based on applicable law, management direction in the ROD/RMP, and information gathered during project planning and preparation. The MFO analyzed these issues in detail if the analysis was useful for making a reasoned choice between alternatives or if the analysis was necessary to determine the significance of the effects. Analysis of the issue provide a basis for comparing the environmental effects of the action alternatives and the no action alternative and aids in the decision-making process. All specialists' reports referenced in this EA are available to the public upon request and summaries of these reports are provided in Chapter 3 and Appendix A. The IDT analyzed the following issue-based questions:

Forestry Management:

1. How would harvest operations within the HLB contribute to the achievement of Declared Allowable Sale Quantity?

2. How would the proposed regeneration harvest change age-class distribution within the SYU Scale?
3. How would commercial thinning affect stand merchantability and value of the 12 overstocked acres?

Silviculture:

4. How would the proposed harvest actions affect forest stand development in the LSR and RR?

Hydrology/Fisheries

5. How would commercial and non-commercial thinning activities in the Riparian Reserve provide trees that would function as stable in-stream wood?

6. How would the proposed vegetation management affect summer streamflow volume and summer stream temperature in fish habitat?

Wildlife:

7. How would the proposed treatments in the LSR and RR vegetation modification result in the availability and development of owl nesting, roosting, foraging (NRF) habitat within the owl nesting analysis area?
8. How would vegetation modification affect known spotted owl nests in the project area?

2 Alternatives

This chapter describes the alternatives the BLM analyzed in detail in this EA (including the No Action Alternative, Section 2.1). Sections 2.2 through 2.4 provide a description of management activities considered for the BWE project across each action alternative.

2.1 Alternative 1 (No Action)

The no action alternative provides a baseline for the comparison of the action alternatives. Analysis of this alternative describes the environmental baseline in the absence of the proposed action. Selection of the no action alternative would not preclude future forest management actions in this area. Under this alternative:

- The BLM would not conduct commercial timber harvest as described in this document within the project area without additional NEPA Review.
- The BLM would not construct, improve, renovate, or decommission roads in the area to facilitate timber harvest and restoration activities.
- The BLM would not offer for sale under commercial timber sales, and sample tree falling would not occur in these areas.
- The BLM would not conduct activity fuels reduction treatments within the project area.

Forest stands proposed for treatment in the LSR and RR would continue their current growth trajectory (See Appendix H). In the LSR, the MFO would not treat the identified stands to promote the development of forest stands to speed the development of spotted owl habitat. In the RR, the MFO would not treat identified stands to promote the development of large trees that would provide stable wood to neighboring streams. In the HLB, the MFO would not produce volume towards the Declared ASQ for this project but would continue to produce ASQ from other projects identified in environmental assessments such as Upper Rock Creek and Catching located within the Coos Bay District. Stands proposed for regeneration harvest would not contribute to the age class distribution in the SYU and stands proposed for thinning would continue to be overstocked leading to high mortality and less valuable timber.

BLM activities that would continue to occur in the analysis area include silvicultural activities in young stands, wildfire suppression, and construction of roads across BLM land under existing right-of-way agreements, routine road maintenance, control of noxious weeds, and other projects covered by earlier decision records.

2.2 Actions Common to Alternatives 2 and 3

The ROD/RMP contains measures in both Management Direction and Best Management Practice(s) (BMPs) designed to prevent and reduce the amount of pollution generated by non-point sources to a level compatible with water quality goals (USDI-BLM 2016b p. 139). The IDT incorporated a list of BMPs (from Appendix C in the 2016 ROD/RMP) into the BWE project (Appendix B) for roads and landings, timber harvest activities, silvicultural activities, and fire and fuels management to comply with the Clean Water Act.

The IDT developed and incorporated Project Design Feature(s) (PDF) (Appendix B) to avoid, minimize or rectify effects on resources, and these are included as part of the proposed actions. PDFs are site-specific measures, restrictions, and requirements included in the design of a project to reduce adverse environmental consequences.

Sample tree falling for commercial timber sales in the HLB, LSR, and RR
The BLM would derive harvest volumes for treatment from cruising methods that would employ sample tree falling techniques. The BLM would conduct sample tree falling in preparation of timber sale contracts to improve the accuracy of the final cruise volume. Sample tree selection would come from trees marked for removal. Appendix F contains more information about sample tree falling. PDFs for sample tree falling can be found in Appendix: B. Sample trees would remain on-site if a timber sale does not occur, any felled trees would remain on site as large down wood.

Lands and Realty Actions

The BLM would pursue obtaining access across privately owned lands to BLM-administered lands in support of the BWE project area. Any documentation for proposed road access needed would be covered under another NEPA analysis and not part of this action.

Fuels Reduction Treatments
The BLM proposes to use a combination of prescribed fire and mechanical treatments to reduce hazardous fuel loadings from the proposed actions at landings, along property lines and roadsides, and within timber harvest units. Hazard reduction treatments common to both action alternatives would include any of the following:

- chipping slash,
- lop and scatter,
- hand or machine piling,
- covering and burning,
- hand or machine piling and leaving.

Prescribed fire treatments would include pile burning during the late fall/early winter months after wetting rains have occurred. BLM fuels specialists could choose to use more than one type of fuels reduction treatments in one unit.

The BLM would comply with the Oregon Smoke Management Rules (2014 OAR 629-048-0001–629-040-0500) for all prescribed burning.

Port-Orford-Cedar (POC)
The IDT applied the Port-Orford-cedar Risk Key (Appendix E) and determined that BWE units 18, 23, 29, 31, and 34 (all units within the LSR and RR) are located adjacent to, or upstream from the Euphoria Ridge and Brownson Ridge ACECs. The Relevant and Important Values designated to these areas include:

- well-developed Port-Orford-cedar stands with all age classes (Brownson Ridge).
- and Old-growth western red cedar stand series rare in Coastal Oregon (Euphoria Ridge).

Currently, there are infected POC in the BWE project area, and in both the Euphoria Ridge and Brownson Ridge ACECs.

Transportation Management Actions
Transportation Management for this project consists of developing and maintaining a transportation system that serves resource management needs in an environmentally sound manner, as directed by the ROD/RMP (p. 83) and the Western Oregon Districts Transportation Management Plan (USDI BLM, 2010). To implement these actions the BLM would provide access across BLM-controlled roads and private roads over which the BLM has rights of use under the terms and conditions of reciprocal right-of-way agreements. Both action alternatives include managing BLM's road network through renovation and improvement of existing roads and decommissioning of selected roads.

The BLM would design the use of existing roads to allow for operations to occur at times of the year appropriate to minimize effects to spotted owl and marbled murrelet (MM), and take into consideration existing road conditions, unit size, unit volume, and logging costs. For treatment operations to occur year-round in identified units, roads would have a rocked or paved surface adequate to withstand winter operations. The BLM would emphasize winter operations within areas that already have adequate all-weather haul routes. Proposed road management activities are discussed below and shown in Appendix D.

The BLM staff estimated proposed road work distances and locations in the EA and these values and locations are subject to change during project layout final field verification checks, and individual timber sale preparation. The BLM would disclose final field verified roadwork mileage and roadwork locations in the forest management decision and exhibit maps. The variability of estimates is included in the effects analysis.

There are approximately 22 miles of road (improvement and renovation) located behind privately controlled gates due to the checkerboard ownership in the project area. These gates would remain after the BLM concludes project activities and the Transportation Management Plan classifies this as a 'temporary closure' (USDI BLM, 2010, p. 34).

For road activities, the MFO would adopt both BMPs and PDFs (Appendix B) to guide final road location and design. As development of each individual sale progresses and becomes more refined, some identified spur roads or landings may be required that would better facilitate harvest operations. Past BLM experience shows that additional spurs added during advanced sale planning are less than 500 feet in length and landings are less than ¼ acre in size. These spurs would be decommissioned following harvest operations or fully decommissioned and the roadway reclaimed for timber production and hydrological function if there is no planned future use. Any roads or landing not identified in this EA that are larger than ¼ acre or 500 feet would be analyzed in further NEPA documentation.

The MFO defined the road renovation and improvement based on the Road Maintenance, Renovation, Construction, and Improvement Definitions paper (Aron, C., M. Bailey, 2020), hereby incorporated by reference, and described below. The specifics of the needed renovation and improvement would be determined at the time of project implementation based on road conditions. For purposes of analysis, the BLM assumes all roads would receive the renovation and improvement actions as described in Appendix D.

Road Improvement and Renovation

Road renovation includes road work to bring existing road back to its original design. Road improvement includes work done to an existing road to elevate the design to a higher standard. The MFO would require road maintenance in the form of improvement or renovation of existing roads to meet transportation needs for haul routes crossing BLM and private lands as described for each alternative in Appendix D.

Road Maintenance

Road maintenance activities include:

- Road brushing and grading
- Surface, culvert, ditch, and bridge cleaning
- Hauling
- Paving, chip-sealing, asphalt patching and surface rock replacement
- Culvert replacement
- Minor slide removal
- Slip-out repair

For purposes of analysis, the BLM would maintain all 20.4 miles of haul routes with the maintenance actions described in Appendix D.

Road Decommissioning
Appendix D provides road numbers and lengths proposed for decommission for each alternative. Decommissioning would mean closing roads to vehicles on a long-term basis (> 5 years), but they may be used again in the future. Prior to closure, the BLM would leave the road in an erosion-resistant condition by establishing cross drains, eliminating diversion potential at stream channels, and stabilizing or removing fills on unstable areas. The BLM would treat exposed soils to reduce sediment delivery to streams. The BLM would close these roads using an earthen barrier or its equivalent. Decommissioning can include roads that have been or would be closed due to natural process (abandonment) and may be opened and maintained for future administrative use. The Field Manager has determined that there are future administrative uses for these roads in accordance with the ROD/RMP (pp. 301-302).

LSR Treatments
The MFO would adopt three prescription approaches for stands within the LSR that fall into two general categories: commercial and non-commercial treatments (listed below). The proposed prescriptions are contingent on current stand structure and applying silvicultural treatments to speed the development of spotted owl nesting-roosting habitat outlined in the ROD/RMP (USDI BLM, 2016b, p. 66).

Commercial Treatments
The following treatment categories would be implemented as commercial timber sales and analyzed as site specific actions in this EA. If stands analyzed as commercial treatments are not economically viable, they would be implemented under stewardship authority (where timber would be sold to offset the costs of restoration activities) or as service work subject to available funding.

1. Implement heavy commercial thinning to 20-30 RD, the lower densities allowed in the Management Direction in stands that are not currently spotted owl NRF habitat, or function as dispersal habitat only (e.g., stands 40-60 years old without roosting or foraging features, see Appendix F). The ROD/RMP (USDI BLM, 2016b, p. 66) describes this treatment[6], including skips, snag creation, variable thinning, and group selection harvest.

2. Implement a light commercial thinning to 30-40 RD in stands age class 90 and less. These stands have conditions ranging between spotted owl dispersal and foraging quality but exhibit low tree vigor and simplified stand structure (see Appendix F).

Non-commercial Treatments
Through a combination of remote sensing data and field review, BLM foresters and wildlife biologists identified additional stands that do not meet the desired spotted owl habitat conditions described in the ROD/RMP (USDI BLM, 2016b). Unlike the stands identified for Treatments 1 and 2 above, these stands contain some of the desired habitat components, or are in the process of developing them naturally. Specific treatments are described below under Treatments 3, but they would retain the current habitat quality for spotted owl, and all cut trees would remain on site.

[6] In stands ≥ 10 acres treated with selection harvest or commercial thinning,
- Conduct harvest to result in stand average Relative Density percent between 20 percent and 45 percent after harvest.
- Do not create group selection openings more than 4 acres in size.
- Do not create group selection openings on more than 25 percent of the stand area.
- Leave untreated skips on at least 10 percent of the stand area.

3. Limited to stands age class 90 and under that currently support spotted owl foraging functions (e.g., stands 60-90 years old with some foraging features), but lacking adequate canopy layering, snags, down wood, or structures that constitute high quality nesting habitat. The treatment includes a combination of silvicultural actions such as individual tree falling/non-commercial thinning, and snag creation.

No treatment is proposed in stands with NRF.

Snags and Downed Woody Material in the LSR (commercial and non-Commercial)
During silvicultural treatment of LSR stands, the BLM would retain existing snags ≥ 6 inches dbh and down woody material ≥ 6 inches in diameter at the large end and >20 feet in length (except for safety, operational, or fuels reduction reasons). The BLM would retain snags ≥ 6 inches dbh cut for safety or operational reasons as down woody material, unless they would also pose a safety hazard as down woody material (USDI BLM, 2016b, pp. 65,69).

In all commercially harvested LSR stands with less than 64 snags per acre >10 inches dbh and less than 19 snags per acre >20 inches DBH on average across the harvest unit, the BLM would create five new snags >20 inches dbh and five snags >10 inches dbh within one year of completion of yarding the timber in the timber sale. The BLM would use trees from the largest size class available if an insufficient number of trees are available in the size class specified. The BLM would meet snag creation levels as an average at the scale of the harvest unit, and not necessarily attain snag creation levels on every acre (USDI BLM, 2016b, pp. 66-67).

The BLM would:
- Locate the required number of new snags in a variety of spatial patterns, including aggregated groups and individual trees.
- Concentrate created snags in areas of the stand where the BLM does not presently anticipate skidding or yarding will occur within 20 years.
- Use trees impacted by logging damage such as intermediate support trees, tail hold trees, guyline trees, and rub trees for post-harvest mortality or created structural legacies such as snags and down woody material.
- Count broken tops, slash pile scorch and weather event damage towards snag recruitment.

The BLM would not create new snags within falling distance of power lines, structures, or roads that would remain open after harvesting activities are complete. If it is not possible to create snags beyond the falling distance of power lines, structures, or roads that would remain open after harvest activities are complete, the BLM would cut trees equivalent to the required number of snags and retain as down woody material within the harvest unit (USDI BLM, 2016b, p. 67).

Table 4. LSR Timber Sale Units with treatment acres, treatment prescriptions for BWE.

Sale Area Name	EA Unit	Age Class (10 years)	Alternative 2					Alternative 3				
			Prescription Acres[1]				Commercial Units	Prescription Acres[1]				Commercial Units
			1	2	3	Total	Unit Vol. (Mbf) estimate	1	2	3	Total	Unit Vol. (Mbf) estimate
Anderson Brown	16	40	33	0	0	**33**	507	33	0	0	**33**	503
	17	40	80	0	0	**80**	1,216	80	0	0	**80**	1,220
		60	7	0	0	**7**	108	7	0	0	**7**	107
	18	60	9	0	0	**9**	135	9	0	0	**9**	137

Sale Area Name	EA Unit	Age Class (10 years)	Alternative 2					Alternative 3				
			Prescription Acres[1]				Commercial Units	Prescription Acres[1]				Commercial Units
			1	2	3	Total	Unit Vol. (Mbf) estimate	1	2	3	Total	Unit Vol. (Mbf) estimate
	19	50	38	0	0	**38**	577	38	0	0	**38**	580
		60	11	0	0	**11**	175	12	0	0	**12**	175
		70	0	0	0	**0**	0	9	0	0	**9**	145
	20	50	71	0	0	**71**	1,086	71	0	0	**71**	1,086
	30	50	22	0	8	**30**	334	30	0	0	**30**	459
	37	60	7	0	0	**7**	111	7	0	0	**7**	107
		90	21	0	14	**35**	318	35	0	0	**35**	534
Bear and Elk Creek	1	80	8	0	0	**8**	127	0	8	0	**8**	127
		90	8	0	1	**9**	125	9	0	0	**9**	143
	9	40	5	0	0	**5**	77	5	0	0	**5**	76
		50	2	0	0	**2**	29	2	0	0	**2**	31
	10	40	21	0	0	**21**	322	21	0	0	**21**	320
	12	40	17	0	0	**17**	264	17	0	0	**17**	259
	13	40	15	0	0	**15**	222	15	0	0	**15**	229
	14	40	35	0	0	**35**	530	35	0	0	**35**	530
	15	50	18	0	0	**18**	267	18	0	0	**18**	267
	34	60	0	0	6	**6**	0	0	0	6	**6**	0
		70	0	0	52	**52**	0	0	0	52	**52**	0
		80	0	0	4	**4**	0	0	0	4	**4**	0
	38	80	0	0	6	**6**	0	6	0	0	**6**	94
Casey Jones	31	40	53	0	8	**61**	815	61	0	0	**61**	930
		60	86	0	7	**93**	1,309	93	0	0	**93**	1,418
		90	35	0	0	**35**	526	35	0	0	**35**	534
	32	40	14	0	6	**20**	214	20	0	0	**20**	305
		50	27	0	14	**41**	413	41	0	0	**41**	625
		60	18	0	0	**18**	278	18	0	0	**18**	278
	33	40	31	0	0	**31**	478	31	0	0	**31**	473
		50	47	0	0	**47**	721	47	0	0	**47**	717
		60	54	0	26	**80**	828	80	0	0	**80**	1,220
Elk Creek Ridge	2	40	24	0	0	**24**	359	24	0	0	**24**	366
		50	10	0	0	**10**	154	10	0	0	**10**	153
	3	40	68	0	0	**68**	1,020	0	68	0	**68**	1,020
	4	40	7	0	0	**7**	105	7	0	0	**7**	105
	28	40	22	0	3	**24**	330	24	0	0	**24**	360
	29	40	26	0	0	**26**	390	26	0	0	**26**	390
	41	70	0	0	24	**24**	0	24	0	0	**24**	360
Lower Frenchie	42	50	2	0	0	**2**	30	2	0	0	**2**	30
		60	28	0	0	**28**	420	28	0	0	**28**	420

Sale Area Name	EA Unit	Age Class (10 years)	Alternative 2 Prescription Acres[1] 1	2	3	Total	Alternative 2 Commercial Units Unit Vol. (Mbf) estimate	Alternative 3 Prescription Acres[1] 1	2	3	Total	Alternative 3 Commercial Units Unit Vol. (Mbf) estimate
		70	1	0	0	**1**	15	1	0	0	**1**	15
Restoration Units	3	40	0	0	11	**11**	0	0	0	11	**11**	0
	5	40	0	0	9	**9**	0	0	0	9	**9**	0
	11	40	0	0	27	**27**	0	0	0	27	**27**	0
	50	40	0	0	21	**21**	0	0	0	23	**23**	0
		50	0	0	31	**31**	0	0	0	31	**31**	0
		60	0	0	14	**14**	0	0	0	14	**14**	0
		80	0	0	122	**122**	0	0	0	122	**122**	0
		90	0	0	3	**3**	0	0	0	3	**3**	0
Sheep Mountain	43	80	62	0	24	**85**	930	86	0	0	**86**	1,290
Small Sandy	35	40	9	0	0	**9**	135	9	0	0	**9**	135
South Elk 23	6	40	20	0	0	**20**	300	20	0	0	**20**	300
		50	25	0	0	**25**	375	25	0	0	**25**	375
	7	40	30	0	0	**30**	450	30	0	0	**30**	450
	8	50	36	0	0	**36**	540	36	0	0	**36**	540
		90	8	0	0	**8**	120	8	0	0	**8**	120
Weekend Falls	21	60	11	0	0	**11**	165	11	0	0	**11**	165
	22	50	35	0	0	**35**	525	35	0	0	**35**	525
	23	60	35	0	13	**48**	525	48	0	0	**48**	720
	24	40	10	0	0	**10**	150	10	0	0	**10**	150
		50	11	0	0	**11**	165	11	0	0	**11**	165
		60	12	0	32	**43**	180	43	0	0	**43**	645
	25	50	7	0	3	**10**	105	10	0	0	**10**	150
	26	40	13	0	0	**13**	195	13	0	0	**13**	195
	27	40	24	0	0	**24**	360	24	0	0	**24**	360
Totals			1,328	0	488	1,816	19,920	1,450	76	302	1,828	22,890

[1] LSR prescriptions as identified in the description above this table. (1) includes heavy commercial thinning to an RD 20-30, (2) includes light commercial thinning to an RD of 30-40, and treatment (3) is non-commercial including individual tree falling/non-commercial thinning, and snag creation.

RR Treatments[7]

Non-commercial Thinning in the Middle Zone and Outer Zone RR

Under both action alternatives the MFO proposes to non-commercially thin 30 units (~270 acres) of Middle and Outer Zone RR 50-120 feet in intermittent, non-fish-bearing streams (Middle Zone) and perennial streams (Outer Zone) as defined in the ROD/RMP (p. 71). The MFO would maintain at least 30

[7] Acreages in the RR are approximations and are subject to change based on subsequent field review. Any additional acreage would be addressed with further NEPA documentation.

percent canopy cover and 60 TPA average at the scale of the portion of the harvest unit within the RR. Locations of the proposed harvest units are in the maps section in Appendix C. Table 5 (below) specifies which units are designated for Middle or Outer Zone non-commercial treatment.

Table 5. Proposed Non-Commercial RR Treatments in the Middle Zone (50'-120') and Outer Zone (120'-Site Potential Tree Height)

EA Unit	Alternative 2 (acres)		Alternative 3 (acres)	
	Outer RR	Middle RR	Outer RR	Middle RR
2		5.8		5.8
3		32.1		32.1
4		7.3		7.3
5	5.7	3.5	5.7	3.5
6		28.7		28.7
7		3.4		3.4
8		13.2		13.2
9		0.9		0.9
10		5.8		5.8
13		2.4		2.4
14		3.1		3.1
15		3.0		3.0
16		2.9		2.9
17		18.5		24.0
19		3.3		3.3
20		19.4		19.4
22		4.5		4.5
24		12.4		12.4
26		3.0		3.0
27		6.8		6.8
28	3.5	6.9		6.9
29		8.9		8.9
30		0.4		10.2
31	0.4	9.3		9.3
32	2.1	11.2		11.2
33		9.7		9.7
35		1.5		1.5
50	13	15.1	13	15.1
100		3.9		3.9
101		4.0		4.0
Subtotal (Outer vs. Middle)	24.7	250.9	18.7	266.2
TOTAL	**275.6**		**284.9**	

Commercial Thinning in the Outer Zone RR (120'-Site Potential Tree Height)

The Site Potential Tree Height (SPTH), for the Middle Fork Coquille 5th field HUC[8] is 200', and SPTH for the East Fork Coquille 5th field HUC is 220'.

Table 6 below provides the proposed units and acreage for commercial thinning common to both alternatives, Alternative 2, and Alternative 3. Under both action alternatives the MFO would commercially thin 28 units for a total of ~301 acres.

[8] Subwatersheds, 12-digit HUCs, are generally 10,000–40,000 acres in size and have a single outlet (USDI BLM, 2016c, p. 386). Drainages or named streams nest within subwatersheds and consist of catchments containing one or more stream reaches. In this analysis, the term watershed means an area of land, size not defined, that drains to a single outlet.

Table 6. Commercial Thinning – Outer Zone

EA Unit	Alternative 2	Alternative 3
2	11.7	11.7
3	34.2	34.2
4	9.3	9.3
6	36.4	36.4
7	4.5	4.5
8	16.1	16.1
9	1.0	1.0
10	7.9	7.9
13	2.5	2.5
14	4.6	4.6
15	9.2	9.2
16	7.2	7.2
17	22.2	28.4
19	2.7	2.7
20	19.6	19.6
22	6.7	6.7
24	14.5	14.5
26	4.0	4.0
27	11.9	11.9
28	4.7	8.2
29	12.2	12.2
30	11.3	11.3
31	10.9	11.3
32	8.9	11.0
33	12.1	12.1
35	1.5	1.5
100	6.5	6.5
101	6.6	6.6
TOTAL	**300.9**	**313.1**

Individual Tree Cutting or Tipping (Inner Zone)

The BLM proposes to cut or tip trees up to 15 square feet of BA per acre adjacent to fish streams in select units. The MFO would directionally fall trees into adjacent streams; however, the BLM could yard or deck trees and make them available for other instream restoration projects. Under both action alternatives the MFO would cut or tip individual trees in one unit (Unit 6) for a total treatment area of 2.3 acres.

Snags in the RR

When conducting commercial thinning in the outer zone RR, the MFO would create five snags >20 inches dbh and five snags >10 inches dbh within one year of completion of yarding the timber in the timber sale (ROD/RMP pp. 66, 67, 71). If trees are not available in the size class specified, the BLM would use trees from the largest size class available. The BLM would meet snag creation amounts as an average at the scale of the portion of the harvest within the RR, and not on every acre.

During implementation, the MFO would:

- Create snags in a variety of spatial patterns, including aggregated groups and individual trees.
- Concentrate created snags in areas of the stand where the BLM does not presently anticipate skidding or yarding will occur within 20 years. Snag creation levels can be met with trees from any species.
- Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete. If it is not possible to create snags beyond the falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete, cut trees equivalent to the required number of snags and retain as down woody material within the harvest unit (ROD/RMP p. 71).

The MFO would not create new snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete. If it is not possible to create snags beyond the falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete, the BLM would cut trees equivalent to the required number of snags and retain as down woody material within the harvest unit (ROD/RMP p. 71).

HLB Treatments

Regeneration Harvest

Within stands proposed for regeneration harvest, the BLM would retain levels of the pre-harvest stand BA of 5-15 percent in the MITA and 15-30 percent in the LITA in each harvest unit consistent with the management direction for the HLB (USDI BLM, 2016b, pp. 62-63). Retained live trees and snags would be left in a variety of spatial patterns, including aggregated groups and individual trees. Aggregated retention may be placed to protect existing snags and larger down wood to retain connectivity where feasible and provide legacy features to enhance the regenerating stand. The BLM would create one snag per acre, greater than 20 inches dbh. If insufficient trees are available in the pre-harvest stand greater than 20 inches dbh, snags would be created from the largest size class available (USDI BLM, 2016b, p. 61, Table 2). Full suspension of logs would be required across any stream channel corridors to satisfy BMP TH03 and TH05 (Appendix B) with one–end suspension required everywhere else regardless of harvest system.

Commercial Thinning

Commercial thinning (CT) in the HLB would reduce stand densities by thinning from the current RD of 69 percent to a RD of 35 to 40 percent. Using a combination of skyline cable and ground-based harvest systems, commercial thinning would occur on 12 acres in the 40-year-old stands in both the LITA (10 acres) and MITA (2 acres) for both action alternatives.

Table 7. HLB Proposed Harvest Activities in the BWE Project Area.

Timber Sale	EA Unit	Harvest Acres	Age (Years)	Acres in Land Use Allocation (Acres)	Harvest Type (Acres)		Unit Vol. (Mbf)	Harvest Operation and Season of Operations (Acres)[1]	
					CT	Regen		Ground (Summer)	Cable (All)
Common to both Action Alternatives									
New Yankee	100	71	50 (23) 80 (6) 90 (43)	MITA (71)	0	71	3,629	0	71
The Belieus	103	40	160	MITA (40)	0	40	2,680	0	40
South Elk 23	101	34	50	MITA (34)	0	34	1,258	17	17
Small Sandy	106	12	40	MITA (2) LITA (10)	12	0	180	0	12
King Salmon	109	24	130	MITA (24)	0	24	1,880	18	6
	110	9	140	MITA (9)	0	9	667	0	9
Total	**6**	**190**	**40-160**	**MITA (180), LITA (10)**	**12**	**178**	**10,294**	**35**	**155**
Alternative 2									
Lower Frenchie	105	193	60 (183) 130 (10)	LITA (193)	0	193	8,685	0	193
Sugar Rush	102	81	60 (79) 130 (2)	MITA (81)	0	81	4,080	4	77
The Belieus	104	56	70	MITA (56)	0	56	3,192	27	29
Total	**3**	**330**	**60-130**	**LITA (193)**	**0**	**330**	**15,957**	**31**	**299**

Timber Sale	EA Unit	Harvest Acres	Age (Years)	Acres in Land Use Allocation (Acres)	Harvest Type (Acres)		Unit Vol. (Mbf)	Harvest Operation and Season of Operations (Acres)[1]	
					CT	Regen		Ground (Summer)	Cable (All)
				MITA (137)					
Total including common to both actions	**9**	**520**	**40-160**	**LITA (203)** **MIT (317)**	**12**	**508**	**26,251**	**66**	**454**
Alternative 3									
King Salmon	108	30	60 (18) 170 (13)	MITA (30)	0	30	1,830	0	30
Lower Frenchie	105	230	60 (220) 130 (10)	LITA (230)	0	230	10,580	0	230
New Yankee	111	20	240	MITA (20)	0	20	1,058	0	20
Rock Slide	107	58	60 (13) 100 (45)	LITA (58)	0	58	3,422	0	58
Sugar Rush	102	114	60 (79) 70 (34) 130 (2)	MITA (114)	0	114	4,560	4	110
The Belieus	104	85	70	MITA (85)	0	85	4,845	28	57
Total	**6**	**537**	**60-240**	**MITA (249)** **LITA (288)**	**0**	**537**	**26,295**	**32**	**505**
Total including common to both actions	**12**	**727**	**40-240**	**MITA (429)** **LITA (298)**	**12**	**715**	**36,589**	**67**	**660**

[1]Operation type and seasonality is subject to change based on guidance during layout operations. Each timber sale decision will provide final results to the type and season of the operation.

Commercial Thinning in the HLB

Under both action alternatives the MFO would conduct commercial thinning using a cable yarding system on 12 acres in 40-year-old stands in the MITA (2) and LITA (10) in one unit (EA Unit 106). This unit has a current RD of 71 and would be thinned to a RD of 27.

Yarding

The BLM would conduct forest management treatments using either a cable (skyline) system, ground-based system, or a combination of these yarding systems. Table 7 shows which system would be used in each unit for all alternatives. The BLM may adjust final yarding system design (system, acres, locations) during timber sale finalization and would provide final yarding system information in the Exhibit A portion of a timber sale decision rationale. Ground-based yarding equipment is generally limited to slopes less than 35 percent; however, the BLM may make exceptions based on BMPs TH 13 and TH 10 (USDI BLM, 2016b, p. 160). Contractors may also choose to cable yard areas identified as ground-based areas, as approved by the authorized officer, providing it does not conflict with objectives and design features.

2.3 Alternative 2 (No New Road Construction)

Under Alternative 2, the BLM would not construct new roads as part of the proposed project. The MFO would access units proposed for restoration and timber harvest through renovation and improvement of existing roads (see Alternative 2, Appendix C) and would be able to construct landings as needed. Renovation and improvement are considered as actions in both action alternatives and are described above (see Actions Common to Alternative 2 and 3).

LSR

Commercial Treatments

Under this alternative the MFO would use commercial thinning prescriptions described in section 2.2 to thin to a RD of 20-30 percent on 35 units (1,328 acres). Table 4 in Section 2.2 breaks acreages down to units analyzed. Total unit volume of commercial timber harvest would be approximately 19,918 Mbf.

Non-commercial Treatments

Stands would be treated as non-commercial units under the prescription described in section 2.2 (all units are identified in Table 4 in Section 2.2). The MFO would treat approximately 18 units or 488 acres.

RR

The MFO would commercial thin 28units (approx. 301acres), non-commercial thinning 30 units (approx. 276 acres) in the middle and outer zone RR and cut or tip live trees in one unit (2.3 acres) in the inner zone RR. Units are identified in Table 6 in section 2.2.

HLB

Using a combination of ground-based and skyline cable harvest systems, regeneration harvest would occur in 9 units (520 acres) in both the LITA and MITA. The MFO would conduct harvest operations at all times of the year depending on seasonal restrictions for MM and spotted owl, road surface type, and harvest system. Table 7 provides the season of operation the harvest operations would occur. Table 7 also shows the total acres, including actions common to both action alternatives, proposed for this alternative.

2.4 Alternative 3 (New Road Construction)

New Roads

The BLM would construct approximately 7.35 miles of new roads, as presented in Appendix D and on maps in Appendix C. All new roads would be rocked for winter operations. The IDT designed proposed roads on or near ridge tops and stable slope locations. All new road construction would be subject to BMPs and PDFs outlined in Appendix B. The BLM would design new roads to allow for treatments to occur at times of the year appropriate to minimize effects to spotted owl and MM.

LSR

Commercial Treatments

The BLM would commercially thin to a RD of 20-30 percent on 36 units or 1,450 acres. The BLM would commercially thin to a RD of 30-45 percent on 2 units or 76 acres. Table 4 in section 2.2 break acreages down to units analyzed. Total unit volume of commercial timber harvest would be approximately 22,890 Mbf.

Non-commercial Treatments

The MFO would treat 5 units or 302 acres as non-commercial treatment described in section 2.2 (all units are identified in Table 4 in section 2.2).

RR

Under this alternative, the MFO would meet the restoration objectives in the RR by commercial thinning 28 units (approx. 313 acres), non-commercial thinning in 30 units (approx. 285 acres) in the outer zone RR and cut or tip live trees in one unit (2.3 acres) in the inner zone RR.

HLB

Using a combination of skyline cable and ground-based harvest systems regeneration harvest would occur on 12 units (727 acres) in both the LITA and MITA. Table 7 shows the distribution of regeneration harvest by stand age class in each land use allocation, for each action alternative.

2.5 Alternative Considered but Eliminated from Detailed Analysis

1. **Develop an alternative that does not include regeneration harvest in the HLB.** BLM Foresters analyzed the current distribution of stand age classes within the HLB across the SYU and found that fewer than two percent of the HLB stands are in the 0-10-year age class; this is a noticeable deficit relative to the other available age classes. An alternative that does not include regeneration harvest would not meet the purpose and need for this project, which includes adjusting the age class distribution in the HLB.

2. **Develop an alternative that includes treating all proposed LSR and RR units non-commercially.** The BLM proposed to set stands on the trajectory that was analyzed as most effective in developing spotted owl habitat (based on thinning to RDs of 20-30, or 30-40). The BLM could not safely non-commercially thin to the relative RDs mentioned above without removing the trees cut. Leaving these trees would create an unnecessary fire risk by changing the 1,539 to 1,989 acres proposed for commercial harvest in alternatives 2 and 3 from a lower risk timber fuel model to a high-risk Slash/Blowdown model. Below are the stand ages analyzed for commercial thinning and the approximate tons per acre of 10,000-hour fuels left if treated non-commercially.

    a. 40-year-old: approximately 51 tons/acre + slash
    b. 50-year-old: approximately 68 tons/acre + slash
    c. 60-year-old: approximately 122 tons/acre + slash
    d. 70-90-year-old: approximately 122 tons/acre + slash

    Additionally, these acres would increase risk on Douglas-fir bark beetle infestations across the planning area (Oregon Department of Forestry , 2015). This alternative is technically infeasible based on the information provided above.

Develop an alternative that includes treating all proposed LSR and the outer zone RR units commercially. The BLM identified units proposed in alternatives 2 and 3 for both commercial treatment and non-commercial treatments. Based on project lead prescriptions identified in the purpose and need for the LSR and RR, units proposed for non-commercial restoration would not be economically feasible. The BLM identified non-commercial units as either inaccessible, difficult to access or will not produce enough revenue to justify the logging system needed to treat the unit. A Non-commercial treatment (hand felling or snagging) would be more cost effective.

3 Affected Environment and Environmental Consequences

This chapter combines the affected environment and environmental effects analysis and includes those resources that may be affected by implementation of each alternative. In Chapter 3 each issue identified for detailed analysis, each issue presents-

- the background of the issue, including explaining relevant terms, under the heading Background,
- the methodology used in the analysis, including the assumptions used in the analysis, under the heading Analytical Process
- a description of the environment to be affected by the alternatives (40 CFR 1502.15) under the heading Affected Environment,
- a description of the changes that are reasonably foreseeable and have a reasonably close causal relationship to alternatives (40 CFR 1508.1(g)) under the heading Direct and Indirect Effects, and
- a description of the effects of the alternatives combined with the effects of reasonably foreseeable environmental trends and planned actions in the area (40 CFR 1502.15) under the heading Cumulative Effects.

It also addresses the interaction between the effects of proposed actions with the current environmental baseline, describing the effects that might be expected, how they would occur and the incremental effect that could result. The description of the current conditions inherently includes and represents the cumulative effects of past and current land management activities undertaken by the BLM, and other land management and regulatory entities.

Specialists originally reviewed RR for treatment based on TPA, RD, QMD, tree composition (species, age) and whether or not stands had been previously treated. The original treatment acres included stands 40-90 years old, specialists included these stands in individual analyses. In attempting to quantify RR thinning benefits related to stable wood development, FVS modeling was used. FVS modeling did not support thinning RR stands greater than 50-year classes, thus stands in the 60-year-old category and older were eliminated from further consideration. For this reason, acreage identified in sections 3.1 and Appendix A for the RR will have larger numbers then what is proposed in the chapter 2 of this EA. The IDT agreed that the difference in acreage did not affect their analysis, and all proposed acreage in the RR (Chapter 2) was within their analysis area.

3.1 Issues Analyzed

3.1.1 How would harvest operations within the HLB contribute to the achievement of Declared Allowable Sale Quantity?

Methodology and Assumptions

The BWE Analysis Area contains lands that are designated as HLB and includes specific objectives for timber production under the ROD/RMP. The Analysis Area contains 6,471 acres of HLB and is comprised of multiple age classes in different stand developmental phases. This presents BLM with an opportunity to conduct stand treatments and contribute to the Coos Bay Declared ASQ of 12 MMbf annually (USDI BLM, 2016b, p. 6).

BLM initially used the FOI to determine stand boundaries and stand age. Adjacent FOIs with similar stand attributes were combined into single EA units. Lidar data (2008) was used in the acquisition of the initial stand metrics for EA units. Stand metrics were later updated with stand-specific inventories (stand exams) and the data was used to model the proposed treatments using the FVS program. In preparing this analysis for the action alternatives, the BLM has made some analytical assumptions that provide the framework to the analysis of this issue below:

- The Coos Bay Sustained Yield Unit's ASQ would be 12 MMbf throughout the decade considered for this analysis.
- Approximately 70 percent of the Coos Bay SYU is in the Myrtlewood Field Office and 30 percent is in the Umpqua Field Office.
- The BLM would plan to offer timber analyzed in this EA under eight timber sales (within the HLB), in Fiscal Years (FY) 2021 through 2025.

The unit of measure used in this analysis for each alternative is volume of timber in board feet. Therefore, the measurement indicators in this analysis would be the percent of the Coos Bay SYU's ASQ harvest volume the BLM expects to produce through implementations of the BWE Project in 2021; and percent of the Coos Bay SYU's ASQ decadal harvest volume for fiscal years 2021-2025.

The regeneration harvest units are spread across seven sixth-field watersheds (117,222 acres) with Belieu Creek-Middle Fork Coquille River having the highest concentration of proposed treatment acres for both action alternatives (Alt. 2 is 289 acre and Alt. 3 is 413 acres, See Appendix H Table 49).

The temporal scale for determining effects for ASQ in HLB is immediately after the timber sale is offered. This scale is appropriate because ASQ volume attainment is calculated on volume offered regardless of sale or harvest.

Affected Environment

The HLB in the analysis area is made up of stands in various developmental phases and conditions. These stands are a direct product of past silvicultural practices and natural disturbances. Past silvicultural practices within the district's SYU directly affects the amount and rate of volume the SYU can produce towards the annual ASQ. Fully stocked mature Douglas-fir stands have the potential to produce a greater amount of ASQ per acre than a poorly stocked mature Douglas-fir and mixed conifer stand with a hardwood component. Some of these past timber harvest activities range from post-fire salvage harvest, opportunistic harvest (high grading) and conventional clearcutting of mature or old growth forests. Stands that regenerated following a natural disturbance (stand replacing fire) do not show signs (cut stumps, roads, skid trails) of past harvesting and have most likely developed in the absence of direct human interactions. Table 8 below shows current stand metrics from district stand exams (2020) for the proposed HLB treatment units.

Table 8. Current Vegetation Attributes for Proposed Units (All Tree Species) (2020 Stand Exam Data).

EA Unit	Alt 2 (ac)	Alt 3 (ac)	BH^2 Age	Basal Area (Ft^2/Ac.)	Trees per Acre	Quadratic Mean Dia. (In.)	Height (Ft.)	Volume (Mbf/Ac.)	Canopy Cover (Percent)	Relative Density (RD)
100	71	71	59	275	132	20	125	76	68%	61
102	81	114	47	227	175	16	99	43	71%	58
103	40	40	105	315	134	21	154	93	74%	69
104	56	85	61	255	179	17	124	63	78%	63
105	193	230	53	255	189	16	121	62	83%	64

EA Unit	Alt 2 (ac)	Alt 3 (ac)	BH[2] Age	Basal Area (Ft²/Ac.)	Trees per Acre	Quadratic Mean Dia. (In.)	Height (Ft.)	Volume (Mbf/Ac.)	Canopy Cover (Percent)	Relative Density (RD)
106[1]	12	12	34	253	249	14	137	57	84%	69
107	0	58	82	327	260	15	137	99	80%	84
108	0	30	68	294	193	17	130	78	81%	72
109	24	24	119	420	177	21	160	69	77%	92
110	9	9	106	307	123	21	150	91	81%	66
111	0	20	174	467	94	30	150	137	67%	85
Total[2]	486	693								

[1]Commercial Thinning Units – Shaded row indicates commercial thinning units and information derived from 2020 stand exams.
[2]Total acres do not reflect EA Unit 101. Stand exams were not completed for this unit (EA Unit 101 is 34 acres for both alternatives).

Douglas-fir (*Pseudotsuga menziesii*) is the predominant overstory tree species. Treatment units in the 50-80-year age classes may have remnant trees of an older age class but are not present in sufficient numbers to affect structural classification. For a complete list of plant association groups within the proposed harvest units see Appendix H Table 53 and Figure 10.

Environmental Effects

Alternative 1 - No Action

Direct and Indirect Effects: Selection of the No Action alternative would result in no volume harvested from the BWE project. Under the No Action Alternative, the BLM would forego the opportunity to contribute timber volume toward meeting the declared ASQ of 12 million board feet annually for FY 2021, 2024 and 2025. BLM could possibly meet the 12 MMbf ASQ target in FY 2021 from volume analyzed in the Catching EA (Foreseeable Future Action). Volume from Catching could cover the district ASQ commitments for FY 2021 and 2022 and a portion in 2023. There is currently no alternative volume available to cover FY 2024-2026, the BLM would need to start a new analysis in FY 2021 to have ASQ available for FY 2024 and FY 2025.

Cumulative Effects: The No Action alternative would not contribute volume to the Coos Bay SYU's annual or decadal ASQ target. Without Volume from BWE the district would still meet the annual ASQ requirement (Annual ASQ Variance: 12 MMbf +/- 40% = 7.2 to 16.8 MMbf) in FY 2021 with the BWE No Action alternative because Upper Rock Creek and Catching would produce 9.6 MMbf in FY 2021. As mentioned above BLM would need to start a new analysis immediately in 2021 for the reasons listed below:

- The process of physically installing a timber sale on the ground on the Coos Bay District is very labor-intensive requiring 6–7 months to complete, without allowing for uncertainties such as the severity of fire season, snow levels, and staffing shortfalls. Additionally, there is a 4-month period for appraisal, review, and advertisement resulting in 11 months from the start of field work to the timber sale date. FY 2021 timber sales would have to be initiated in FY 2020 to be available. FY 2024 timber sales would need to be initiated in FY 2023.

- Pre-disturbance surveys for spotted owl and marbled murrelet require a minimum of two years of surveys and would need to be completed. Potential harvest units surveyed beginning in 2021 would not be available until 2023 and therefore would not contribute ASQ volume in FY 2021.
- EAs for the projects listed in the 5-year Sale Plan usually need 18–24 months to complete. If initiated in FY 2021 these projects would not have timber volume available to count towards the districts ASQ till the fourth quarter of FY 2023 at the earliest.

The foreseeable action of Catching is estimated to have enough volume to be able to cover the Coos Bay District's SYU ASQ targets for FY 2021, 2022 and part of 2023. To reach the ASQ target of 120 MMbf per decade BLM would need to start analyzing in FY 2021 to have Volume ready for FY 2024-2028. Future timber sales would need to produce roughly 10.7 MMbf per year to meet the decadal target of 120 MMbf. This is within the decadal ASQ variation allowed (Decadal Variance: 120 MMbf +/- 20% = 96 to 144 MMbf).

<u>Alternative 2</u>

Direct and Indirect Effects: This action alternative would result in approximately 27 MMbf of timber offered for sale from the HLB. This net volume reflects the BA retention required for each sub land use allocation of LITA (15-30 percent BA/ac retention) and MITA (5-15 percent BA/ac retention) (USDI BLM, 2016b, pp. 62-63). There would be variations between modeled volumes and final volumes upon completion of stand layout, marking, and timber cruising.

In fiscal year 2021 the BWE project would contribute 25 percent (4 MMbf) of the Coos Bay SYU's ASQ and 100 percent of the Coos Bay SYU's ASQ in 2024 and 2025. Umpqua's Catching Project is expected to supply 100% of the ASQ volume in FYs 2022 and 2023. If the Catching project is delayed, then FYs 2024 and 2025 volume would be brought forward to cover FYs 2022 and 2023 ASQ targets.

Cumulative Effects: Implementation of this alternative combined with the 29.6 MMbf of ASQ volume already harvested would yield a total of 72 MMbf (47.5 percent of decadal ASQ) for the 5-year period from 2021-2025. <u>Table 9</u> illustrates that selection of Alternative 2 combined with past and planned future actions occurring in the decade would meet the yearly ASQ commitment and contribute 120.8 MMbf (within the 20 percent decadal variance) to the Coos Bay SYU decadal ASQ target.

<u>Alternative 3</u>

Direct and Indirect Effects: Alternative 3 differs from Alternative 2 in that it would contribute 10 MMbf more through regeneration harvests in HLB. This increase is due to 2.7 miles (12.3 acres) of New Construction (NC) roads allowing BLM to access an additional 207 acres of regeneration units in the HLB. Approximately 1.52 miles of NC roads would be decommissioned with the shortest segment length being 0.03 miles and the longest being 0.47 miles with an average segment length of 0.15 miles. Alternative 3 is expected to result in approximately 37 MMbf of timber offered for sale from the HLB.

In FY 2021 the BLM anticipates that the BWE project would contribute approximately 25 percent of the Coos Bay SYU's ASQ, 100 percent of the Coos Bay SYU's ASQ in 2024 and 2025 and approximately 65 percent of the annual ASQ in 2026. As stated above if the Catching project is delayed the BWE volume in FYs 2024-2026 would be shifted forward to cover FY's 2022 and 2023.

Cumulative Effects: Implementation of this alternative plus the 29.6 MMbf of ASQ volume already harvested and foreseeable future actions would yield a total of 96.8 MMbf (80.6 percent of decadal ASQ) for the 8-year period from 2019-2026. <u>Table 9</u> illustrates that selection of Alternative 3 combined with past (29.6 MMbf), foreseeable (30.2 MMbf), and future (33.6 MMbf) actions occurring in the decade would contribute 130.4 MMbf exceeding the Coos Bay SYU decadal ASQ target of 120 MMbf by 10.4 MMbf but is within the 20 percent decadal variation (96-144 MMbf). BLM would most likely move the 10.4 MMbf into FY 2029, the next decade and round out the first decade as close to 120 MMbf.

Cumulatively, if Alternatives 2 or 3 were selected, BWE together with the other foreseeable actions would produce approximately 48 and 56 percent of the SYU's declared decadal ASQ respectively (120 MMbf).

Table 9. Coos Bay SYU Decadal ASQ Commitments.

Fiscal Year	**Project Name**	**Offered ASQ in MMbf (Past Actions)**	**Planned ASQ[1,3] in MMbf (Current Actions)**			**Foreseeable Future Actions or 5-year sale Plan ASQ[2,3,] in MMbf**	**Balance of Decadal ASQ in MMbf**	**Total ASQ in MMbf**		
			No Action ALT. 1	**ALT. 2**	**ALT. 3**			**No Action ALT. 1**	**ALT. 2**	**ALT. 3**
2019-2020	Upper Rock Cr.	29.6						29.6	29.6	29.6
2021	Upper Rock Cr.	6.4						10.1	14.1	14.6
	Big Weekly Elk		0.0	4.0	4.5					
	Catching					3.7				
2022	Catching					12.3		12.3	12.3	12.3
2023	Catching					13.3		13.3	13.3	13.3
2024	Big Weekly Elk		0.0	11.6	12.8			0.0	11.6	12.8
2025	Big Weekly Elk		0.0	11.8	12.0			0.0	11.8	12.0
2026	Big Weekly Elk		0.0	0.0	7.7	0.9 [4]	3.4	4.3	0.0	7.7
2027-2028	Future Project (TBD)						33.6 [5]	33.6	27.3	17.7
Total		36.0	0.0	27.4	37.0	30.2	36.7	102.7	120.0	120.0

[1] iPlanned ASQ is volume that is currently being considered in a NEPA analysis and/or substantial work investment has been made.

[2] 5-year sale plan ASQ is volume that has been identified and is being considered but analysis has not been initiated.

[3] Voume needed to meet ASQ is slightly overestimated during the planning phase to avoid continually not meeting the 12 MMbf target due to unforeseen circumstances.

[4] Volume of 1.2 MMbf is from the Pacific Connector Gas Line.

[5] This represents the maximum ASQ amount that can be harvested over 2 years. Calculation: 12 MMbf * (12 MMbf * 40%) = 16.8 MMbf = 16.8 MMbf *2 yrs = 33.6 MMbf.

3.1.2 How would the proposed regeneration harvest change age-class distribution within the SYU Scale?

Methodology and Assumptions

Stand ages and boundaries for this project were initially derived from the FOI. BLM used Micro*Storms to validate stand age by reviewing the harvest and treatment histories of the proposed stands. Finally stand exams were performed for the proposed project units to further refine stand age and metrics.

This age class distribution indicator is specific to the HLB within the Coos Bay District SYU consisting of LITA and MITA, i.e., the LUA upon which the ASQ is based. For timber harvest to contribute changes in age class distribution, a reset of the stand age is required. This is accomplished through implementation of a regeneration harvest. Age class is defined as classes of ten-year increments, beginning with zero. An essential requirement to achieving Sustained Yield[9] and associated ASQ is the establishment of a regulated forest with an equal distribution of stand age and size classes so that over time, approximately equal periodic harvests of the desired size and quality are produced. Achievement of a regulated forest condition can take many decades to attain.

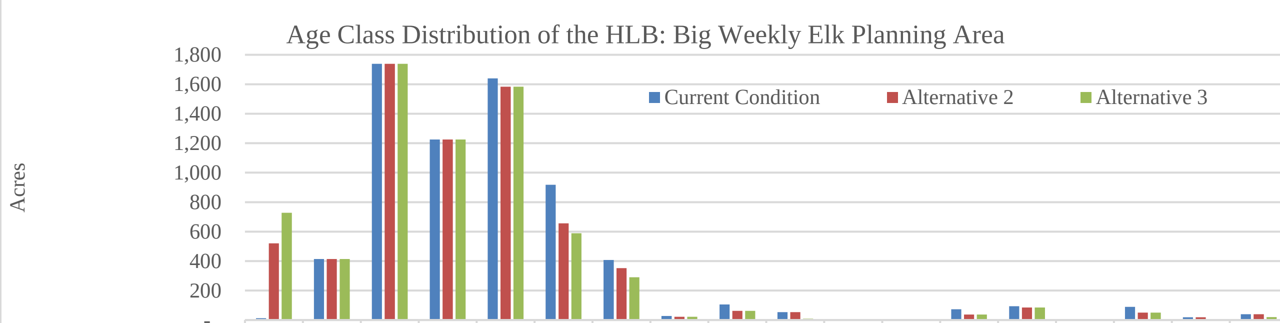
The temporal scale for determining effects for changes of age class distribution within the HLB is immediately after post-harvest and stand reestablishment.

Affected Environment

Early harvests and subsequent reforestation have directly contributed to the Project Area age class distribution for the HLB (Figure 2). Commercial thinning treatments occurred throughout much of the BWE over the past two decades which adjusted stand composition and density but did not modify stand age. Roughly 427 acres of regeneration harvest occurred on BLM lands in the Project Area 15-25 years ago contributing to the acres shown in the 0-20 age class in Figure 2**.** For past silvicultural treatment within the HLB analysis area see Affected Environment for Issue 1 (Section 3.1.1) above. Stand metrics of the proposed units analyzed for effects to age class distribution are listed in Table 8.

The action alternatives would change harvested areas from a tall, predominantly single-story canopy with occasional gaps and understory trees to a stand providing complex early-successional habitat with small patches of older forest in the form of aggregate retention, occasional legacy trees, large down wood, and dense cover by shrub and tree species. Aggregate retention patches within portions of the harvest area would ameliorate loss of structural diversity and structural legacies because the aggregates are designed and located to protect existing high-quality structures. The individual tree retention would add structural diversity in the regenerating stand.

Figure 2. Alternatives 1-3 Age Class Distribution in the BWE Analysis Area current and post-harvest.



	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	190+
Current Condition	13	414	1,739	1,225	1,640	918	408	28	106	54	-	-	73	94	-	90	19	40
Alternative 2	521	414	1,739	1,225	1,583	656	352	22	63	54	-	-	38	85	-	50	19	40
Alternative 3	728	414	1,739	1,225	1,583	589	290	22	63	9	-	-	38	85	-	50	6	20

Acres by 10-year Age Class

Environmental Effects

Alternative 1 - No Action

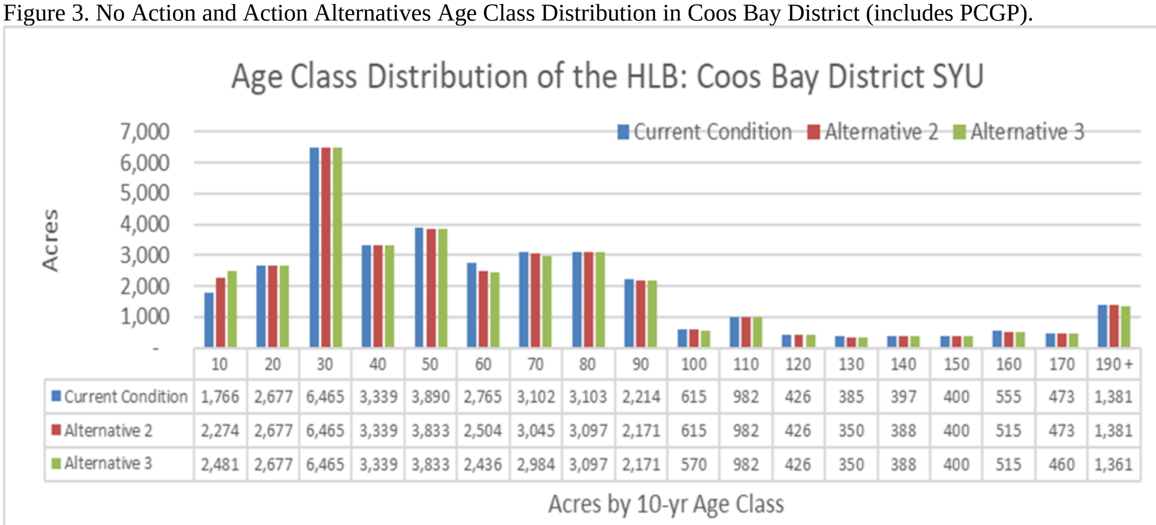
Direct and Indirect Effects: There would be no direct effects to the age class distribution at the SYU scale (Figure 2) from the No Action alternative. As discussed in Issue 1 and shown in Table 9. *Cumulative*

[9] Sustained Yield – The board foot volume of timber that a forest can produce in perpetuity at a given intensity of management, the achievement and maintenance in perpetuity of a high-level annual or regular periodic output of the various renewable resources.

Effects: The cumulative effects spatial scale for this issue is the Coos Bay District SYU and the temporal scale is the time that these foreseeable actions will take place. There are approximately 849 acres of potential regeneration harvest units being considered in the HLB in a timber harvest plan along with the reasonably foreseeable Pacific Connector Gas Line (PCGL) Right of Way within the next 5 years. Projects that are developed or are proposed include Upper Rock Creek, Catching Project, and PCGP. Proposed regeneration activities are assumed to be similar in application and effects as those proposed in the Big Weekly Elk analysis. Coos Bay BLM foreseeable action Catching Project planned in FY 2022 and 2023 would change the current age class distribution. After FY 2023 BLM does not have any foreseeable actions that would change the age class distribution in the SYU other than BWE EA. Any regeneration harvest treatments would change the age class distribution.

With the selection of the No Action alternative this analysis assumes that the Coos Bay BLM would continue to meet its ASQ obligations declared in the RMP under separate analysis. The PCGP would still change 36 acres of HLB on Coos Bay District from various age classes to the 0-10 age class (Figure 3). The proposed permanent easement contains 13 acres. These acres would be removed from the HLB. Twenty-three acres of the PCGP are considered temporary clearing areas. After work completion when these areas are no longer needed, they would be planted and maintained as a functioning part of the HLB with expected future harvest.

Figure 3. No Action and Action Alternatives Age Class Distribution in Coos Bay District (includes PCGP).



	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	190+
Current Condition	1,766	2,677	6,465	3,339	3,890	2,765	3,102	3,103	2,214	615	982	426	385	397	400	555	473	1,381
Alternative 2	2,274	2,677	6,465	3,339	3,833	2,504	3,045	3,097	2,171	615	982	426	350	388	400	515	473	1,381
Alternative 3	2,481	2,677	6,465	3,339	3,833	2,436	2,984	3,097	2,171	570	982	426	350	388	400	515	460	1,361

<u>Alternative 2</u>

Direct and Indirect Effects: Alternative 2 would increase the number of acres in the 10-year age class by 508 acres (29 percent change) in the HLB on the Coos Bay District SYU (Table 50). Regeneration harvest from the 50-90, 130, 140, and 160-year age classes would decrease these age classes by an average of 4.2 percent. There would be no change to the age classes 20-40, 100-110, 150 or 170+. Most of the regeneration harvest comes from age classes 50-70 which represents about 28 percent of the of HLB acres in the SYU pre- and post-harvest.

Cumulative Effects: The cumulative effects spatial scale for this issue is the Coos Bay District SYU. There are approximately 849 acres of potential regeneration harvest units being considered in the HLB in a timber harvest plan within the next five years. Projects that are developed or are proposed include Upper Rock Creek, Catching Project, and PCGP. Proposed regeneration activities are assumed to be similar in application and effects as those proposed in the BWE analysis. Any regeneration harvest treatments would change the age class distribution. Alternative 2 when added to the effects of other timber harvest activities, would have a cumulative effect by adding 508 acres of regeneration harvest towards changes in age class distribution across the Coos Bay District SYU. Therefore, moving more acres from older age classes to younger age classes.

Alternative 3

Direct and Indirect Effects: Alternative 3 would result in 208 more acres than alternative 2 converted to the 10-year age class because of regeneration harvest in the HLB. The changes in distribution at the SYU Level are listed in Table 51. Approximately 84 percent of the increase in acres comes from the 60, 70, and 100-year age class with the remaining increase coming from the 170 and 190+ age classes. The effects of Alternative 3 are like Alternative 2 at the SYU scale when comparing the decrease in age classes regenerated (< 1 percent difference between action alternatives). Outside of the affected age classes (50-100, 130, 140, 170, and 190+) there is no difference between Alternative 2 and Alternative 3.

Cumulative Effects: The cumulative effects spatial scale for this issue is the Coos Bay District SYU. There are approximately 849 acres of potential regeneration harvest units being considered in the HLB in a timber harvest plan within the next five years. Projects that are developed or are proposed include Upper Rock Creek, Catching Project, and PCGP. Proposed regeneration activities are assumed to be similar in application and effects as those proposed in the BWE analysis. Any regeneration harvest treatments would change the age class distribution. Alternative 3 would add 715 acres of regeneration harvests to the 849 acres for a total 1,564 acres in the current five-year sale plan. This would increase the SYU decadal regeneration harvest acres to 2,321 acres therefore moving acres in older age classes to younger age classes.

3.1.3 How would commercial thinning affect stand merchantability and value of the 12 overstocked acres?

Methodology and Assumptions

The ROD/RMP provides Management Direction to conduct commercial thinning to adjust stand composition, reduce stand susceptibility to disturbance, and improve stand merchantability and value ROD/RMP (USDI BLM, 2016b, p. 60). For stands to be considered for thinning, Coos Bay District established it would need to have at least 180 sq. ft. of BA/acre and a RD of 50 or higher. Relative density "expresses the actual density of trees in a stand relative to the theoretical maximum density (RD100) possible for trees of that size" (Hayes, 1997).

The spatial scale used for this analysis is the 12 acres mentioned in this issue statement (issue statement 3.1.1). The units of measure used in this analysis for each alternative is RD, dbh or diameter growth, volume per tree and volume per tree in trees ≥ 20 inches dbh. These measurements would help to define stand vigor, merchantability, and value. RD is a measurement used to estimate when a stand reached a density where diameter growth begins to decline, and suppression mortality increases. When Douglas-fir stands grow to a relative density of about 55% of maximum, mortality of smaller trees is likely to occur from inter-tree competition (Drew and Flewelling 1979). An assumption is made that with all other stand metrics being assumed equal, a stand that has larger diameter trees and/or a greater volume per tree is more desirable therefore is more merchantable. Stand value is measured using the amount of volume/tree of trees over 20" dbh in a stand. A 20" dbh tree was used for comparison because trees of this diameter and greater are likely to develop into higher grade logs between now and final harvest.

The temporal scale for determining effects for changes in stand vigor, merchantability and value following a thinning within the HLB is 50 years after post-harvest. This scale is appropriate because trees do not immediately respond after a thinning. Field observations by BLM foresters over time show that after 20 years, thinned stands are fully utilizing the site resources made available after the thinning and the effects become apparent through larger tree diameter and crown. These observations are supported by FVS growth model. Fifty years was chosen to compare the effects of a longer rotation.

Affected Environment

The treatment unit proposed for commercial thinning is on the Coos Bay Wagon Road lands which have been managed for timber production. BLM normally schedule commercial thinning harvests to avoid stem mortality caused by overcrowding and to capture volume that would otherwise be lost. The unit proposed for commercial thinning in Alternative 2 or 3 has not been previously pre-commercially or commercially thinned by the 294 trees per acre (RD 69) shown in Table 52. District records show that the proposed unit has been planted and had some stand maintenance (manual brush release) performed.

Environmental Effects

Alternative 1 - No Action

Direct and Indirect Effects: Under the No Action Alternative, no trees would be harvested so the stand would continue to remain overstocked, and trees would continue to grow, but tree and stand vigor would decrease with age due to overcrowding. The overcrowded condition eventually would lead to a random suppression mortality (stem exclusion phase) of smaller less vigorous trees. The mortality would free up growing space that would release the surviving stems from the intense competition allowing them to put on diameter growth as well as height growth. Table 10 shows how the No Action would affect the merchantability and value of the stand. As shown, the average diameter, bd. ft. (board feet)/tree, and bd. ft./tree for trees over 20" would all increase over the 50-year period.

FVS modeling from 2020 through 2040 shows mortality could affect over 74 TPA and 10,251 bd. ft./acre (Figure 9) across the proposed unit. There would be no revenue generated from this mortality. Few large trees die because of competition (Peet; Christensen 1987). With dominant (large) trees utilizing most of the finite resources, mortality would be linked to insects, disease, mechanical or weather-related injury or physical disturbance.

Table 10. Change in Diameter and Volume (bdft/tree) at 20 and 50 Years.

No Action	2020	+ 20 years	+ 20-year Difference	Percent Difference	+ 50 years	+50-year Difference	Percent Difference
	No Action						
Average Dbh (inches	13.1	18.3	5.2	40%	23.9	10.8	82%
Volume (Bdft/tree)	183	459	276	151%	1,254	1,071	585%
Volume/tree over 20 inches	855	976	120	14%	1,261	406	47%
	Alternative 2 and 3 Treatment (BA 110)						
Average Dbh (inches	13.1	21.7	8.6	66%	28.1	15	115%
Volume (Bdft/tree)	183	767	584	319%	1,605	1422	777%
Volume/tree over 20 inches	855	1,049	194	23%	1,893	1,038	121%

Alternative 2 and Alternative 3

Direct and Indirect Effects: Alternative 2 and 3 would thin 12 acres in the unit 106 (Table 8) to reduce the average RD of the stands from 71 (mortality zone) to 27 (optimal growth) percent. This thinning would also increase the average stem diameter by three inches over the No Action Alternative in 20 years, and 4-1/2" in 50 years (Table 11). However, because thinning from below allows the best trees to remain as crop trees, the diameter increase described above would occur on trees already showing superior traits, such as greater height and diameter, better crown development and an increase in growth potential. This increase in diameter results in an estimated 73 bf/tree increase in trees over 20" dbh than the no action in 20 years and 632 bf/tree in 50 years (Table 10). This is important because future growth (post-harvest) is being captured in trees that are comprised of higher grade saw logs, therefore a higher value than the trees harvested which are comprised of understory and some codominant trees that produce a lower grade of saw log harvested. A 20-inch minimum diameter was used for comparison because FVS modeling shows a greater response in volume per tree in trees ≥ 20-inches dbh after thinning than if the stand is left alone and grown (No Action). Thinning would increase the volume/tree in trees ≥ 20-inches dbh nine percent more than the no action after 20-years post-harvest and 74 percent more than the no action after 50-years post-harvest (Table 10). This increase in volume per tree would increase the marketability of the stand at final harvest and therefore increase the future merchantability and value. This increase in bd. ft./tree, coupled with fewer TPA and having an existing logging system in place (from thinning) would decrease the logging cost per acre and add to the increase in stand marketability.

Table 11. Proposed Action Thinning Pre-thinning, Post-thinning, and 20 Years Post-thinning.

	Avg. Age	BA (ft^2/ acre)	TPA[1]	QMD[1] (in.)	Height (feet)	Vol. Harvested Mbf/Ac.	Canopy Cover (%)	RD[1]	Tree Spacing	Total Standing Vol./Ac.
Current (2020)	41	258	277	13	122	NA	71	71	13'x13'	50,797
Post-Thin	41	123	56	20.1	122	19,774	28	27	27'x27'	31,023
NA + 20 yrs.	61	322	177	18.3	149	NA	72	75	16'x16'	81,242
PA[2] + 20 yrs.	61	183	71	21.7	149	NA	39	39	25'x25'	54,512

[1]TPA= trees per acre, BA = basal area, QMD = quadratic mean diameter, RD = residual density, Mbf = thousand board feet.
[2] PA=proposed action (Alt. 2 and 3)
* FVS prescription was thin to a BA of 110 ft^2 to reflect a result closest to an RD of 30.

Thinning would allow the BLM to capture volume that would have been lost in the stem exclusion phase (2020-2040) of stand development. Figure 9 shows that the stand would experience a high amount of mortality in the smaller diameter classes (8-18 inches) with Alternative 1. Alternatives 2 and 3 would thin from below hence removing the smaller diameter classes and freeing up resources for overstory trees. In volume terms this equals 8,832 bd. ft./ac that would be captured and applied towards the Coos Bay District's annual ASQ target.

Management direction from the ROD/RMP requires leaving untreated areas (skips) and group selection openings in 5-10 percent of the planned harvest unit and create one snag/acre greater than 20" dbh (USDI BLM, 2016b, pp. 60-61).

Cumulative Effects – For both action alternatives there is no past, present and reasonably foreseeable actions located within the analysis area that would incrementally affect stand merchantability and value of the 12 overstocked acres discussed in this section over the period of time outlined in the direct and indirect effects section above.

Silviculture

3.1.4 How would the proposed harvest actions effect forest stand development in the LSR and RR, would the desired habitat values described for the LSR in Table 3 develop as a result?

Methodology and Assumptions

The BLM conducted project area reconnaissance, stand exams, and multiple GIS datasets including US Forest Service Region 6 insect and disease aerial surveys, aerial photos, Coos Bay District FOI and BLM Micro*Storms (activity tracking databases), South Coast Light Detection and Ranging (LiDAR) data products, as well as the analyses, direction and conclusions found in the ROD/RMP and the supporting PRMP/FEIS. Stand trajectories were modeled using the FVS, the Pacific Northwest FVS variant was used over a 60-year time horizon starting to model anticipated treatment outcomes. Stand exams were performed in 2019.

The spatial extent for the silviculture direct and indirect effects analysis to forested vegetation is the treatment area proposed in the RR and LSR of this project. The cumulative effects are described by the past actions in the proposed treatment units which have resulted in the current condition of these stands, as well as the reasonably foreseeable actions in these stands. The timeframe considered for short-term direct and indirect impacts to stand structure, composition, forest health risk, and appearance is the time needed to complete the proposed silvicultural treatments, approximately three to ten years. The timeframe for long-term direct and indirect impacts to forested vegetation is 60 years to better model long term growth and change in species composition at 20-year intervals.

The stands within LSR and RR were identified using forest principles described in the Silviculture Report, hereby incorporated reference (pp. 9-10), and stratified by FOI, first sorting by age class, and then populated with LiDAR derived stand metrics from the South Coast lidar acquisition (BA, QMD, Lorey's Stand Height, and TPA). When the stands were grouped by age class, they displayed a normal distribution in these four metrics. BLM foresters then sampled a subset of these that represented the range of conditions within each age class using common stand exam methods in 2019. The stand exams were then modelled using the FVS Pacific Northwest Variant defaults, thinning to 20, 30 and 40 RD as well as a "No Action" over a 60-year period to analyze the difference between these thinning intensities. The results were summarized into the Tables 55-57 (Appendix H) that show the 40, 50, 60, and 70 - 90-year-old age classes under a heavier thinning intensity (20-30 RD), and a lighter thinning intensity (30-40 RD). BLM wildlife and fisheries biologists provided descriptions of desired stand conditions, and these were then pulled out of the multi-stand reports for review and analysis at 20-year intervals. Stand metrics (BA, QMD, RD, Canopy Cover), as well as number of mid-story conifers from 21-32" dbh, number of overstory conifers greater than 32" dbh indicated desired conditions for spotted owl nesting habitat (refer to Table 3 in Chapter 1 of this EA), while total volume of wood (Cubic Feet) in trees over 20" dbh and over 30" dbh are the desired attributes for the Outer Riparian Zones for stream functions. The ROD/RMP requires the creation of 10 snags/acre on the Coos Bay District when thinning in the LSR (USDI BLM, 2016b, pp. 66-67). This snag creation was not modelled in this analysis; however, because snag creation is a form of density reduction, the Light Thinning prescription allowed for an upper limit RD of 40 to accommodate this density reduction through snag creation post-harvest.

Affected Environment

The BWE planning area is located on the western side of the Middle and East Fork Coquille River HUC 5 watersheds totaling about 69,635 acres, of which approximately 43% is managed by the BLM. As shown on Figure 10 and Table 53, these forests are made up primarily of the Western hemlock, Douglas fir, Tanoak/Douglas fir and True fir plant association groups (PAGs) that can support diverse stand compositions of conifers such as Douglas fir, western hemlock, Port-Orford cedar, grand fir Pacific yew and western redcedar, as well as hardwood species such as red alder, tanoak, golden chinquapin California-laurel/myrtlewood, Pacific madrone, and big-leaf maple. These PAGs have the potential to exhibit a wide variety of conditions, differing by slope, aspect, elevation, and soil transitions as shown in Table 53 and Figure 10 however stands proposed for management have had this variability reduced through past harvest practices described below.

As shown in Table 54, approximately 40% of all the BLM lands contained in the BWE planning area have undergone some form of clearcut or regeneration harvest which has been the most common silvicultural management approach. This was primarily implemented in the 1970s and 1980s and declined following implementation of the Northwest Forest Plan in the 1990s. About a quarter of the plantations on BLM land in the planning area that resulted from these harvest practices have been thinned since the year 2000. Structural and tree species diversity has decreased due to forest management practices that emphasize high yield Douglas fir timber production over late-successional habitat values. Dispersed areas of structurally diverse older forest exist on federal lands that were reserved from previous harvest schedules.

Densely stocked stands such as those proposed for thinning in the LSR of the BWE project area do not exhibit the characteristics of stands in later stages of stand development (Oliver C. D., 1980) such as understory reinitiation, nor the maturation, or the vertical diversification stage of structural development as described by Franklin et al. (2002). For the later stages of stand development to occur, closed canopy conditions undergo disturbance such as insects and disease mortality, fire, windthrow or harvest, which allows accelerated diameter growth of residual trees and canopy layering through understory tree re-establishment. Maturation is typified by a shift from density dependent to density independent overstory tree mortality (Franklin, et al., 2002). Douglas-fir trees complete most of their growth in height and crown spread during the maturation stage, and at 100 years have typically achieved only 60–65% of their eventual height (Franklin, et al., 2002). The characteristics of vertical diversification would include increased tree height diversity, presence of large shade-tolerant trees, deciduous shrub layer, large snags, and large down woody material. Figure 11 offers a general characterization of structural development stages in relation to stand age. This will be discussed in more detail below.

Environmental Effects

Alternative 1-No Action

Direct/Indirect and Cumulative Effects: The cumulative effect of past management practices including timber harvest and fire suppression at the project boundary, BLM administered, and proposed treatment unit scales is a continuation of closed canopy and simplified stand conditions. Overall stand growth would remain stagnant as stands would be left in overly dense conditions, and because trees growing in dense conditions grow in height, but very little in diameter, stand stability would decline (Oliver and Larson 1996, pg. 75, Tappeiner et al. 2007, p.124). As a result of the limited resources for tree growth in the stands, diameter growth would lag behind height growth (O'Hara, 2014, p. 100), and the risk for windthrow would increase over time as height to diameter ratios continue to increase and crown ratios decrease. Alternative 1 ensures the direct and indirect effect of declining individual tree and stand vigor because if a stand can grow for many years within the zone of imminent competition mortality, mortality will occur (Drew & Flewelling, 1979). In dense stands, large trees are unlikely to persist or develop and a stagnant stand is unlikely to develop large diameter snags or down wood. The No Action Alternative would prevent stands from attaining vigorous conifer growth because all stands proposed for management are already within the zone of competition mortality. Forest floors would continue accumulating fuel as trees continue to self-prune. Current densities threaten the persistence of species composition indirectly by the effects of competition induced mortality.

Young stand management in the planning area, such as tree planting, brush cutting, pre-commercial thinning, plantation maintenance and protection treatments would continue. Reduced biological and structural diversity is expected in private industrial forestland which can continue long-term if planted with single crop tree species. Forest operations on private land were anticipated in the development of the ROD/RMP, the landscape planning of the project itself. Fire suppression activities would continue on Federal and non-Federally administered lands in accordance with the fire protection contract the BLM holds with the Oregon Department of Forestry (ODF).

In summary, the No Action Alternative would result in a continuation of the existing stand development trajectory that consists of increasingly unstable tree form, reduced tree species diversity, and mid-seral, closed canopy conditions. The current trajectory does not promote the development of complex, multi-cohort stands and open grown trees, nor would it increase or maintain vegetative species diversity or create growing space for hardwood persistence and regeneration (ROD/RMP 2016).

Alternative 2 and 3

Direct/Indirect and Cumulative Effects: The prescription elements in the LSR do not vary between Alternatives 2 and 3, only the total amount of treated acres; therefore, they are discussed together and compared to the No Action alternative. The primary difference between Alternative 2 and 3 are the number of available acres for habitat development due to increased access from new road construction. After several FVS modelling efforts and field review, the desired future conditions would be achieved through thinning from below at variable densities with group selection in younger stands (age 40-50). Because these stands are comprised of a single cohort of trees, smaller trees in the stands tend to be suppressed stems rather than new recruitment. This was not always the case in the 60-90 years old stands, which occasionally displayed hardwood recruitment and small inclusions of younger trees. As a result, the FVS model was altered to selection/free thinning with group selection while retaining the largest trees in the stands in order to preserve and promote these components. The full range of allowable RD have been modelled for all proposed stand age groups with the resulting stand composition and structure at 20-year intervals over 60 years in Tables 55-57 (Appendix H). Individual units have been assigned to a “Light Thinning” (target RD of 30-40) or “Heavy Thinning” (target RD of 20-30) density target as shown on Table 4.

The modelled results, found in Table 59 (Appendix H), show that thinning these stands as early as possible is the best way to achieve the desired stand conditions over time (refer to Table 3 in Chapter 1). These sampled stands are already within the zone of competition mortality. When an even-aged stand grows for many years within this zone of imminent competition mortality, mortality will occur and individual tree growth is reduced compared to the growth rates found in open growing conditions (Drew and Flewelling 1979, Tappeiner et al. 2007). Trees growing in such dense conditions will continue to grow in height, but little in diameter and the risk for windthrow will increase over time as height to diameter ratios continue to increase, and crown ratios decrease. (Oliver and Larson 1996, O’Hara, 2014).

In general, the stands from 40-50 years old better achieve the stand characteristics described Table 3. under the "Heavy Thinning” prescription than did the older stands within the analysis area. Older stands that have not previously undergone a thinning responded better to a "Light Thinning” because they have already grown in overly dense conditions for several decades. For example, 40- and 50-year-old stands attain many of the key structural characteristics of nesting habitat by age 80-90 when a “Heavy Thin” is applied now. The heavy thinning with group selections allowed the stand to differentiate into multi-layered canopies and recruit new cohorts of trees, whereas the no-action retains an even aged, single story structure and dense canopies that restrict seedling recruitment. Thinning in the outer zone of the RR also increases the size of individual trees, and the greatest benefit is observed when stands are thinned earlier than later. For example, 20 years after thinning a 40-year-old stand, outer zones attain approximately 6800 cubic feet of wood in trees greater than 20” dbh compared to 6200 cubic feet under No Action, and over time a greater proportion is coming from trees over 30” dbh when thinning has occurred.

In summary the direct and indirect effects of active management as described in Alternatives 2 and 3 are:

- A reduction in stand densities that promote growth and vigor; living vegetation must expand in size and a tree cannot grow larger unless its growing space is increased; residual trees are expected to increase in diameter growth, including the diameter of the largest trees (Oliver and Larson 1996, Tappeiner et al. 2007).
- Tree species diversity would be increased, ensuring that RMP species diversity goals would be met (USDI BLM, 2016b, p. 66) when compared to the No Action. This diversity in tree species and sizes is important for ecosystem function (Franklin, et al., 2002).
- A short-term increase of fine fuels deposited on the forest floor could result in an immediate and short-term increase in fire hazard until activity fuels are treated. Activity fuels treatments are proposed that would reduce this immediate deposition of fuels as described in the Fuels Section of Issues not Analyzed in Detail (Appendix A), PDFs and BMPs (Appendix B), and the Fire and Fuels Specialist Report incorporated here by reference.
- Risk of windthrow would be increased in the short term when opening a stand, however windthrow occurs in both managed and unmanaged stands and low levels of windthrow may be desirable for wildlife habitat and stand complexity. Silvicultural prescriptions proposed are designed to remove trees that are most susceptible, such as those with low vigor, poor crown ratios and those with high height to diameter ratios. Often 80:1 is used as a threshold, for example a 12” DBH tree at 85’ tall is more likely to fall over than a 12” DBH tree at 55’ tall (Worthington and Staebler, 1962, p. 21, Moore et al. 2003, Wonn and O’Hara, Tappeiner et al. 2007, pp. 129-130, O’Hara, 2014). This is important because trees allocate resources to height growth before diameter growth, so in the absence of disturbance (harvest, fire, etc.) resources become limited in a stand and the risk for windthrow increases as stability decreases (O'Hara, 2014, p. 100).
- Selection of Alternative 2 would allow for 2,489 acres of previously managed overly dense stands to attain many of the essential habitat features for spotted owl nesting habitat within 40 to 60 years. Selection of Alternative 3 would allow for 2,490 acres of these stands to attain these habitat features within 40 to 60 years.

Hydrology/Fisheries

3.1.5 How would commercial and non-commercial thinning activities in the Riparian Reserve provide trees that would function as stable in-stream wood?

Methodology and Assumptions

The Analysis Area includes the following 6th field sub-watersheds:

- Yankee Run – East Fork (EF) Coquille River
- Elk Creek – EF Coquille River
- Big Creek – Middle Fork (MF) Coquille River
- Indian Creek – MF Coquille River
- Belieu Creek – MF Coquille River

Approximately 17 unit acres (King Salmon, Unit 109) are in Dement Creek (South Fork Coquille River) and approximately 6 unit acres are in Myrtle Creek (MF Coquille River). These acres are included in the Effects Analysis, but the entire 6th fields are not included. The unit(s) are located on ridgetop areas away from streams and including the 6th fields would have skewed the Analysis Area in a fashion that did not accurately reflect quantities and magnitude of effects.

Based on the MFO Fish Biologist Resource Report (pp. 3-8), hereby incorporated by reference, a GIS-based analysis was conducted by the Coos Bay District Office Silviculture Program Manager with the assistance of the MFO fish biologist and reviewed by BWE IDT. Untreated (not previously thinned) riparian areas were identified based on information collected by foresters during previous EAs, LiDAR information, and timber stand examinations. RD and QMD metrics were generated for the RR adjacent to sale units within the Analysis Area. Based on modeling, mean slope percentage ranges from 18.5% to 68% across all planned units making it highly likely that outer zone RR trees would contribute stable wood to streams, once they grow tall enough to reach the streams. Stable wood would also be contributed from beyond SPTH through natural processes such as landslides and debris flow. Transient pieces, such as limbs, would also be contributed to streams within the project area. RD and QMD model data tell managers if trees in the middle and outer zones of the RR are competing for resources, they would benefit from thinning. RDs over 45% indicate that trees are competing, and as a result, potential diameter growth is reduced. QMD indicates tree diameter of outer RR, and if those areas are largely comprised of trees less than 20" DBH, thinning would accelerate diameter growth as expressed through total volume when compared to the No Action Alternative. This is true of 40- and 50-year-old stands, which make up a vast majority of the proposed units. For example, in 40-year-old stands, FVS modeling indicates that total volume of trees over 20" DBH increases at every increment measured. Additionally, modeling concludes that total volume of trees greater than 30" DBH (stable wood in larger streams) increases and accounts for 55% of total outer zone RR volume compared to 37% of total outer zone RR volume in untreated stands 60 years post-treatment. In older RR outer zones with high RD and low QMD, a less intensive thinning regime (to 40 RD) would still yield benefits in the aspect of accelerating growth of larger trees and placing RR on a trajectory that more closely mimics pre-disturbance conditions by promoting multi-layer canopies, aiding the development of multiple age classes, and improving species diversity. The Lead Forester, District Silviculturists, Wildlife and Fish Biologists were then able to place RR into prescription categories based on stand age and RD. For a summary of prescriptions for each RR, please see Chapter 2 for more details. For a summary of FVS modeling runs for RRs based on stand age, projected at 20, 40 and 60-year intervals and compared to a No Action Alternative, please see Table 59.

Figure 15 provides a decision tree rationale for which RR were selected for outer zone thinning (120'-SPTH).

Affected Environment

Past management practices have resulted in the conversion of RR forests from stands with large diameter trees that are structurally complex (i.e., different age classes and species composition) to young high density stands composed of small diameter trees. Young, dense riparian stands have a large amount of small diameter trees which limit the ability of these stands to provide functional wood to streams (USDI BLM, 2016c, p. 285).

Past timber harvest practices near streams have caused a loss of in-stream large wood and a diminished recruitment of future large wood. The lack of large wood and disassociation from the floodplain has caused increased stream velocities to continually scour stream channels and remove substrate during high flows. Reeves et al. (2016) suggest that wood from headwater streams influences debris flows and landslides, and the response of the stream network to such events. Wood from headwater streams positively affects stream morphology in several ways, including sediment retention/sorting, promoting floodplain connection and as a stimulant to aquatic foodwebs. Lancaster et al. (2003) found that large wood in debris flows factors in the run-out length of episodic disturbance events through the dissipation of energy and reduced velocity due to wood presence. Large wood serves an important role in creating and maintaining stable and functional stream channels, reducing stream energy, retaining stream sediments, maintaining lower width/depth rations, and allowing floodplain development. A stable stream channel is one that maintains its pattern, profile, and dimension over time and neither aggrades nor degrades. The interaction of large wood with streams is essential for creating juvenile and adult fish habitat.

Stream habitat inventories are available for some streams in the analysis area. ODFW completed habitat surveys on portions of EF Coquille River (2000), MF Coquille River (2000, 2009), Elk Creek (2004, 2016), Elk Creek tributaries (2014, 2017, 2018), Yankee Run (2014), and Weekly Creek (2016). Habitat surveys indicate that several streams in the analysis area are classified as undesirable, or less than desirable, for large wood categories (pieces, total volume, key pieces). The MF Coquille River habitat surveys rated as undesirable for percent gravel and had a large percentage (29%) of actively eroding stream banks. Habitat conditions were determined by comparing stream conditions to the ODFW Aquatic Habitat Benchmarks for Western Oregon (Moore 1997). For a detailed description of aquatic habitat in the analysis area, refer to the East Fork Coquille Watershed Analysis (USDI 2000) and the Watershed Analysis of the Middle Fork Coquille Analytical Watershed (USDI 2007).

Timber harvest occurs primarily in the middle and upper portions of the EF and MF Coquille River 5th field watersheds. Grazing, rural residential development, and other agricultural uses are dominant in the lower portion of the EF and MF Coquille River watersheds. Approximately 68 percent of the MF Coquille River watershed is in private ownership (USDI 2007), while approximately 47 percent of the EF Coquille River watershed is privately owned (USDI 2000). Present actions on private land in the Middle and East Fork Coquille 5th fields that have direct and indirect effects to fish habitat include road construction and timber harvest (and associated activities).

<u>Environmental Effects</u>

<u>Alternative 1 - No Action</u>

Direct and Indirect Effects: The RR would continue successional processes and would continue to provide shade, nutrient input, and an altered regime of future large wood recruitment under the no action alternative.

Greater mortality rates from suppression mortality in early-seral stands would produce small dead trees and hence smaller pieces of large woody debris. Bragg *et al*. (2000) point out that "Turnover rates for small pieces are likely to be rapid in all but the smallest flows, while larger pieces can persist for extended periods even in large rivers. Therefore, a stream with many small pieces is less structurally productive because of debris instability, while a stream with a few large pieces will have a value proportionate to the abundance of LWD." While smaller wood can be functional in stream channels (i.e., sediment capture, nutrient storage, and macroinvertebrate habitat), it is more susceptible to displacement downstream during high flows and it is less resistant to decay than larger wood (Harmon et al. 1986, Spence et al. 1996). McHenry *et al*. (1998) found that piece movement increased when large wood is composed of small diameter pieces recruited from young riparian forests. The smaller wood recruited to stream channels under the no action alternative would not be as effective as larger wood at trapping gravel and small debris, storing sediment and nutrients, or pool formation for fish habitat.

While suppression mortality would eventually release conifers for growth, the recruitment of large diameter logs to stream channels would remain deficient for a longer time if left untreated FVS modeling shows that treated stands respond at the 20, 40 and 60-year time intervals analyzed. See Appendix H for details regarding the No Action Alternative. Wood recruitment to stream channels would remain at its current level until trees in riparian stands grow to larger sizes and eventually fall into stream channels. Instream wood improves fish habitat by providing cover from predators, scouring out pools, providing pool cover, slowing water velocities, retaining spawning gravels, and providing nutrients for macroinvertebrates; however, the no action alternative would delay the beneficial habitat characteristics.

Cumulative Effects: The Table 61 provides a breakdown of past, present, and reasonably foreseeable future actions within the analysis area.

Alternative 2

Direct and Indirect Effects: Without new road construction, BLM would be able to reach less Riparian Reserves eligible for thinning and would be able to treat fewer acres. Four units (Units 17, 28, 31, and 32) would be changed under Alternative 2, and the overall reduction in commercial thinning would be approximately 13 acres, or a 4% reduction when compared to Alternative 3. Conversely, non-commercial Riparian Reserve outer zone thinning would be increased by approximately 6 acres in Alternative 2 vs. Alternative 3, largely because new road construction would allow commercial access to more outer riparian zones. Middle zone thinning would be slightly changed (approx. 15.2 acres less under Alt 2) between alternatives, and inner zone tree tipping acreage would be unchanged. Under Alternative 2, riparian treatment is proposed in approximately 18.8% of RR units managed by the BLM in the Analysis Area, while under Alternative 3, riparian treatment is proposed in 19.5% of RR units. The current average trees per acre (TPA) across all stand types in RRs selected for treatment ranges from 113 to 243. Following commercial and non-commercial treatment in RRs in selected units, the average RD across all stand types would range from 20 to 40. The average post vegetation treatment tree height in RRs would remain unchanged. Please see Appendix C for a synopsis of thinning type (commercial vs. non-commercial) by unit for Alternative 2.

Alternative 3

Direct and Indirect Effects: In Alternative 3, RR timber harvest consists of approx. 313 acres of outer zone commercial thinning which is approx. 10 percent of RR managed by the BLM in the analysis area. Pre-thin conditions in RR indicate that areas selected for treatment are RD >45 and QMD <20” DBH; post-thinning, the RR would range from 25-35 (±5) RD, which would allow for trees to grow bigger, faster to later contribute to streams as stable wood. Outer zone thinning would contribute to the conservation and recovery of ESA-listed fish species and their habitats and provide for the conservation of Bureau Special Status fish and other Bureau Special Status riparian-associated species. Outer zones would be thinned to ensure that stands are able to provide trees that would function as stable wood in streams. This would help to maintain and restore natural channel dynamics, processes, and the proper functioning condition of riparian areas, stream channels and wetlands by providing sediment filtering, wood recruitment, stream bank and channel stability, water storage and release, vegetation diversity, nutrient cycling, and cool and moist microclimates. and cool and moist microclimates.

Inner zone tree tipping is limited to 15 square feet of BA per acre (averaged throughout the RR treatment area) in units that were thinned in the outer zone. To reach this benchmark, two to seven trees per acre between 20” and 36” DBH may be directionally cut into the stream and riparian buffer. Trees greater than 20” will be selected to provide the immediate benefits of stable wood to selected stream reaches. Based on professional field observations of stream conditions within the project area, this will increase wood inputs from approximately 50-1,000% within tree tipping treatment reaches.

Alternative 2 and 3 Cumulative Effects:

A summary of reasonably foreseeable future actions is outlined in Table 61. The condition of RR pre-thinning can be described as overstocked, not diverse in age or species composition, young and not ideal for present and future in-stream wood recruitment. A future desired condition can be described as diverse in age and species composition, capable of regularly contributing in-stream wood, and trending toward a pre-disturbance condition.

Outer zone thinning and inner zone tree tipping would countervail effects to wood recruitment to fish habitat when contrasted with the effects of past, present, and reasonably foreseeable future actions described in the cumulative effects in the No Action Alternative (Alternative 1) for this analysis. Based on the results of FVS modeling, treated RRs produce larger trees in a quicker timeframe. In 40-year-old stands designated for treatment, FVS modeling shows an increase of 600 cubic feet per acre of trees greater than 20" dbh by year 20 post-thinning. Modeling also indicates at increase in cubic feet of volume per acre and 40 and 60-year intervals. An increase in volume of 30" dbh trees as expressed in cubic feet per acre is realized by year 60 post thinning (6,800 cubic feet per acre in non-treated stands vs. 10,500 in treated stands). In 50-year-old stands, cubic volume per acre of stable wood is similar (7,700 untreated vs. 7,300 treated stands) at year 20 post thinning, while at year 40 and year 60 intervals, the total volume of larger 30" dbh trees increases. The cubic feet per acre at year 40 (3,000 non-treated vs 5,000 treated) and at year 60 (7,000 non-treated vs. 11,700 treated) demonstrates an increase in larger trees that function as stable wood in stream channels for a longer time.

The past, present and reasonably foreseeable actions include Outer zone thinning would contribute to the conservation and recovery of ESA-listed fish species and their habitats and provide for the conservation of Bureau Special Status fish and other Bureau Special Status riparian-associated species. Outer zones would be thinned to ensure that stands are able to provide trees that would function as stable wood in streams. This would help to maintain and restore natural channel dynamics, processes, and the proper functioning condition of riparian areas, stream channels and wetlands by providing sediment filtering, wood recruitment, stream bank and channel stability, water storage and release, vegetation diversity, nutrient cycling, and cool and moist microclimates.

Both action Alternatives include constructing yarding corridors across perennial and intermittent streams. Yarding corridors would not cause a reduction in current or future recruitment of wood to fish habitat for the following because trees felled within the inner or middle zone of RRs for yarding corridors would remain on site as down wood material.

Sample tree falling would occur in the proposed units, including in riparian stands. Sample tree falling would not affect current or future large wood recruitment because trees selected would be located outside of the NTZs and would be a subset of those already identified in the prescription for removal. If for some reason the unit did not sell at auction or otherwise proceed, those trees would remain on the ground as downed wood.

Thinning in previously un-thinned RR would begin to restore historic landscape-level vegetation patterns. A study located on the western slope of the central Oregon Cascades consisting of four thinning treatments in second-growth Douglas-fir stands indicated that heavy thinning would accelerate development of large trees (Beggs 2004). Spies et al. (2013) concluded that the effects of thinning are variable depending on site-specific conditions, but that thinning can accelerate the development of very large diameter trees. Larger trees would be available for large wood recruitment, both in and near streams in a shorter period than would occur without thinning. The increased availability of larger down logs in streams would benefit fish habitat by preventing downstream transport of large wood debris (LWD), storing large volumes of sediment and smaller wood, and creating pools and backwaters, which provide rearing habitat and places for fish to rest during high velocity flow events. Based on this analysis the proposed actions would result in an increase of in-stream stable wood, which would benefit fish habitat both directly and indirectly, and in the reasonably foreseeable future.

3.1.6 How would the proposed vegetation management affect summer streamflow volume and summer stream temperature in fish habitat?

Methodology and Assumptions

The BLM's geographic scales for issue analysis include the headwater catchments draining the proposed regeneration harvest and commercial thinning units, the drainages or named streams to which these catchments contribute, and the five subwatersheds that contain the catchments, drainages, and proposed harvest units: Belieu Creek-Middle Fork Coquille River, Big Creek, Elk Creek, Indian Creek-Middle Fork Coquille River, and Yankee Run-East Fork Coquille River.These five subwatersheds comprise the analysis area, and for brevity's sake they will be referred to as Belieu, Big, Elk, Indian and Yankee in this analysis. Two additional subwatersheds contain relatively small amounts of proposed BLM harvest—approximately 16.3 harvest acres in Dement Creek-South Fork Coquille River (approximately 27,658 total acres, all ownerships) and approximately 17.3 harvest acres in Myrtle Creek (approximately 20,000 total acres, all ownerships). This equates to an approximately 0.06 percent and 0.09 percent harvest of total subwatershed acres, respectively. The BLM is omitting these two subwatersheds from further analysis given the relatively minor amount of proposed harvest acres versus total subwatershed acres.

The exception to this is Dement Creek-South Fork Coquille River and Myrtle Creek. The BLM is proposing to harvest less than one tenth of a percent in each of these watersheds and therefore omitting these two subwatersheds from further analysis.

The BLM uses multiple geographic scales (hundreds to thousands of acres) for analysis to disclose anticipated streamflow volume and temperature effects to small stream networks and to the broader landscape where multiple ownerships and land uses exert cumulative influence on the aquatic environment.

The BLM's temporal scale for issue analysis is the period 2019–2154. The BLM identified this period as appropriate for capturing the streamflow volume and temperature characteristics of the existing forest stands, and the streamflow volume and temperature effects of the proposed vegetation management (i.e., forest harvest, subsequent planting and planned pre-commercial thinning, forest stand growth in the HLB until next harvest, and forest stand maturation in all Reserves over the next 130 years).

Analytical Assumptions

- The BLM, consistent with Harr et al. (1979) and Perry (2007), defines summer streamflow as streamflow occurring from July through September. In summer, evapotranspiration is at its maximum, and both rainfall and streamflow drop to seasonally low levels. Summer streamflow, low streamflow, and low flow are used synonymously in this analysis.
- Temperature refers to the seven-day average maximum temperature (7DAMT), a calculation of the average of the daily maximum stream temperatures from seven consecutive days made on a rolling basis. The streams within and downstream of the proposed harvest units are designated for

salmon and trout rearing and migration so their 7DAMT may not exceed 64.4 °F according to the Oregon Department of Environmental Quality (ODEQ) (Anthony 2019, ODEQ 2005).

- The BLM considers fish habitat to be the mapped upper extent of Coho and steelhead distribution, and the mapped upper extent of Coho Critical Habitat. This mapping is inclusive of streams occupied by Endangered Species Act-listed fish and Bureau Sensitive fish on the BLM Oregon/Washington State Director's Special Status Species List (USDI-BLM 2019), Essential Fish Habitat for Coho and Chinook Salmon, and Coho Critical Habitat.
- Lower summer streamflows and higher summer stream temperatures affect salmonids and other native fish by reducing available summer rearing habitat and increasing thermal stress. Specific detrimental flow effects may include loss of flow connectivity, trapping of fish in isolated habitats, inhibiting of migration, increased predation, interruption of juvenile behaviors such as feeding, and direct dewatering mortality (USDC-NMFS 2015, USDC-NMFS 2016). Higher stream temperatures can potentially lead to earlier emergence, altered growth and survival rates, changes in migration timing, increased susceptibility to disease, and altered response to competition and predation (IMST 2004, Boyd and Sturdevant 1997).
- Regional paired watershed studies including those by Perry (2007), Perry and Jones (2016), and Segura et al. (2020) provide a frame of reference for interpreting the potential effects of BLM's proposed vegetation management on summer streamflow volume. However, vegetation treatments in regional paired watershed studies are dissimilar from BLM's vegetation treatments under the ROD/RMP limiting direct comparison of study results and proposed management outcomes. Also, regional paired watershed studies have been important to show local consequences of forest manipulation on streamflow but generalizing these findings and making predictions from them across diverse climate, geology, vegetation, and topographic settings has been difficult. Predicting the response of streamflow to forest cover change is complicated due to the variability of water stored in soil and weathered and fractured rock, and the evolving and differential forest access to available water (McDonnell et al. 2018, Bladon et al. 2019). It is challenging to transfer results beyond watershed boundaries where suitable data exist due to scaling issues, the unique characteristics of individual watersheds, and the complexity of the processes involved. Interactions between climate variability and disturbance affect water quantity response making predictions of end-states difficult (Pike et al. 2010).
- Hydrologic recovery refers to the decreasing impact of forest practices through time because of vegetation regrowth (Moore and Wondzell 2005). Hydrologic recovery also refers to the processes by which hydrologic functions return to pre-harvest levels, and to the degree of recovery (Perry et al. 2016). Reduced interception of precipitation and reduced evapotranspiration following timber harvest can increase water yield including low flow (Harr 1983). Streamflow changes are generally proportional to the amount of vegetation removed (Harr 1976a, Harr et al. 1979, Bosch and Hewlett 1982), and harvested areas do not permanently change streamflow. Streamflow returns to pre-harvest levels or the hydrologically recovered state as interception and evapotranspiration change in response to the growth of planted trees and the growth of remaining and naturally recruited vegetation.

The rate and trajectory of low flow hydrologic recovery depend in part upon species-specific water use changes with age (Moore and Wondzell 2005, Perry 2007). Cut areas can produce higher (surplus) low flow relative to the pre-harvest condition and transition to lower (deficit) low flow relative to the pre-harvest condition as young, densely planted, and vigorously growing trees increase site transpiration. Deficits diminish over time because trees exhibit declining transpiration with increasing stand age (Perry 2007, Perry and Jones 2016, Moore et al. 2004). Perry (2007) and Perry and Jones (2016) found that entirely clearcut catchments produced the largest and most persistent summer streamflow deficits. Specifically, the authors found that, relative to catchments with 100+ year old Douglas-fir, dense plantations with greater than 360 trees per acre (Perry and Jones 2016 p. 5, Table 2) in 100 percent clearcut, 25–237-acre catchments initially produced surplus low flow and transitioned to deficit low flow 6 to 23 years post-harvest. Deficit low flow persisted from 37 to 46 years post-harvest, the period of record for the individual catchments (Perry and Jones 2016 p. 8 Figure 6(b)). Perry (2007) and Perry and Jones (2016) also discovered that the amount and spatial arrangement of harvest affect the rate and trajectory of hydrologic recovery. Thinning and patch cutting created much less low flow response than clearcutting. Summer streamflow surpluses were lowest and disappeared most quickly in a 50 percent thinned, 171-acre catchment (stand age 100–150 years from Rothacher 1964) relative to more intense treatments, and summer streamflow deficits did not emerge over time in the 50 percent thinned catchment and a 169-acre, 30 percent patch cut catchment with small (less than four acres) openings (stand age 100–300+ from Rothacher 1964).

The rate and trajectory of low flow hydrologic recovery occur on a continuum influenced by not only stand age and the intensity and arrangement of harvest, but also species composition, stocking density, site productivity, disturbance, precipitation, soils, geology, aspect, elevation, and hydrologic regime (rain-dominated versus snow-dominated) (Moore and Wondzell 2005, Perry 2007, Perry and Jones 2016, Brown et al. 2005, Winkler et al. 2010). Perry and Jones (2016) do not give an estimate of years to low flow hydrologic recovery; 37–46-year-old densely stocked plantations in 100 percent clearcut catchments exhibited deficit low flow relative to the 100+ year-old stands they replaced. Perry (2007 p. 102) does suggest, based on limited information from entirely clearcut catchments, that stand level transpiration may return to near old-growth levels by 130 years in Douglas-fir dominated stands. The BLM considers this 130-year figure as a coarse screen for hydrologic recovery to historical low flow conditions.

Hydrologic recovery can have two end points: hydrologic recovery to pre-harvest or baseline conditions, or hydrologic recovery to historical conditions (i.e., flow conditions associated with a previously unmanaged stand). Recovery to historical stand and low flow conditions as measured by stand age is not a management objective of the HLB Land Use Allocation. The proposed HLB harvests in 40–240-year-old age class stands represent a cessation of hydrologic recovery towards historical low flow conditions. Hydrologic recovery to current conditions would occur during the post-harvest decades, and forest stands would achieve at least partial hydrologic recovery relative to historical conditions before the next, relatively long harvest rotation. The portions of BLM’s HLB in MITA would have a mean regeneration harvest age of 90 years between 2023 and 2113 (USDI BLM, 2016c, p. 317). One management objective of the MITA is to provide complex early-successional ecosystems (USDI BLM, 2016b, p. 63), and fulfilling this objective by removing a portion of the existing stand would produce some measure of surplus summer streamflow relative to both the existing baseline and historical flow conditions. Satisfying the other two MITA objectives—develop diverse late-successional ecosystems for a portion of the rotation, and provide a variety of forest structural stages distributed both temporally and spatially (USDI BLM, 2016b, p. 63)—provides for summer streamflow recovery and maintenance because older trees would exhibit declining transpiration with increasing stand age making more water available for other vegetation, groundwater storage, and streamflow, and retention of stand components reduces harvest area and harvest-related streamflow changes.

Recovery to historical stand and low flow conditions as measured by stand age would eventually occur on reserve forest acres. Reserve forest acres are exempt from regeneration harvest, and BLM management direction limits the extent and intensity of upslope harvest in the Reserve. Even if reserve forest acres are thinned, the remaining forest would continue to age and contribute to the pool of older forest acres.

Hydrologic recovery rates for stand-level processes can be quantified using a chrono sequence approach (Perry et al. 2016). Hydrologic recovery can be computed based on how an individual stand relates to newly harvested areas and reference stands, with hydrologic recovery ranging from zero percent for a new clearing up to 100 percent for a stand that functions like the original stand, baseline or historical. The BLM defines four categories of hydrologic recovery for this analysis based on this chrono sequence approach and the preceding analytical assumptions: flow surplus, flow deficit, partial hydrologic recovery, and hydrologic recovery. These categories are relative to older stands, 130+ years old, that occupied the proposed harvest units before commercial harvest reset stand age trajectories. Flow surplus occurs when reduced interception and reduced evapotranspiration following timber harvest increase low flows. Forest acres in flow surplus are less than 20 years old (Table 63, 0- and 10-year columns, and Table 64, 0–19 years column). Flow deficit occurs when replanted harvest units transition to deficit low flow relative to the pre-harvest condition as young, densely planted, and vigorously growing trees increase site transpiration. Flow deficit acres are found in the 20–70-year columns in Table 63 and the 20–79 years column in Table 64. Perry and Jones (2016) do not report on low flow hydrologic recovery for stands greater than 50 years old, but since their graph (p. 8 Figure 6(b)) still shows deficit flow at the end of their study period, it is appropriate to assume continued flow deficit beyond 50 years relative to historical stand conditions. If the end point for hydrologic recovery is the pre-harvest stand and not the historical stand, then 60-year-old stands regenerated under this proposal would achieve hydrologic recovery within the flow deficit time period and BLM's extended rotation period. Hydrologic recovery acres are captured in the 130+ columns in Table 63 and 72. The BLM includes a partial hydrologic recovery category between flow deficit and hydrologic recovery because hydrologic recovery progresses along a continuum and does not occur in discrete steps at specific times. Partial hydrologic recovery acres are found in Table 63, 80–120-year columns and Table 64, 80–129 years column. The mean annual increment, referring to the average growth per year that a tree or stand accrues at a specified age (Curtis 1995, McArdle et al. 1961), supports using 80 years as a partial recovery inflection point. While a tree always accrues growth in the absence of damage, the volume growth rate starts out small as the seedling establishes, then increases markedly as the tree matures until it hits a certain age. Once the age is attained, the growth rate declines slowly over the remainder of the tree's life. For Douglas-fir, the age where the decline presents itself is generally around 80 years of age. Because the rate and trajectory of low flow hydrologic recovery depend on many factors, it is possible for a stand in the partial hydrologic recovery category to produce low flow similar to a stand in the hydrologic recovery category. For example, a 90-year-old stand with relatively wide spacing either as a result of management or stochastic events could produce low flow comparable to the 130-year-old stand that it replaced. Forest acres in partial hydrologic recovery are behaving more like hydrologically recovered acres because the maximum flow deficit has already occurred and stand age and stand structure are getting closer to historical conditions.

Private forest land accounts for almost 60 percent of the forested acres in the five subwatersheds containing the BLM's proposed harvest units, and the BLM assumes that the relatively young private age class distribution that we see today (Table 63) is very likely the age class distribution that we will see in the future—a distribution resulting from one or more rotations of relatively high-intensity, short-duration forestry. Over time, private forest management (non-BLM (federal)) would produce relatively small contributions to older forest age classes due to access and productivity limitations, and maturation of Riparian Management Areas, and this would incrementally benefit (increase flow of the lowest) low flow volume. Clearcutting most of a young stand on private, at 40 years for example, would produce low flow surplus (more flow) relative to the 40-year-old stand and a much older stand, 130 years for example, due to reductions in interception and evapotranspiration. As the clearcut 'matures' to rotation age (40 years for example) it would return to the baseline condition of higher transpiration and lower streamflow, and it would exhibit low flow deficit relative to the historical low flow condition. Private harvest units, therefore, cycle between low flow surplus and low flow deficit relative to the older forests that occupied private forest land prior to initial logging entry.

Analytical Methods

Step 1—Bin BLM HLB and forested Reserve acres by age category and subwatershed using BLM's Forest Operations Inventory data. This 2019 information represents BLM pre-harvest, baseline vegetation conditions (Table 62 and Figure 17).

Step 2—Adjust the proportion of BLM acres in the respective age class bins to account for proposed regeneration harvest (e.g., in the Belieu subwatershed, remove 277 of the 346 acres from the 60-year column, all of the acres from the 70-year column, all of the acres from the 100-year column, 10 of the 15 acres from the 130-year column and all of the acres from the 160-year column and return these acres to the HLB 0-year column). This 2024 information (Figure 17) represents BLM post-harvest vegetation conditions (i.e., the direct effect of implementing Alternative 3).

Step 3—Based on the analytical assumptions, calculate BLM HLB and forested Reserve acres in flow surplus (0- and 10-year columns), flow deficit (20–70-year columns), partial hydrologic recovery (80–120-year columns), and hydrologic recovery (130+ year column). Graph acres by flow category for 2019, 2024, and every decade thereafter through 2154 by advancing HLB and reserve forest acres to the next older age column (Figure 17). HLB acres would advance through the decades until reaching the 90-year column at which point these acres are returned to the 0-year column signifying harvest. Reserve forest acres would continue to age and accrue in the 130+ year category. This multi-decadal information (Figure 17) represents the cumulative effect of the proposed harvest and subsequent harvests at the 90-year mean rotation age, and the maturation of reserve forest.

Note that Steps 2 and 3 use total harvest acres and do not reflect LITA and MITA management direction to retain 15–25 and 5–15 percent respectively of pre-harvest stand BA in live trees. In Step 2, retention would reduce the number of acres returning to flow surplus from flow deficit and partial hydrologic recovery. In Step 3, retention would reduce the number of acres leaving partial hydrologic recovery to return to flow surplus at the 90-year mean rotation age.

Step 4—Use LiDAR heights and stand ages on BLM-administered lands to bin private forest land acres by age category and subwatershed: 0–19-year-old stands are 0–57 feet tall, 20–79-year-old stands are 58–100 feet tall, 80–129-year-old stands are 101–122 feet tall, and 130+ year old stands are over 122 feet tall. These age categories correspond to flow surplus, flow deficit, partial hydrologic recovery, and hydrologic recovery. Use satellite images from spring 2019 to get a more recent accounting of private clearcut acres for the flow surplus category. Because the BLM does not have fine scale stand age data for private forest land, this step is done once to show current conditions, with the assumption that the relatively young private age class distribution that we see today is very likely the age class distribution that we will see in the future.

Units of Measure

The BLM will disclose the proximity of proposed vegetation management to fish habitat and assess the probability that fish habitat would be exposed to management-related flow changes directly and indirectly at the catchment and drainage scales. The magnitude or intensity of anticipated flow changes is given in the context of the results from regional paired watershed studies. The BLM would not directly measure stream discharge, or the loss or gain in summer streamflow volume and flow connectivity. Streamflow gaging data that describes baseline low flow conditions in the catchments, drainages, and subwatersheds of the analysis area does not exist, and the BLM is not planning to install the research-grade equipment necessary to provide high resolution low flow measurements; therefore, comparisons of actual low flow measurements from pre- to post-harvest and through time are not possible. Also, the BLM has not mapped the seasonal extent of perennial (continuous) and intermittent (discontinuous) flow at lowest discharge or measured or estimated the volume of individual pools at lowest discharge, and it would be an unreasonable commitment for the BLM to complete such fine-scale surveys at the appropriate time of year every year for even a portion of the time period identified for this analysis.

The BLM shows existing flow conditions on BLM and private (baseline), BLM post-harvest conditions (direct effect), and trends for BLM forest acres through the year 2154 (cumulative effect) by graphing the proportion of forest acres in each of the four hydrologic recovery categories by time period and subwatershed.

Affected Environment

Fish habitat is found within and downstream of the proposed harvest units Table 65. Approximately 15 stream miles cross the proposed harvest units, and slightly less than one mile contains fish habitat. Fish habitat found within the proposed harvest units occurs in third-order or higher perennial stream reaches. Perennial streams typically have running water year-round; their base level is at, or below, the water table (USDI BLM, 2016c, p. 299).

Intermittent streams, non-permanent drainage features with a dry period (USDI BLM, 2016c, p. 296), are common on BLM-administered lands which are typically located in headwater areas of mountainous terrain. In western Oregon, the pronounced seasonal rainfall pattern, several months of wet weather followed by several months of dry weather, supports the establishment of intermittent streams (Nadeau 2015). Intermittent streams account for roughly half of the stream miles crossing BLM-administered lands within the planning area for the ROD/RMP (USDI BLM, 2016c, p. 374), and intermittent streams account for 40 percent of the approximately 15 stream miles within the proposed harvest units. The within-unit intermittent stream mileage may be higher given that the BLM District Aquatics field staff surveyed many streams during the winter, spring, and early summer when streamflow would not be at a seasonal minimum. Stream presence/absence, stream inception points, and streamflow duration were verified between February 20, 2018 and February 20, 2020 for the purposes of accurate buffering of aquatic resources and accurate Land Use Allocation acreages for this environmental assessment. Only 20 percent of the surveys were completed in September and October of 2019 when spatial interruption of surface flow indicative of intermittent streams would have been most pronounced.

Intermittent streams transition to perennial streams at variable locations within stream reaches over time and not at the same geographic points year after year. Several factors other than harvest including the amount and timing of yearly rainfall, changes in stream morphology (streambed scour and deposition), and changes in forest species composition and cover resulting from forest succession and disturbance can affect the spatial and temporal expression of surface flow in streams.

Only Belieu Creek is listed from mouth (mile 0) to headwaters (mile 3.1) by the Oregon Department of Environmental Quality as water quality limited for exceeding the 64.4 °F standard designated to protect salmon and trout rearing and migration (ODEQ 2019). This is the only stream temperature listed stream that crosses into or within 0.5 miles of BLM managed lands and proposed harvest units within the analysis area. BLM generated water quality data on this stream is not able to be found, however site reviews of this area show that the stream starts on non-BLM managed land and transitions through just

0.4 miles of BLM management forest and back to non-BLM managed land before joining the Middle Fork Coquille River.

Road construction and harvest would not occur in the Belieu Creek RR; therefore, shade would be protected, and management-related water temperature increases would not occur.

Perennial streams that exit the proposed harvest units likely produce water temperatures well below the State temperature standard based on several years of nearby continuous water temperature monitoring. This is also supported through field surveys performed by the Myrtlewood Field Office hydrologist who has identified stream inception points in proposed timber sale units each year between x year and x year and estimates that one-quarter of the streams were likely perennial (i.e., had year-round surface flow) at their inceptions due to spring flow. The Coos Bay District has a long-term temperature study in the BLM Umpqua Field Office. The Umpqua Field Office hydrologist monitored summer water temperatures at the downstream edge of five BLM timber sale units between 2010 and 2017 according to protocol (OPSW 1999), and the 34 individual continuous data files produced 7DAMTs ranging from 54.9 to 61.7 °F (58.9 °F average). These temperatures represent conditions pre- and post-upslope thinning including thinning in the RR. The BLM reasonably expects that this data is representative of conditions on neighboring BLM-administered land, especially given the similarities between the proposed harvest units and the previously monitored harvest units: all units are in headwater areas, the forests are 40–240 and 50–80 years old, respectively, and all drainage areas are less than 480 acres.

Current or baseline stand ages for BLM-administered forest land and private forest land are displayed in Tables 63 and 64, and the 2019 partitioned bars in the Figure 17 bar graphs show BLM's baseline acres by hydrologic recovery category. Private manages 50 to 75% of the forested acres in each of the analysis area subwatersheds and private forest acres are 61-39 percent split between flow surplus and flow deficit with relatively few acres in partial hydrologic recovery and hydrologic recovery (Table 64). Although the baseline proportions vary by subwatershed, nearly 150 acres in the proposed harvest area HLB and over 10,000 acres of reserve forest acres are categorized as hydrologically recovered.

Environmental Effects

Alternative 1 - No Action

Foregoing BLM harvest in the near term (next 20 years) would mean that 539 acres of HLB forest proposed for management would move from flow deficit to partial hydrologic recovery. These acres would join the other 183 acres of HLB forest proposed for management that are currently in partial hydrologic recovery. Foregoing BLM harvest now does not mean that harvest in the analysis area would not occur.

It is reasonably foreseeable that the BLM would harvest most if not all of the 2,662 acres of HLB within the five subwatersheds (Table 62) during the temporal scale identified for this analysis (135 years). Future harvest is probable because the HLB occupies a small percentage of total BLM acres, and an objective of the HLB is to manage forest stands to achieve continual timber production that can be sustained through a balance of growth and harvest (USDI BLM, 2016b, p. 59). HLB acres make up 46 percent of all BLM forested acres in the analysis area, and approximately 20 percent of the BLM-administered land in the planning area for the ROD/RMP. Reserve forest acres would continue to get older independent of management actions affecting the HLB. Aging of Reserve forests is the primary driver for the future partial hydrologic recovery and hydrologic recovery acreage gains depicted in Figure 17.

Action Alternatives

Under alternative 2 the BLM proposes to harvest in the same Land Use Allocations as in Alternative 3 but, would not be constructing new roads. Therefore, access to the same acreage of those LUAs will be limited and as such there will be less harvest. HLB proposed harvest activities common to all Action Alternatives Considered in the BWE Project shows the difference in acres for Alternative 2 compared to Alternative 3 (See Table 7 in Chapter 2). For this analysis Alternative 2 is entirely within the footprint of Alternative 3, with Alternative 3 providing the largest effect. The BLM uses Alternative 3 to assess effects of harvest on low flow.

The proposed harvest including group selection openings and commercial thinning common to both action alternatives has little potential for adverse or prolonged effects on summer streamflow volume. Based on the regional literature cited in the Analytical Assumptions and Alternative 3 Environmental Effects sections, the BLM expects that the proposed commercial thinning of 40–99-year-old stands with limited group selection openings that make up less than 10 percent of the harvest area would produce relatively small compared to background levels and likely unmeasurable from background levels and short-lived (few years) summer streamflow surpluses relative to existing baseline conditions without trending to summer streamflow deficits relative to baseline conditions. The direct effect (occurring in the same time and place) and the indirect effect (farther removed in distance) of the proposed thinning and group selection versus the proposed regeneration would be less flow surplus for a shorter amount of time. Thinning of mature to old-growth forest produced streamflow surpluses for only five years in the H.J. Andrews Experimental Forest and less than 10 years in the South Umpqua Experimental Forest (Perry 2007). Reducing the number of trees would make soil moisture available for the remaining vegetation (Reiter and Beschta 1995, Satterlund and Adams 1992 p. 253), groundwater storage, and streamflow. Retained portions of the existing stands would likely exhibit declining transpiration with increasing age (Perry 2007 pp. 100–102) somewhat offsetting increased transpiration from remaining and naturally recruited vegetation in the thinned areas. Compensatory transpiration by remaining trees and shrubs or increased evaporation from more open areas may reduce an already small flow surplus signal even further (Bladon et al. 2019).

The proposed thinning and group selection would produce low intensity or small magnitude summer streamflow change. This is consistent with Perry (2007) saying that variable-intensity logging prescriptions over small areas to approximate natural forest structure may have the least effect on summer stream flows and thinning of both young and old stands may mitigate summer streamflow deficits. Given this, it is probable that fish habitat would not be exposed either directly or indirectly to a substantially different flow regime post-harvest.

The indirect effect (later in time) of the proposed thinning would be more HLB acres (approximately 80 percent from the flow deficit category and the remainder from partial hydrologic recovery) progressing towards historical low flow conditions within the bounds of HLB management objectives and direction. For reasons stated previously, it is foreseeable that these acres would still be managed with additional thinning or regeneration.

The proposed thinning and group selection would have unmeasurable effect compared to background levels on summer streamflow volume at the catchment and drainage scales, and even less effect on cumulative volume at the subwatershed scale. The BLM's management of reserve forest acres that are more numerous and on a trajectory of partial hydrologic recovery and hydrologic recovery would have a greater influence than HLB treatments on subwatershed streamflow output. Private and non-BLM forest land management that is more intense and widespread would continue to have the greatest influence on subwatershed streamflow output.

The PRMP/FEIS addressed low flow under issues considered but not analyzed in detail (USDI BLM, 2016c, pp. 408-409). The PRMP/FEIS analysis concluded that timber harvest according to the Proposed RMP would not have a measurable effect on low flow at the subwatershed scale due to the RR and the limited extent of the HLB. The low flow information in this EA for proposed regeneration and thinning aligns with the conclusion in the PRMP/FEIS, that there would be no measurable effect to low flow at the subwatershed scale. The proposed vegetation management would not have a significant effect on low flow and fish habitat at the catchment and drainage scales (i.e., within and downstream of the proposed harvest units). Summer streamflow change would be muted due to the presence of the RR and other PDF (i.e., BA retention, thinning to control density, interspersing cut and uncut areas), and the signal from any management-related low flow change would be indistinguishable or unattributable to BLM management at the subwatershed scale. Low flow changes from the less intensively managed and limited extent BLM HLB would mix and become subordinate to low flow changes created by interannual rainfall variability, intensive management of the widespread private forest land that makes up three fourths of the analysis area, and succession in the BLM Reserve accounting for 85 percent of the BLM forested acres in the analysis area.

Alternative 3 involves regeneration harvest of approximately 772 acres less the 5–15 percent of stand retention.

As stated in Chapter 2 of this EA, there would be both commercial and non-commercial LSR treatments. Commercial thinning prescriptions described in section 2.2 would thin to a relative density (RD) of 20-30 percent on 64 units or 1,935 acres. This Alternative would also commercially thin to RD of 30-45 percent on 3 units or 145 acres. Table 4 in section 2.2 breaks acreages down to units analyzed. Total unit volume of commercial timber harvest would be approximately 31,204.

As part of alternative 3, the MFO would treat approximately 11 units or 409 acres as non-commercial treatment number three described in section 2.2 (all units are identified in Table 4 in section 2.2).

Under alternative 3, the MFO would meet the restoration objectives in the RR by commercial thinning 20 units (295 acres), non-commercial thinning 1 units (8 acres) in the outer zone and cut or tip live trees 2 units (8 acres) in the inner zone. Units are identified in Table 5 through 7 in section 2.2.

Finally, using a combination of skyline cable and ground-based harvest systems regeneration harvest would occur on 6 units (632 acres) in both the LITA and MITA. Tables 8 show the distribution of regeneration harvest by stand age class in each land use allocation, for each action alternative. The table also provides the season of operation the harvest operations would occur. The MFO would conduct harvest operations at all times of the year depending on seasonal restrictions for MM and spotted owl, road surface type, and harvest system.

The aerial photograph in Figure 16 provides a useful starting point for the effects analysis. No two regeneration harvests are exactly alike. For instance, the pictured variable retention unit shows RR thinning, as stated above only 295 acres of RR commercial thinning is proposed across 20 units to meet RMP requirements; non-commercial selective tree tipping without planting is proposed for 8 acres in only 1 unit and only in select drainages that would benefit from large wood recruitment in fish habitat. This prescription is described above and in the Chapter 2. The size, number, and placement of aggregate retention areas varies. The important point to notice is the lack of tree retention in the private clearcut, analogous to entire catchment clearcuts in experimental forests, versus the distributed tree retention in the regeneration harvest.

Magnitude, proximity, and probability are used to answer the issue question: How would the proposed vegetation management affect summer streamflow volume and summer stream temperature in fish habitat? Magnitude refers to the intensity of flow and temperature changes brought about by the proposed vegetation management. Little change means low intensity and pronounced change means high intensity. Proximity refers to the geographic relationship between the action (vegetation management) and our resource of concern, fish habitat. Probability refers to the likelihood that fish habitat would be exposed to lower flows and higher temperatures.

The BLM's Alternative 3 proposed vegetation management including LSR treatments would produce a less intense maximum summer low flow response than that described by Perry (2007) and Perry and Jones (2016). As mentioned in the Analytical Assumptions section, the authors found that entirely clearcut catchments produced the largest and most persistent summer streamflow deficits and thinning and smaller patch cuts (less than eight acres) produced much less low flow response than clearcutting, and no summer streamflow deficits over time. The BLM is not proposing to clearcut entire catchments, but the proposed regeneration openings would be greater than four acres in some areas suggesting a summer low flow response moderate in intensity (i.e., some low flow effect, at times positive (surplus) and negative (deficit), that may persist for a decade or more).

PDFs including tree retention, the spatial arrangement of harvest, and the amount and timing of planned pre-commercial thinning would lessen the intensity of the summer low flow response. The BLM is not proposing commercial regeneration harvest within the RR, however there will be approximately 0.7 mile of new road construction (allowed in accordance with the RMP) adjacent, crossing within tens of feet to stream headwaters/inception points. These roads would maintain ditch relief and sediment controls designated by BMPs listed later that would channel overland wash from storms out and away from connecting to the stream channels greater than 120 feet from streams. Perennial and intermittent streams would be buffered at least a 120-foot in the RR. Some trees will be cut for selective tree tipping and non-commercial thin as described above but would contribute to an overall healthier stand providing more recruitment to streams and aquatic habitat. Streamflow changes are generally proportional to the amount of vegetation removed, and the RR as retained forest cover would reduce timber harvest unit size. In addition to reducing unit size, the RR would intercept a portion of the soil moisture made available by upslope harvest and reduce streamflow changes pre-harvest to post-harvest. The riparian zone has been conceptualized as a zone of transmission of groundwater and hillslope water to the stream channel (Moore and Wondzell 2005), and modeling by Abdelnour and others (2011) in the H. J. Andrews Experimental Forest determined that streamflow response is sensitive to harvest distance from the stream channel—"this streamflow sensitivity to harvest location stems from the fact that subsurface flow generated from an upland clearcut area, as opposed to a lowland clearcut area, has a relatively longer flow path. This longer flow path subjects subsurface flow to downslope plant water uptake, which reduces the amount of water that reaches the stream channel."

Maintaining the RR would enhance stream-aquifer interactions (Moore and Wondzell 2005) and benefit low flow maintenance. Water storage capacity in the smaller intermittent and perennial headwater streams and larger perennial main stems draining the proposed harvest units would temper potential harvest-related summer streamflow changes. The RR provides a continual source of large wood for channels, and small headwater streams function as one of the dominant storage reservoirs for sediment in mountainous terrain given an adequate supply of in-stream wood (May et al. 2004). Studies in the Oregon Coast Range (May and Gresswell 2003a and 2003b) and Cascade Range (Swanson et al. 1982, Grant and Wolff 1991) indicate fluvial transport of sediment and wood in high gradient headwater streams is minimal in the interval between debris flows. Large wood recruited from adjacent hillslopes and riparian areas is typically large in relation to the size of the channel and therefore resistant to movement. As wood continues to accumulate, the water storage capacity of low order channels increases (May and Gresswell 2003b). This water storage capacity is important, especially in late summer when deep hillslope and long hyporheic flowpath contributions to streamflow become increasingly dominant (Bond et al. 2002). Wood recruited from the RR would also benefit both the magnitude and duration of water storage in larger channels by capturing sediment and organic material, creating, and enlarging pools, and enhancing stream–floodplain connectivity. Streams with well-connected floodplains and deep sediment store water from periods of higher runoff and release the water gradually during periods of lower runoff (Coutant 1999, Winter et al. 1998).

Maintaining the RR would prevent riparian species composition changes that can exacerbate low flow deficits. Persistent summer flow deficits developed in WS1, a 237-acre clearcut catchment in the H.J. Andrews Experimental Forest analyzed by Perry (2007) and Perry and Jones (2016), in part because hardwoods colonized the relatively wide valley floor after logging, and hardwoods use more water per unit leaf area than the conifer species that were present in the riparian zone prior to logging. Hicks et al. (1991) suggest that the establishment of hardwoods in the riparian zone following clearcut logging caused water yields to drop below predicted yields. Red alder established after debris flows in WS3, a 250-acre catchment in the H.J. Andrews Experimental Forest that was 25 percent patch cut, intensified summer streamflow deficits (Perry 2007). The BLM's proposed harvest would not result in near-stream species composition changes like those seen in the H.J. Andrews thus eliminating this as a factor influencing post-harvest low flow change.

The RR is just one of the features that distinguish the proposed regeneration harvest from the entire catchment clearcuts analyzed by Perry (2007) and Perry and Jones (2016). In each regeneration harvest unit, the BLM would retain 5–15 percent of pre-harvest stand BA in live trees. Retaining individual trees and aggregate groups of trees outside of and in addition to the RR reduces the harvest footprint and decreases the potential for adverse changes to summer streamflow volume for fish habitat. Retained portions of the stand would exhibit declining transpiration with increasing age somewhat offsetting increased transpiration from younger vegetation. Also, proposed pre-commercial thinning would reduce the number of transpiring trees below the clearcut planting densities studied by Perry (2007) and Perry and Jones (2016) and mute the flow deficit response. If abundant natural regeneration augments planting or mortality is low, The BLM would be reducing the number of transpiring trees during the post-harvest period when Perry and Jones (2016) identified the beginning of deficit low flows in densely planted (greater than 360 trees per acre) clearcuts. The BLM would implement additional pre-commercial treatments 25–30 years post-planting to maintain spacing. Pre-commercial thinning is likely to occur because it is standard practice on the Coos Bay BLM District—85 percent of the stands planted from 1994 through 2004 have been pre-commercially thinned (Huff 2019). Perry and Jones (2016 p. 7) note that a 12 percent BA pre-commercial thin in a 38-acre clearcut replanted to 364 trees per acre did not slow the decline of summer streamflow. This situation is unlike the BLM proposal to reduce the number of transpiring trees by 33–60 percent from initial planting density, and Perry (2007, p.114) admitted that a very light pre-commercial thin with only 12 percent BA removal was unrepresentative of forest practices with thinning of 35 to 45 percent BA removal. Reducing the number of stems would make soil moisture available for other vegetation, groundwater storage, and streamflow.

The spatial layout of BLM's proposed harvest units further distinguishes MITA vegetation management from the entire clearcut catchments and drainages analyzed by Perry (2007), Perry and Jones (2016), and Segura et al. (2020). Clearcutting whole experimental catchments and drainages concentrated disturbance and maximized summer streamflow change. Contrast this with the BLM where topographic divides split the proposed harvest units, the proposed harvest units drain to different catchments within different drainages and five different subwatersheds, and all within-unit streams are surrounded by site-potential-tree-height RR. This spatial layout keeps disturbance away from streams, and disperses disturbance minimizing the amount of change in any one area. Also, in addition to being staggered in space, the proposed BLM timber harvest would be staggered in time desynchronizing flow changes. Proposed timber sales would occur between 2021 and 2026 and purchasers would have three years to harvest.

The BLM's proposed vegetation management would affect summer flow surplus and summer flow deficit by changing interception and evapotranspiration. What is less certain is determining the amount of flow surplus, and more importantly, flow deficit that would come from the proposed vegetation management within the context of experimental forest treatments. The BLM's proposed regeneration harvest of 50–240-year-old stands with PDFs has no treatment intensity and treatment arrangement analogues in the handful of experimental treatments completed in western Oregon—six clearcuts, two larger-opening patch cuts, and one smaller-opening patch cut (Table 62). With the exception of the Alsea Watershed Study in the Oregon Coast Range, the proposed harvest units are also at a different elevation, in a different geology, and in some cases in a different hydrologic regime. The way flow deficit is created and measured in the experimental forests also makes it difficult for the BLM to compare study results with proposed management outcomes. Researchers establish a streamflow relationship between a reference or control catchment/drainage and a treatment catchment/drainage prior to harvest, and then measure the relative mean daily streamflow departure (treatment versus reference) following harvest (Table 62 Summer Flow Deficit column). Studies have subjected older, hydrologically recovered forests to intense treatments that maximize flow surplus and later flow deficit, conditions that create more departure from older, hydrologically recovered reference stand streamflow conditions. Compare this with the BLM's proposal to treat younger, flow deficit and partially hydrologically recovered stands less intensely through implementation of PDFs, conditions that limit flow surplus and flow deficit relative to pre-harvest streamflow conditions.

Flow surplus, unlike flow deficit, is regarded as a good or positive outcome; therefore, the following analysis concentrates on the magnitude or intensity of anticipated flow deficit. Direct comparison notwithstanding, the BLM can use the experimental results as a frame of reference for estimating the magnitude of management-related summer streamflow deficit. The BLM's proposed vegetation management would clearly not generate flow deficit similar to experimental clearcutting (Table 62). Clearcutting entire older forests and establishing plantations took stands with fewer, slower growing trees and replaced them with openings with few or no trees (lower transpiration/higher streamflow) followed decades later by stands with fast growing and densely planted young trees (higher transpiration/lower streamflow). The BLM is not proposing to harvest entire catchments or drainages without riparian buffers as was done in the experimental forests, establish dense plantations, or remove wood from stream channels as was done in Needle Branch, part of the Alsea Watershed Study (Segura et al. 2020); therefore, the maximum flow deficit would not develop. With live tree stand retention acres outside of and in addition to the RR (reserve acres), the BLM would be leaving more of the forest than it proposes to harvest as a total across all proposed HLB units (1,250 reserve acres and the 5-15 percent retention from the 810 harvest acres). The BLM stands would not approach the extremes of transpiration and streamflow seen at the experimental forests, and retaining trees, thinning trees to control density, interspersing cut and uncut areas, and implementing longer rotations means streams would experience less streamflow change compared to wholesale harvest.

It is possible that BLM's proposed vegetation management would generate flow deficit nearer but not meeting that demonstrated by the larger-opening patch cuts of the experimental forests, if not more modest. Still the comparison is problematic given such a small sample size (two experimental treatments), and obvious differences in forest age, harvest configuration, and stream channel condition. The patch cut versus clearcut flow deficit values support the idea that streamflow change is generally proportional to the amount of vegetation removed. Streamflow change is also sensitive to harvest distance from streams, and on this point, there is an obvious difference between the BLM's proposed management and experimental treatments. The BLM is not proposing to harvest through intermittent and perennial streams or use narrow buffers on perennial streams as was done in the patch cuts. The BLM's RR would be 120 feet on all perennial and intermittent streams. Wider buffers in the experimental patch cuts would have reduced harvest acres or shifted harvest upslope providing for a better comparison to BLM's contemporary practices. It is conceivable that the 21 percent flow deficit for the one larger-opening patch cut in the H.J. Andrews would have been reduced if not for 'significant' debris flows in December 1964 and February 1996 that resulted in the destruction of the gaging station in the catchment (OSU 2017) and riparian vegetation changes. Swanson et al. (1980) state that "the road fill failures at the heads of long, steep, straight channels-initiated debris torrents which flushed the WS3 channel system." As mentioned previously, Perry (2007) noted that red alder established after debris flows intensified summer streamflow deficits. In contrast, the streams draining the BLM's proposed harvest units do not show signs of recent debris flow activity (i.e., they have accumulated sediment that facilitates water storage for more gradual water release) and the RR prevents encroachment of species that transpire more water and diminish streamflow. The 14 percent flow deficit for the one larger-opening patch cut in the Alsea (original harvest 1966) is also the product of additional clearcutting and thinning between 1978 and 1988 in three units totaling just over 100 acres (Stednick 2008 pp. 145–147 Figures 9.2 and 9.3, Segura et al. 2020 Figure 2—1969 aerial photo showing three original patches outlined in yellow and 1994 aerial photo showing three patches harvested later outlined in orange). Considering the important differences between the experimental treatments and what's being proposed, it's reasonable and conservative for the BLM to assume a 15 percent flow deficit to further this analysis.

The BLM cannot quantify a 15 percent flow deficit using measured summer streamflow values from the analysis area, but modeled data is available and useful. The BLM downloaded July and September 50 percent duration and five percent duration values from StreamStats (USGS 2020) for one site on Belieu Creek (Unit 103, drainage area 601 acres) at the downstream side of BLM management from the end of fish habitat (Coho and Coho Critical Habitat), and one site on Frenchie creek (Unit 105, drainage area 825.6 acres) at the culvert on Hwy 42 flowing into the Middle Fork Coquille. The 50 percent duration value represents a flow that is equaled or exceeded 50 percent of the time, the five percent duration value represents a flow that is equaled or exceeded five percent of the time, and, for reference, one cubic foot per second of flow equals approximately 449 gallons per minute (gpm). For Belieu Creek, the modeled 50 percent duration for July and September is 80.7 gpm and 24.9 gpm, so a 15 percent flow deficit reduces July and September flow by 12.1 and 3.7 gpm. For the Frenchie Creek, the modeled 50 percent duration for July and September is 123 and 40.4 gpm, so a 15 percent flow deficit reduces July and September flow by 18.5 and 6.1 gpm. The 5 percent duration for Belieu Creek in July and September is 222 and 144 gpm, and the five percent duration for Frenchie Creek in July and September is 328 and 204 gpm.

Actual discharge data from just outside the analysis area is also available and useful in quantifying potential flow deficit. The Priorli Creek gaging station10, now discontinued, was located in a 275-acre drainage in the Coos basin approximately 20 air miles to the north of the analysis area. Priorli Creek gaging data for water years11 1984 through 1996 is available from the Oregon Water Resources Department website (OWRD 2020). With the exception of approximately 44 acres of harvest in 1987, the Priorli drainage was unmanaged for the period of record. The July and September mean streamflows for the period of record vary between 53.9–287.3 gpm and 53.9–157.1 gpm, respectively. The mean of the

July means is 134.6 gpm so a 15 percent flow deficit would reduce this value by 20.2 gpm, and the mean of the September means is 80.8 gpm so a 15 percent flow deficit would reduce this value by 12.1 gpm. The difference in July maximum flow minus minimum flow in any one water year ranges from 26.9 to 498.2 gpm, and the difference in September maximum flow minus minimum flow in any one water year ranges from 31.4 to 314.2 gpm. Priorli Creek did not go dry at the gaging station during the period of record annual low flow ranged from 22.4 to 53.9 gpm. Although Priorli Creek is similar in size and representative in slope, aspect and drainage to the main stems of tributaries in the proposed harvest units (from 9 acres to 321 acres) the Priorli modeled 50 percent duration for July and September is most likely greater by 1 to 2 times than any of the main stems within the harvest units due to drainage size. But Priorli Creek gage data represents the most similar stream flow to those main stem tributaries within the harvest units.

The information from Priorli Creek and StreamStats as well as the gages at Fall Creek and Big creek, highlights the relatively large variability in annual, month-to-month (July versus September), and within month streamflow. The information also highlights the streamflow variability between sites. This variability stems from annual differences in the amount and timing of rainfall, and differing watershed characteristics. Harr (1976b) recognized the changeable nature of small (first through third order) streams, like those in Priorli Creek and the proposed harvest units and stated, "if there is a term that can most appropriately be applied to the hydrology of small forest streams, it is 'variability,' not only in streamflow and hydraulic characteristics, but also over time and space… variability is the rule rather than the exception." Potential flow deficits of several gpm to 20 gpm are likely not negligible at the habitat unit scale (e.g., riffle), but they are also not outside the range of streamflow variability.

The proposed vegetation management would cause some summer streamflow volume change. The direct effect and the indirect effect would be an incremental flow surplus. Approximately 80 percent of the 772 regeneration acres would come from acres in the flow deficit category, and the remainder of the regeneration acres would come from partial hydrologic recovery acres. The 2019 and 2024 columns in Figure 17 show the pre- and post-harvest breakdown of hydrologic recovery categories and the relative increase in flow surplus by subwatershed. The relative change in flow surplus pre-harvest to post-harvest would be muted by within-unit vegetation retention and would fall within the range of streamflow variability.

The proximity of fish habitat to the proposed harvest units, and the anticipated relatively modest flow surplus response lessen the probability that fish habitat would be exposed either directly or indirectly to a substantially different flow regime post-harvest. If streams within the proposed harvest units were instrumented to provide high resolution low flow measurements, there would be more flow response in the first- and second-order headwater streams than in the higher order streams where fish habitat is located (Reiter and Beschta 1995, Surfleet and Skaugset 2013). Smaller watersheds generally have greater variability in streamflow and show a relatively larger impact of land use change than larger watersheds (Pilgrim et al. 1982). Flow surplus would produce a relatively small rise in stage or flow depth in perennial stream fish habitat, and this would primarily affect riffles as explained in the next paragraph. Even small flow surplus may provide improved habitat conditions by increasing stream volume (Reiter and Beschta 1995). The flow surplus would not drastically increase the amount of habitat available at tributary junctions for volitional fish use because the flow increase would be small, and these tributaries increase in gradient and become difficult to ascend within feet to tens of feet of fish habitat in the main stems. A continual supply of large wood from the RR to the proposed harvest unit streams would enhance the storage of sediment and organics in and upstream of fish habitat, boosting the storage of water including flow surplus, however small.

The indirect effect (later in time) of the proposed vegetation management would be an incremental flow deficit moderated by PDFs. The magnitude or intensity of the flow deficit beginning roughly 20 years post-harvest would be substantially less than the relative changes reported by Perry (2007), Perry and Jones (2016), and Segura et al. (2020) for entirely clearcut catchments and drainages, and the magnitude of the flow deficit would be within the range of streamflow variability. Anadromous species that rear in freshwater throughout the year must tolerate a wide range of streamflow conditions in coastal streams. Fish are adapted to the environment in which they have evolved, and salmonids are well adapted to steep western watersheds characterized by seasonal variability in streamflow (Everest et al. 1987, Bottom et al. 1985, Bateman et al: 2018). There is a low probability that the extent of fish habitat, defined within the context of naturally variable streamflow and naturally variable habitat conditions, would contract significantly (hundreds of feet) downstream that would extirpate fish habitat solely in response to the proposed vegetation management and hindering fish survivability. There is also a low probability that fish habitat would be exposed to a management-related flow deficit that results in persistent (year after year) and widespread loss of flow connectivity, trapping of fish in isolated habitats, or dewatering mortality. Fish habitat within the proposed harvest units occurs in higher-order, valley-bottom perennial streams with relatively fine sediment (gravel, sand, silt) and contributing areas greater than 250 acres. The MFO hydrologist visited similar and nearby streams (contributing areas 100–400 acres) repeatedly throughout the summers of 2014 to 2019 while monitoring continuous stream stage and water temperature, and in all cases, despite seasonally dropping water levels, found pools interconnected by surface flow. Riffle flow depth and flow width contracted as summers progressed, but surface flow remained, and pools dropped comparatively little because of the controlling influence of downstream riffles. The Myrtlewood hydrologist measured total pool depth during stream surveys of perennial streams in the proposed HLB units during summer field surveys and found that pools averaged 45 percent of their depth compared to winter flows. These measurements were based on three to four measurements for each stream over the course of two years upstream of road crossings (out of influence of crossing, typically 10 to 20 meters) within units that had streams crossing existing roads while transporting to and from other survey sites. These results are consistent with Janisch et al. (2012) who found more surface flow in fine-textured than coarse-textured coastal headwater streams, and Bradford and Heinonen (2008) who state that pool habitats are less affected by flow changes, and the physical attributes of riffles and other shallow areas (depth and velocity) are impacted most rapidly by decreasing flows. The modeled flow deficits would mostly affect shallow water habitats such as riffles leaving Coho, a species that prefers pools and glides, with survivable volumes of water. The risk to fish generally increases as low flows are reduced, but other than at two end points—no flow and a natural volume of flow—there is considerable uncertainty in the biological responses for a given hydrologic change (Bradford and Heinonen 2008). Inasmuch as fish habitat generally occurs in streams with the necessary contributing area and low base level to consistently remain perennial, relatively small flow reductions would have a limited, and not significant, effect.

Harvest-related summer streamflow change at the subwatershed level is largely driven by the management of private forest land. Private forest land accounts for approximately 75 percent of the forest land in the analysis area (range 30–75 percent per subwatershed), and private forest land is managed nearer the extremes of transpiration and streamflow—stands with fast growing and relatively dense young trees (higher transpiration/lower streamflow) are clearcut with limited tree retention (lower transpiration/higher streamflow) according to the Oregon Forest Practices Act. Table 64 shows that the numbers of private flow surplus and flow deficit acres show more surplus flow for the analysis area. Flow surplus acres account for 56 percent of the total private forest acres in the analysis area, and 30, 25, 28, 29 and 20 percent of the total private forest acres in the analysis subwatersheds Belieu Creek, Big Creek, Elk Creek, Indian Creek and Yankee Run, respectively. This indicates that near term flows (next 10–20 years) may be elevated in the subwatersheds to the potential benefit of fish habitat, and the subwatersheds running in flow deficit now would likely see increasing harvest and increasing summer streamflows in the next two decades.

The trajectory of hydrologic recovery shows BLM's cumulative contribution to subwatershed low flow condition. Even with the proposed regeneration harvest, and all BLM HLB acres returning to 0 year/flow surplus when approximately 90 years old, the hydrologic recovery acres increase in all subwatersheds during the analysis period due to the relatively large number of Reserve acres (Table 63**,** Figure 17). The BLM did not include acres of the proposed PCGP Proposed Route because construction of the PCGP would affect less than one percent of Reserve acres in only three of the subwatersheds within the analysis area and only crosses two proposed thinning units:

- PCGP crosses Yankee Run-East Fork Coquille River, Elk Creek, and Big Creek subwatersheds.
- PCGP crosses 3.75 acres in Elk 29 (Bear and Elk CT) Unit 10 of 20 acres. Crossing one stream on the far east boundary of the unit.
- PCGP crosses 1.9 acre in Golden Elk (Bear and Elk CT) Unit 1 of 8.19 acres and no streams.

The PCGP Proposed Route would cross approximately less than one percent of District-Designated Reserve, Riparian Reserve and Late-Successional Reserve in each of the subwatersheds. The cumulative effect of the proposed harvest plus the PCGP clearing does not impact summer streamflow conditions on BLM-administered land as measured by stand age would improve during the Issue analysis period. Furthermore, revegetated PCGP construction right-of-way, temporary extra workspace, and permanent easement features on BLM-administered land now in Reserve would not cross fish habitat as defined in the EA.

The trajectory of hydrologic recovery shows BLM's cumulative contribution to subwatershed low flow condition. Even with the proposed regeneration harvest, and all BLM HLB acres returning to 0 year/flow surplus when approximately 90 years old, the hydrologic recovery acres increase in all subwatersheds during the analysis period due to the relatively large number of Reserve acres (Table 63).

Apart from Belieu where the BLM manages approximately 39 percent of the forested acres and four percent of the forest acres are proposed for regeneration harvest and 72 percent of the BLM acres are in Reserve destined for hydrologic recovery, the BLM manages very little of the subwatersheds with the proposed HLB regeneration harvest and therefore has little cumulative effect on overall low flow. For example, the BLM is proposing approximately 450 acres of regeneration in the Belieu Creek subwatershed, an area with approximately 3,395 acres of private flow surplus and 2,291 acres of private flow deficit. In another example, the BLM is proposing approximately 140 acres of regeneration harvest in the Indian Creek subwatershed, an area with approximately 4,491 acres of private flow surplus and 3,494 acres of flow deficit. In the Yankee Run subwatershed, private acres of flow surplus and deficit are 3,286 and 1,994, respectively, versus BLM's proposed 98 acres of regeneration, In Big Creek Subwatershed, private acres of flow surplus and deficit are 4,240 and 2,432 respectively versus BLM's proposed 12.3 acres of regeneration. In Elk Creek Subwatershed, private acres of flow surplus and deficit are 2716 and 1412 respectively, versus BLM's proposed 27 acres of regeneration.

The BLM's effect on summer streamflow in these subwatersheds—minimized by a limited HLB and vegetation management that keeps transpiration and streamflow away from the extremes—is overshadowed by private management that produces larger flow surplus and larger flow deficit.

The BLM's ecologically based forest management practices are unlike experimental forest clearcuts or private forest practices. Regeneration as proposed would produce a modest change in summer surplus and deficit streamflow compared to clearcutting. Fish habitat would not be exposed either directly or indirectly to a significantly different flow regime post-harvest. Summer streamflow conditions on BLM-administered land as measured by stand age would improve during the time period for this analysis. The Reserve, making up 85 percent of the BLM's forest acres in the analysis area, would see flow deficit acres move to partial hydrologic recovery and then hydrologic recovery. In the HLB, retention and longer rotations would contribute to older age classes and an uptick in the amount and duration of partial hydrologic recovery acres on the landscape.

Stream Temperature

This stream temperature analysis is common to both alternatives. Perennial streams with fish habitat within and immediately downstream of the harvest units would not exceed the State's 64.4 °F criterion as a result of the proposed vegetation management. Based on nearby continuous stream temperature data, it's plausible that the 7DAMT of water exiting the proposed harvest units is at least 2.5 °F below the standard designated to protect salmon and trout rearing and migration. Retaining the RR would protect existing shade and maintain the current stream temperature conditions.

The majority of energy for summertime stream heating comes from solar radiation (Boyd and Sturdevant 1997) so it is important to maintain near-stream riparian vegetation that has a greater potential impact on stream shade production than riparian vegetation located farther away from the stream (USEPA 2013). The BLM would only be tree tipping within the inner zone and non-commercial thinning the middle zones of the RR. Thinning and tree tipping would be limited to 15 square feet of BA per acre maintain and would restore natural channel dynamics, processes, and the proper functioning condition of riparian areas, stream channels and wetlands by providing sediment filtering, wood recruitment, stream bank and channel stability, water storage and release, vegetation diversity, nutrient cycling and cool and moist microclimates.

With the exception of narrow (12–15-foot) yarding corridors and limited new road construction in the RR and with BMPs to disconnect the road network from hydrology, and the RR would extend 120 feet upslope from the ordinary high-water line along all within-unit perennial and intermittent streams. These RR distances are more than sufficient to prevent summer water temperature increases according to the Environmental Protection Agency (EPA) shade modeling documented in the Biological Opinion for the ROD/RMP. The EPA determined that 120-foot buffers would limit shade reduction and subsequent potential temperature increases to a few situations involving east/west stream aspects and low (40 percent or less) pre-harvest canopy cover (USDC-NMFS 2016 pp. 176, 242). The BLM is not proposing to commercially harvest within 120 feet of any stream, and there are no stream reaches in the proposed harvest units with less than 40 percent canopy cover; therefore, stream temperature increases are not a concern. The trees that would be cut down would be selective and not contribute to measurable increase in shade reduction. Any increase in temperature due to canopy openings would be mitigated by the benefits of the tree tipping and removal as stated in the fisheries report, hereby incorporated by reference. The non-commercial cutting of select trees in the riparian area would be selective and would be left to provide immediate wood delivery to the stream network. There would not be a long-term measurable increase in shade reduction and any increase in temperature due to canopy openings would be alleviated by the benefits of the tree tipping and removal by enhanced water quality and providing enhanced fish habitat and future large wood recruitment. (See Issue # 3.1.5). Groom et al. (2011) provides further evidence that the RR would protect current stream temperature conditions. The authors found no change in maximum temperatures for streams on Oregon's state forest land that had a 25-foot no-cut buffer and a limited entry zone out to 170 feet with retention of a least 50 trees per acre. The BLM expects a similar result, no change in maximum stream temperatures, because the RR has greater shade density than the buffer in the study—the RR is wider than both the no-cut and total buffer widths, and the RR contains more than 50 trees per acre.

In addition to shade, stream width and volume also affect stream temperature. A wide, shallow stream receives more energy and therefore increases in temperature faster than a stream of the same volume that is narrow and deep, and streams with smaller volumes of water change temperature faster than streams with larger volumes of water (Moore and Miner 1997). Regeneration harvest and thinning would produce incremental summer streamflow changes affecting water volume and wetted width slightly, but this would occur in stream reaches that are sufficiently shaded; therefore, existing 7DAMT conditions would persist.

Wildlife:

3.1.7 How would the proposed treatments in LSR and RR vegetation modification result in the availability and development of owl nesting, roosting, foraging (NRF) habitat within the owl nesting analysis area?

Methodology and Assumptions

Spatial scale: The BLM analyzed the spotted owls' ability to successfully nest, roost, and forage within a 1.5-mile buffer (the Oregon Coast physiographic province) for the spotted owl nesting action area, also referred to as the primary action area for owls. A portion of the proposed project overlaps the Klamath physiographic province with a smaller 1.3-mile home range. However, the project area has the majority of units north of highway 42 in the coastal province with the larger home range (1.5 mile), so a buffer of 1.5 miles was applied to all units to create the action area. In addition, the action area was expanded to include several known owl activity home ranges within the action area.

Spotted owls are considered central place foragers, with a home range in which a pair's activities center around the nest site (Rosenberg and McKelvey 1999). Spotted owl's use of an area is inversely related to the distance from the nest site (Rosenberg and McKelvey 1999). Spotted owls primarily occupy a 500-acre (0.5-mile buffer) core area around the nest tree. Their home range size relates to the primary prey in the area, with a 1.5-mile diameter home range in the Coast Region, where spotted owls rely on flying squirrels and red tree voles (Zabel et al. 1995, Forsman et al. 2004, USDI-FWS 2011). These circular areas are commonly used for a simple measure of habitat availability at multiple, ecologically relevant scales. However, the BLM acknowledges that spotted owls' habitat use is more complex, with owls using a combination of older seral habitat and younger forest types (Franklin et al. 2000, Olson et al. 2004, Dugger et al. 2005).

Sample tree falling may remove some individual trees with characteristics that could support spotted owl nesting or foraging functions. However, the sample trees are part of the analyzed units and have been included in the analysis as part of the proposed treatments.

The BLM first evaluated ownership and current habitat quality at the home range scale (USDI-BLM and USDI-FWS 2017). Based on best available information, life history functions of spotted owls are best supported when 30-40 percent of the home range and 50 percent of the core-use area consist of NRF habitat (summarized in USDI-FWS 2009, USDI-FWS 2011).

The spotted owl nesting analysis area of 1.5 miles out from the harvest units is approximately 93,252 acres of which 41,413 acres (44%) is in federal or tribal ownership. The BLM (Coos Bay) manages 40 percent (37,614 acres) of the action area. Coquille tribe owns 4 percent (3,799 acres). Private owners, predominately industrial timber companies, manage the remaining lands for timber production with 56 percent (51,839 acres).

Temporal scale: The BLM evaluated treatments in the LSR after 40 years by which time modelling shows that the stands that received commercial treatments would achieve the desired stand metrics for spotted owl NRF habitat. The BLM defined and quantified the desired future conditions of stand complexity for nesting-roosting habitat in the LSR using field visits, stand modeling with FVS, and recent research from Poage (2004, p. 19) in Table 3 (Andrews, Perkins, Thrailkill, Poage, & Tappeiner II, 2005).

Wildlife biologists worked with the District silviculture specialist to identify stands in the LSR that do not currently meet the conditions described in the ROD/RMP (USDI-BLM 2016b, pg. 64-67) to support spotted owl nesting habitat using a combination of GIS, FOI, stand exams, and RA10 modeling, but in which treatment would result in higher quality NRF habitat sooner with treatment. A similar method was used by fisheries biologists to identify areas within the Riparian Reserve that are not optimizing the goals identified in the ROD/RMP (USDI-BLM 2016b, pg. 64-67). The management direction in the riparian reserve is to provide stable wood in the stream (USDI BLM 2016b, p. 71). This management direction will result in large, open grown trees, large snags and down wood that will also improve spotted owl NRF habitat.

Suitable nesting habitat for spotted owls is typically found in complex forest stands with giant remnant conifer trees. Most of the documented use by spotted owls is in complex forests with multi-layered canopies (Davis et al. 2016). Stand conditions associated with high quality nesting habitat in the coast range modeling region include a large number of conifers with a large dbh (Davis et al. 2016). These trees are critical to the recovery of the species as detailed in the recovery plan (USDI FWS 2011). The trees are typically among the largest and oldest trees in the stands where they are located; they are the result of disturbances, which facilitated their development into suitable nest trees by eliminating competition for light and other resources. Trees used for nesting can take centuries to develop, while other elements of complex forests can develop in decades. For example, depending on growing conditions, middle story hardwood trees can develop in three to four decades, and large trees (>32”-48” dbh) can develop in about six to eight decades if they have enough light and other resources (Hersey et al. 1998).

Silviculture Model

The effect of past management practices including timber harvest and fire suppression on BLM administered lands and at the proposed treatment unit scales is a continuation of closed canopy, simplified stand conditions. When an even-aged stand grows for many years within this zone of imminent competition mortality, mortality will occur and individual tree growth is reduced compared to the growth rates found in open growing conditions (Drew and Flewelling 1979, Tappeiner et al. 2007, pg. 124). Without treatment, stand growth would remain stagnant as stands would be left in overly dense conditions, and because trees growing in dense conditions grow in height, but very little in diameter, stand stability will decline (Oliver and Larson 1996b, Tappeiner et al. 2007). As a result of the limited resources for tree growth in the stands, diameter growth will lag behind height growth (O'Hara 2014), and the risk for windthrow will increase over time as height to diameter ratios continue to increase and crown ratios decrease. In dense stands, large trees are unlikely to persist or develop and a stagnant stand is unlikely to develop large diameter snags or down wood, which are important for owls nesting and roosting (Buchanan et al. 1995, Hershey et al. 1998).

Concentrated areas of older forest suitable for nesting and roosting, or increased amounts of heterogeneity (i.e., mixture of conditions used for foraging), have positive effects on the vital rates of spotted owls (Franklin et al. 2000, Olson et al. 2004, Forsman et al. 2011, Dugger et al. 2016c). Collectively, these and other studies suggest that spotted owls select for abundant, structurally diverse closed-canopy forest with late-seral forest edge at the territory scale, and relatively lower fragmentation in nesting areas (Franklin et al. 2000, Olson et al. 2004, Sovern et al. 2015). The proposed action would temporarily reduce the function of RF stands that are commercially treated but would accelerate the development of large trees with complex, heterogeneous stand conditions. In many cases, the stands proposed for treatment are dense, uniform stands that currently provide little or no utility for spotted owls since they are too dense to function even as dispersal habitat. In non-commercial units, the treatments would be light enough and spread throughout the units such that significant changes to the pre-treatment conditions at the stand level are not expected.

The characteristics of forage habitat in the Oregon Coast Range, as described in the Revised Critical Habitat Rule (USDI-USFWS 2012a), correlate with northern flying squirrel and red-tree vole preferential habitat. Forage habitat is positively associated with tree height diversity, canopy cover greater than 60 percent, density of snags over 20 inch dbh, density of trees 20-31 inches dbh, and an increasing volume of woody debris (USDI-USFWS 2011b, 77 FR 71907). While both the flying squirrel and red-tree vole prefer mature, complex stands, both species can be found in lesser numbers in younger, less structurally complex stands, particularly in young stands adjacent to older stands, or with legacy features. As discussed in Issue 3.1.4, thinning would promote minor species, including hardwoods. These minor species are important to spotted owls which may preferentially select broadleaf or hardwood edges, primarily riparian (Glenn et al. 2004, Wiens et al. 2014), likely for additional forage opportunities.

Most of the stands proposed for thinning do not currently support much, if any, forage function. However, in stands that do, thinning may negatively affect the prey species that spotted owls rely on, although how long this effect continues after thinning is not well understood (Sakai and Noon 1997, Hansen and Dunk 2016). Post-treatment, stands are expected to support foraging within 10-20 years as the opened canopy would promote lower-story development and treatments would provide an increased number of larger snags and down wood in the next decade (Harrington et al. 2005, Davis and Puettman 2009, Ares et al. 2010). For these reasons, the proposed action would not delay the development or availability of spotted owl forage habitat beyond 10-20 years and would likely provide higher quality forage habitat after that.

To evaluate how the proposed commercial actions accelerate the development of nesting habitat in 40 years, the BLM conducted forest stand trajectories that were modeled using FVS, as defined in Section 3.1.4. The Pacific Northwest FVS variant was used over a 60-year time horizon that models anticipated treatment outcomes, with 20-year increments. The program models stand growth trends based on current stand conditions and user applied treatment parameters. The stands within LSR were identified using forest principles described in the Silviculture Report, hereby incorporated by reference (pp. 9-10), and stratified by FOI, first sorting by age class, and then populated with LiDAR derived stand metrics from the South Coast lidar acquisition (BA, QMD, Lorey's Stand Height, and TPA). When the stands were grouped by age class, they displayed a normal distribution in these four metrics. In 2019, BLM foresters then sampled a subset of these that represented the range of conditions within each age class using common stand exam methods. The stand exams were then modelled using the FVS Pacific Northwest Variant defaults, thinning to 20, 30 and 40 RD as well as a "No Action" over a 60-year period to analyze the difference between these thinning intensities. The results were summarized into Tables 65-67 (Appendix H) that show the 40, 50, 60, and 70 - 90-year-old age classes under a heavier thinning intensity (20-30 RD), and a lighter thinning intensity (30-40 RD). All LSR commercial treatments would accelerate to NRF in 40 years based on the stands and modeling post-treatment compared with no action or non-commercial treatments. As shown in Table 59 (Appendix H), in 40 years, the model predicts that the treated stands would achieve the desired mid story conifer numbers in the 21-32" dbh size class and the overstory conifer numbers in the 32-48" dbh size class. Because overstory trees take longer to develop and are more important to support spotted owl nesting, we weighted achieving the overstory metric higher than the mid-story metric. Therefore, in some cases, we would consider the stand successful if the overstory numbers are at or slightly over the target, even though the mid-story metric is farther from the desired outcome.

Based on the modeled outcomes shown in Tables 55-57 (Appendix H), individual units have been assigned to a "Light Thinning" or "Heavy Thinning" density target to best achieve NRF habitat. The modelled results found in Tables 58 (Appendix H) show that thinning these stands as early as possible is the best way to achieve the above-mentioned (Table 3) desired stand conditions for NRF habitat over time. For example, 40- and 50-year-old stands attain many of the key structural characteristics of nesting habitat by age 80-90 when they are thinned heavily now. The heavy thinning with group selections allowed the stand to differentiate into multi-layered canopies and recruit new cohorts of trees.

Potential Owl Core Areas (POCA)

One management direction under the ROD/RMP directs the BLM to "manage for large blocks of northern spotted owl nesting-roosting habitat that support clusters of reproducing spotted owls, are distributed across the variety of ecological conditions, and are spaced to facilitate the movement and survival of spotted owls dispersing between and through the blocks" (USDI-BLM 2016b, p.64).

To evaluate how the proposed action effects the nesting support of the owl nesting action area, the BLM developed a Potential Owl Core Area (POCA) analysis. The BLM completed a neighborhood analysis of the 20 year Gradient nearest neighbor (GNN) spotted owl habitat raster (Davis *et al.* 2016), calculating the percent of suitable and highly suitable habitat within a 500 acre (0.5 mile radius) area in a moving window around each 30 meter raster cell within the owl nesting action area. Cells with more than 50 percent of the neighboring cells supporting suitable and highly suitable habitat were identified as POCA site centers (centroids), and the 500 acres around these cells were identified as POCAs. The BLM then altered the GNN raster data to reflect spotted owl habitat changes in 40 years, including potential treatments under the three alternatives, and re-ran the neighborhood analysis resulting in areas of modeled habitat that could support POCAs. The POCA provides an analysis tool for measuring increase in nesting habitat and areas where that increase would result in 500-acre circles with more than the 50 percent threshold of NRF that increases the likelihood of reproductive success (summarized in USDI-USFWS 2009, USDI-USFWS 2011). The BLM considered 500 acres to be a meaningful scale to spotted owls because the amount of habitat at this scale is related to survival and reproductive success (Olson et al. 2004, Dugger et al. 2005).

The output of the POCA is larger than the treatment units or mapped NRF because it groups habitat into blocked areas (polygons) using the neighborhood or moving window analysis which magnifies the availability of the potential habitat, so blocks that previously did not have at least 50 percent NRF may become available with strategic restoration work.

To evaluate habitat change from the 3 alternatives in the BWE project area the POCA was the analysis based the silvicultural modeling of commercial treatments models (Section 3.1.4) and made the assumption that in 40 years all planned commercial units in HLB and in private and tribal ownership will no longer be habitat, all planned commercial units in LSR would become NRF habitat; in addition, all current RF and NRF habitat, within LSR and/or RR, was modeled as NRF in our 40 year output. While all non-commercial units were not modeled to become habitat within 40 years, their treatments would still improve the habitat by including missing legacy components required for nesting by spotted owls.

Analysis Methodology

The management direction in the LSR under this EA is to accelerate or improve future spotted owl nesting habitat conditions. The BLM assumes stands within the Oregon Coast Range develop spotted owl nesting characteristics as early as 80 years-old (Franklin and Spies 1991). While other components, such as coarse-woody debris, snags, and stand complexity contribute to the age at which a stand is suitable for habitat, the 80-year age class provides a reasonable temporal scale to evaluate the proposed actions. The RR purpose for this project (See Section 1.3.2) would also promote features of NRF habitat in the RR as discussed above.

Within Coos Bay BLM managed lands, spotted owl habitat is mapped as one of four categories: NRF, roosting-foraging (RF), dispersal-only, or non-habitat. Mapped habitat on BLM-managed land was verified with field visits, LiDAR data, and aerial photos. The BLM used analysis from Davis et al (2016) to estimate stand functional type relative to owl use on forest stands on other federal and private lands. The BLM assumed the Highly Suitable and Suitable fields describe available NRF habitat, and the Marginally Suitable fields describe dispersal-only habitat. Davis et al (2016) does not break out habitat that is suitable for only roosting and foraging but not nesting.

The BLM assumes that private land will continue to be harvested on a 40–60-year rotation and will not develop into spotted owl habitat. Therefore, throughout this analysis the BLM assumed early- or mid-seral stand conditions on private land using the Davis et al. (2016) model of owl habitat (USDI BLM, 2016c, pp. 168, 340).

The following analysis focuses solely on spotted owl nesting habitat development. A detailed account of the taxonomy, ecology, and reproductive characteristics of the spotted owl can be found in the Final Recovery Plan (USDI-USFWS 2011); various status reviews (Courtney et al. 2004, Anthony et al. 2006, Davis et al. 2016); the Interagency Scientific Committee Report (Thomas et al. 1990); final rule designating the spotted owl as a threatened species (50 CFR Part 17); population and habitat monitoring reports (Davis et al. 2011, Forsman et al. 2011, Davis et al. 2015); and several key monographs (Forsman et al. 1984, Meyer et al. 1998, Forsman et al. 2002, Anthony et al. 2006, Wiens et al. 2014).

Affected Environment

The BLM and GNN models mapped approximately 15 percent (14,403 acres) of the action area as NRF habitat. Of the action area on Coos Bay BLM managed lands, NRF comprises 31 percent (11,799 acres). The GNN model maps approximately 3 percent (1,442 acres) of nesting habitat on private timber lands; however, these are generally individual raster cells adjacent to federal lands or within riparian corridors, so they are discounted.

Within the owl nesting action area, there are currently approximately 18,390 acres of POCA, about 20% of the area as shown in Table 12.

Table 12. Potential Owl Core Areas (POCA), defined as 500-acre areas with greater than 50% NRF within the spotted owl nesting action area currently, and modelled out to 40 years for the three alternatives.

	POCA centroid acres, % of action area	POCA 500-acre buffer acres, % of action area
POCA baseline, currently	3,638 (4%)	18,390 (20%)
No action POCA, 40 years	6,032 (6.5%)	21,551 (23%)
Alt 2 POCA, 40 years	13,790 (14.8%)	39,596 (42.5%)
Alt 3 POCA, 40 years	13,841 (14.8%)	39,599 (42.5%)

Environmental Effects

Alternative 1 - No Action

Direct and Indirect Effects: Under the No Action alternative, stands would continue to develop under overstocked conditions and lack legacy features of quality nesting habitat for owls. At 40 years from present, FVS modeling indicates stand metrics would support some of the conditions associated with spotted owl nesting habitat, such as canopy cover. However, as described in the Issue 3.1.4, the increased competition associated with high relative density stands would limit development of the multi-story canopy and complexity required by spotted owls for nesting.

The BLM altered the GNN raster data to reflect spotted owl habitat changes in 40 years due to the proposed actions and re-ran the POCA neighborhood analysis. The BLM modelled habitat changes to evaluate the difference in spotted owl habitat development between the alternatives in the POCA. When we apply the POCA analysis for the BWE project area to current conditions, there are 18,390 acres suitable for potential owl core areas or 20 percent of the owl nesting action area. The POCA analysis assumes the NRF will remain, RF will develop into NRF based on the silviculture modeling in 40 years, but dispersal habitat will not develop into NRF habitat because, as discussed in Issue 3.1.4, the stands would continue to develop in an even aged, single story structure with dense canopy closure. Under a no action alternative, 21,551 acres or 23 percent of the owl nesting action would become NRF habitat within 40 years, which is the least amount of NRF for the three alternatives.

After 40 years, the modeled stand would include snags, some down wood, and some larger trees. While these features would benefit spotted owl prey species, there would likely be fewer large overstory conifers 32-48" dbh than in Alternative 2 and 3. There would also be smaller diameter snags and down wood, less down wood, and less species diversity than either of the action alternatives. Without these additional characteristics associated with a complex forest, the stands would be less likely to support successful spotted owl nesting.

Alternative 2 and 3

Direct and Indirect Effects: Both alternative 2 and 3 would increase owl nesting habitat in 40 years through commercial treatments in LSR. The treatments are not proposed to occur in current NRF habitat but are proposed in RF which would temporarily downgrade habitat by decreasing canopy cover and removing the understory throughout most of the stand in the harvesting process. However, over time, proposed treatments would increase the missing stand components that are not currently present. The LSR treatments would develop components that are required for high quality NRF habitat such as snags, open grown trees, a diverse understory, and down wood.

Under alternative 2 there are 1,328 acres proposed for commercial treatment in LSR and 300 acres of commercial treatment in RR; compared to alternative 3 there are 1,526 acres of commercial treatments in LSR and 313 acres of commercial treatment in RR proposed. When the BLM applies the silviculture models for the BWE project area and POCA assumptions, in 40 years under alterative 2 there would be 39,596 acres of POCA and under alternative 3 there would be 39,999 acres of POCA or about 43 percent of the owl nesting action area for both alternatives. The commercial treatments would create NRF and create larger blocks of NRF available for spotted owls resulting in improved likelihood of reproductive success. If Alternative 2 or 3 were implemented, there would be almost double the amount of POCA's available compared the no action in 40 years. There is no significant difference between alternative 2 and 3.

Cumulative Effects: There is one known contemporaneous federal action within the project area: The Pacific Connector Gas Pipeline. The PCGP would intersect the owl nesting action area. The spotted owl nesting action area intersects with 383 acres of the pipeline ROW; of which 66 acres are NRF or RF (17 percent). The PCGP would remove these 66 acres of spotted owl NRF/RF habitat within the owl nesting analysis area. The PCGP in combination with the proposed treatments have negligible cumulative effects due to the limited size, and linear geographic placement of the pipeline in relation to the proposed project. The PCGP would change the modelled outputs by less than 1 percent.

Private timber lands in the action area would not contribute to spotted owl NRF or RF habitat due to the short harvest rotation of approximately 40-60 years. The BLM does not know how the tribal land will be managed, so for this analysis we conservatively assume that it will be harvested regularly and will not develop into NRF habitat.

The proposed BWE project would not reduce spotted owl NRF habitat currently on the landscape and would accelerate the development of future nesting habitat. In 40 years, either of the proposed action alternatives would accelerate the development NRF through thinning treatments, resulting in 43 percent of the owl nesting action area supporting POCA's under Alternatives 2 and 3; compared to 23 percent development of POCA development under the No Action alternative.

3.1.8 How would vegetation modification affect known spotted owl nest sites in the project area?

Methodology and Assumptions

The BLM evaluated the proposed projects' potential impacts on known spotted owl nest sites in the project area by evaluating all known spotted owl activity centers within a 1.5-mile buffer around the proposed project. Seventeen spotted owl activity centers have some overlap with the 1.5-mile analysis area, seven of which would be affected under Alternative 2, and eight of which would be affected under Alternative 3. Since the remaining nine home ranges would not be affected, they are not discussed further.

Surveys in most of the proposed project area were conducted 2019-2020, with additional surveys beginning in 2020 and scheduled for completion in 2021. Surveys or spot checks per the spotted owl survey protocol will continue until sales are complete (USDI USFWS 2012b).

Spotted owls move around the landscape and several of the activity centers have multiple alternative nest sites, or areas where concentrated activity has occurred. For this analysis, the BLM used the most recently occupied activity center. If future surveys or spot checks suggest that the center has moved, the BLM will evaluate whether the effects would change and make changes to the timing or the footprint of the project as necessary to ensure that the effects are within the analysis described in this document.

Most private land in the area is managed for industrial timber production. It is generally clear-cut on a 40–60-year rotation, and the BLM assumes it would continue to be managed in this way in the future. Spotted owls will use this habitat to some extent, but it is unlikely to provide nesting and nesting/roosting habitat functions.

Affected Environment

The BLM evaluated the owl home ranges in the analysis area to identify which have the potential to become high-quality nesting owl sites. The best available information suggests that a minimum of 40 percent of the home range and 50 percent of the core be in NRF habitat to support a reproductive owl pair at both scales (summarized in USDI-USFWS 2009, USDI-USFWS 2011). As noted above, private land is unlikely to ever develop the characteristics to become NRF habitat due to the short harvest cycle. Therefore, the BLM first evaluated how much of each home range is in BLM ownership. As Table 40 shows, two of the home ranges that overlap proposed sale units do not have sufficient BLM ownership to reach these thresholds: McKinley Road and Kincheloe Quarry. The remaining six home ranges have sufficient BLM ownership that they could eventually achieve 40 percent NRF at the Home Range and 50 percent NRF at the Core scale if the land were managed to develop into NRF habitat: Bear Pen, Elk Loop, Brewster Valley, Brownstone Headwaters, Steel Creek, and Remote. However, portions of the home ranges are designated as HLB, and so are not expected to develop into NRF habitat. The BLM evaluated the effects of treatments with the LUA considered for each home range individually in the Environmental Effects Section below.

The PRMP/FEIS, hereby incorporated by reference, modelled that land in the LSR and RR would eventually develop the characteristics of NRF habitat (USDI BLM, 2016c, pp. 928-994). As described in Issue 3.1.4, modelling for BWE concluded that the proposed commercial treatments in the LSR would develop into NRF within 40 years. The proposed non-commercial treatments are small enough in scale that modelling does not show a difference at the stand scale between non-commercial treatments and the no-action alternative in stands achieving NRF characteristics by that time (Table 67, Appendix H). Non-commercial treatments would result in localized responses due to snag creation and individual tree response to increased light from adjacent openings, but modelling does not show that non-commercial treatments would move the stand as a whole, significantly towards NRF habitat within 40 years. At a stand scale, dense, overstocked conditions would persist with an even aged, single story canopy that would restrict seedling recruitment. While the proposed work in the RR outer zone and middle zones is primarily focused on growing large trees to deliver stable wood to the stream (USDI BLM, 2016b, pp. 71-72), thinning to promote large tree growth would also promote development of NRF habitat since large trees that provide stable wood also function as nesting and roosting structure. Thinning would also encourage development of an understory, resulting in complex stand conditions.

The BLM evaluated each of the home ranges overlapping the proposed timber sales using a suite of factors to identify potential high priority areas for restoration to identify where restoration efforts were more likely to provide habitat used by reproductive spotted owls. These factors include; land in reserves; high (greater than 50 percent at the 500-acre scale) percent federal ownership; high (greater than 70 percent) percent valley (spotted owls preferentially select the bottom 1/3 of valleys to nest in); and a MaxEnt score of greater than 0.18 to determine potential suitability for spotted owl nesting (MaxEnt is a model that combines habitat characteristics with owl monitoring data to map areas more likely to be suitable for spotted owl nesting) (USDI-BLM and USDI-FWS 2017). Portions of all the home ranges except for McKinley Road (2117O) have areas with moderate to high potential for restoration based on these factors.

Table 40 (Appendix G) shows a comparison between the two action alternatives by spotted owl home range at the nest patch, core, and home range scales. Because the effects at each scale are important for evaluating the likelihood of spotted owl reproductive success, the numbers are given independently for each scale. For example, the number presented under an alternative for nest patch is also included in the core and home range. Since some treatments overlap more than one home range, those acres appear twice. New roads are grouped with regeneration harvest since they also remove habitat and are counted as part of the harvest unit.

Environmental Effects

The BLM compared differences between the treatments by home range and alternatives. We assume that in 40 years, regenerated areas would not provide NRF habitat. For thinning treatments in the LSR and RR, the number of acres treated are often similar between alternatives, but more acres are treated non-commercially in Alternative 2 compared with Alternative 3 because without new road construction to access units, commercial treatment is not possible.

Non-commercial treatment includes the creation of snags, down wood, and very small gaps (up to one acre, but averaging 0.25 acre) (USDI-BLM 2020). In addition to increased snags and down wood, these actions would allow some additional light into localized areas in the stand which would encourage growth in the trees nearby, resulting in individual trees with a larger DBH and some increased branch development. Because of the small scale of these treatments, they are unlikely to result in significant changes to stand composition such as development of a multi-cohort stand, open grown trees, or persistence of shade intolerant hardwoods, which define NRF habitat (Issue 3.1.4, Thomas *et al.* 1990, Courtney *et al.* 2004). Therefore, in 40 years, stands treated non-commercially would promote individual trees with structure that would provide some increased nesting and roosting opportunities as well as more snags and down wood, but modelling could not distinguish between the no action and non-commercial treatments that would be unlikely to promote NRF development at the stand scale.

Table 40 (Appendix G) shows the stand change differences between Alternative 2 and Alternative 3. As discussed above, the changes would be small enough for non-commercial treatments that the modelling could not detect changes in the stand in 40 years compared with the No Action. Modelling shows the commercial treatments will result in more stand diversity leading to NRF development in 40 years.

Alternative 1 - No Action

Direct and Indirect Effects: HLB and New Road Construction: The Coos Bay District would go forward with another similar sale involving regeneration harvest at a different location in the HLB to achieve the required ASQ quota established in the ROD/RMP (USDI BLM 2016b). Since this alternative sale location is not known, the BLM cannot provide specific effects of this alternative on spotted owl home ranges.

LSR and RR: Stands would continue to develop in dense conditions with few large snags, open grown trees or stand diversity, including hardwoods. The stands would have delayed NRF development and ultimately have lower quality NRF.

Alternative 2

Direct and Indirect Effects: Proposed thinning treatments within home ranges are in the LSR or RR only. In the LSR, treatments are designed to meet the need of promoting the development of NRF as described in Section 1.3.1. Treatments in the RR outer and middle zones are designed to develop large trees to deliver stable wood into the stream. As discussed above, these treatments would promote development of large tree growth that would also provide spotted owl nesting habitat. The proposed action includes commercial and non-commercial treatments. Commercial treatments would only occur in stands with road access due to the volume of material that would be cut while non-commercial treatments do not require road access since treatments would be relatively minor. Modelling suggests that commercial treatments would create growing conditions for improved NRF habitat at the stand scale by 40 years post-treatment (Table 67, Appendix G). As discussed above, while non-commercial treatments would increase the number of snags and down wood and promote larger dbh and structure development of some individual trees caused by small gaps created nearby, the effects of non-commercial treatments are so small that the effects are not distinguishable from the No Action alternative, at the stand scale.

Brewster Valley (2317A) and **Steel Creek (2347O):** All the work proposed in these home ranges is in LSR or RR with the purpose of developing the treated stands into better quality NRF habitat more quickly than if they were not treated (i.e., the No Action). The proposed treatments would treat approximately one percent non-commercially at the home range scale in Brewster Valley, and less than one percent commercially. In Steel Creek, less than one percent of the home range would be treated non-commercially. Under Alternative 2, in Brewster Valley, 58 acres would be treated non-commercially, and 10 acres would be treated commercially while in Steel Creek, 11 acres would be treated commercially. As discussed above, non-commercial treatments would cause only minor changes to the forest structure, which may provide conditions for some individual trees to grow but would not be sufficient to cause the areas treated to develop into high-quality NRF habitat demonstrably faster than the No Action alternative.

As discussed above, both of these home ranges have been surveyed as unoccupied. However, even if they were to become occupied, the BLM would continue with the proposed harvest activities. Proposed Treatments are outside of the Core area and spotted owls would still be able to use the habitat post-treatment. Therefore, even if a spotted owl were to occupy the site, the proposed harvest would not affect its ability to successfully reproduce in these home ranges. The treatments would result in minimal changes in these home ranges compared with the no-action alternative.

If the Bear Pen, Elk Loop, or Brownson Headwaters sites were to be surveyed as occupied, the BLM would not go forward with the proposed actions within the core unless two years of additional 6-visit surveys found the site to be unoccupied in the future. Outside of the core, the BLM would implement timing restrictions within the disruption distance during the critical breeding season (see PDFs). The treatments in these home ranges are all in the LSR or RR and are a combination of commercial and non-commercial treatments. Modelling suggests that the proposed treatments would accelerate NRF development, making these sites more likely to support a spotted owl pair in the future.

Bear Pen (2180A): Compared with the no-action alternative, in 40 years, the BLM models that commercial treatments would increase the amount of NRF at the nest patch scale by approximately 19 percent, bringing NRF up to 91 percent. NRF at the core scale would increase by 16 percent, bringing the total up to 59 percent. NRF at the Home range scale would increase by 7 percent, bringing the total up to 36 percent NRF. As discussed above, the BLM assumes that non-commercial treatments would not result in stand level changes to NRF, although there would be some individual trees that would develop structural complexity, under Alternative 2, non-commercial treatment would occur in 2 percent of the nest patch, 1 percent of the core, and 3 percent of the home range. These changes combined would make it much more likely that this home range could support a successful spotted owl pair in the future.

Elk Loop (2182O): In 40 years, the BLM models that commercial treatments would increase the amount of NRF at the nest patch scale by approximately 11 percent, bringing NRF up to 84 percent. NRF at the core scale would increase by 5 percent, bringing the total to 68 percent. NRF at the Home range scale would increase by 2 percent, bringing the total to 42 percent NRF. As discussed above, the BLM assumes that non-commercial treatments would not result in stand level changes to NRF, although there would be some individual trees that would develop structural complexity, under Alternative 2, an additional 6 percent of the core, and 2 percent of the home range would be treated non commercially. These treatments would make it more likely that this home range could support a successful owl pair in the future.

Brownson Headwaters (2318O): In 40 years, the BLM models that commercial treatments would increase the amount of NRF at the nest patch scale by approximately 11 percent, bringing NRF up to 82 percent. NRF at the core scale would increase by 12 percent, bringing the total to 49 percent. NRF at the Home range scale would increase by 10 percent, bringing the total to 35 percent NRF. As discussed above, the BLM assumes that non-commercial treatments would not result in stand level changes to NRF, although there would be some individual trees that would develop structural complexity, under Alternative 2, an additional 6 percent of the nest patch, 9 percent of the core, and 6 percent of the home range would be treated non commercially. These treatments combined would make it more likely that this home range could support a successful owl pair in the future.

If surveys determine that the Remote site is occupied, the BLM would drop all commercial harvest in these units, with the exception of the proposed regeneration harvest unit The Belieus, which is on the edge of the home range, separated from BLM land by nearly a mile of private timberland.

Because the impact of non-commercial treatments in the inner riparian zone is small due to the limited number of trees cut and the narrow band where it occurs, non-commercial treatments in the riparian zone outside of the core areas would go forward in the Remote home range with seasonal timing restrictions (PDF 41).

Remote (3169O): Approximately 3 percent of dispersal habitat at the core scale and 4 percent at the home range scale would be removed through regeneration harvest. The potential effects are limited because the proposed harvest is entirely in dispersal habitat. However, since habitat is already limited in the home range, it has been hypothesized that owls will use dispersal habitat for some functions for which they would normally rely on NRF, although spotted owl use of younger forests may represent habitat availability rather than species' preference (Glenn et al. 2004). Additionally, 2 percent of the core and 1 percent of the home range would be thinned non-commercially and an additional 1 percent of the home range would be thinned commercially to promote NRF development in the future. In 40 years, these treatments would increase the amount of NRF at the core scale to approximately 38 percent, and at the home range scale to approximately 33 percent. Post treatment, the amount of NRF at both scales would still be below the minimum thought necessary to support a successful breeding pair as discussed in the Affected Environment section above.

The BLM has committed to continuing full 6-visit surveys in the Remote home range until the units that overlap it (Lower Frenchie) are sold. The Lower Frenchie units overlap the Core and extend to the edge of the home range. In addition, the BLM will offer the Lower Frenchie Units that overlap the Remote home range, as well as the Rock Slide unit that overlaps the Kincheloe Quarry home range, as the last two HLB units, after other HLB harvest units have been sold or deferred. The effects of the proposed sale are further reduced because the nest patch is across a major road (Hwy 42) from the proposed units.

While the site has been occupied within the past 10 years, with the commitment to continue full 6-visit surveys until the Lower Frenchie units have sold and to sell the Lower Frenchie units (along with the Rock Slide units) at the end of the HLB sales, the BLM is doing due diligence to ensure that the home range is not re-occupied. The low percentage of NRF and reserve lands in the home range, make it unlikely to support a successful reproductive owl pair in the future. The BLM is not removing NRF or RF from the home range. Therefore, while the site has been occupied within the past 10 years, because of the commitment to delay the sales as long as possible, the low amount of NRF, LSR and RR in the home range, and because the proposed work would only occur in dispersal habitat, the BLM is taking steps to ensure that work is not done in an active owl home range. With the low amount of NRF and land in a protected status, the home range is not likely to be able to support a successful reproductive pair under current conditions or with the implementation of the RMP.

In addition to the regeneration treatments proposed, the BLM is proposing to do commercial thinning, resulting in an approximately 1 percent increase at the home range scale, bringing the total amount of NRF up to 30 percent. The BLM is also proposing non-commercial treatment of approximately 2 percent at the core scale and 1 percent at the home range scale, which as discussed above may improve individual features within the stand. With these treatments, the home range would still be below the minimum thought necessary to support a reproductive spotted owl pair as discussed in the Affected Environment section above.

Alternative 3

Direct and Indirect Effects: See the discussion above in Alternative 2 regarding modelled projections for commercial compared with non-commercial treatments.

Work would go forward in the following home ranges regardless of whether the site is surveyed as occupied due to the location of the proposed units in the site: McKinley Road, Brewster Valley, and Steel Creek since the proposed timber sales would not change the ability of the site to support a spotted owl pair. Seasonal restrictions would not be required because the proposed units are outside of the disruption distance of the nest patch so incidental take would not occur.

McKinley Road (2117O): The BLM would construct approximately 1 acre of new road and conduct 16 acres of regeneration harvest at the edge of the home range. The proposed sale unit is separated from the nest patch by two ridge systems and nearly a mile of private land, in which owls are unlikely to spend much time. For these reasons, the proposed unit is unlikely to provide functional spotted owl habitat for the activity center of this site. The proposed work would remove NRF at the home range scale by less than one percent. As Table 36 (Appendix G) shows, the site has six percent NRF/RF at the home range scale and is 25 percent LSR or RR, well below 50 percent in both of these categories, making it less likely to be successfully used by a reproductive pair. Therefore, even if the site were to become occupied, the proposed sale would not affect the owls' ability to use the home range.

Brewster Valley (2317A): There is no difference between the alternatives for this site. Refer to the analysis under Alternative 2 above.

Steel Creek (233O): There is no difference between the alternatives for this site. Refer to the analysis under Alternative 2 above.

If the Bear Pen, Elk Loop, or Brownson Headwaters sites were to be surveyed as occupied, the BLM would not go forward with the proposed actions within the core unless two years of additional 6-visit surveys found the site to be unoccupied in the future. Outside of the core, the BLM would implement timing restrictions within the disruption distance during the critical breeding season (Table 21). The proposed project would not impede the ability of spotted owls to reproduce.

Within these home ranges, while the total acres treated are very similar between alternatives, resulting in a two percent or less difference in NRF available after 40 years (Table 39, Appendix G), due to accessibility because of new road construction, many of the proposed treatments would change from non-commercial treatments under Alternative 2 to commercial treatments under Alternative 3. The units for which commercial treatment are proposed were modelled to respond much better to a heavier thinning than the minimal work that would occur from a non-commercial treatment. Commercial thinning would promote trees with a large diameter suitable for developing into spotted owl nesting and roosting structure in the future, a more diverse understory, and a more developed multi-canopy layer at the stand level, all characteristics of NRF habitat (e.g. Thomas et al. 1990, Courtney et al. 2004). See Section 2.5.2 of the BA for further discussion of the benefits of commercial thinning.

Bear Pen (2180A): Twenty more acres would be treated commercially than non-commercially at the home range scale under Alternative 3 than Alternative 2. There would be no differences in proposed treatment at the nest patch or core scale between alternatives. The additional 20 acres treated commercially under alternative 3 would not change the percent of the home range treated between alternatives. As noted above, the proposed treatments would make it much more likely that the home range could support a successful spotted owl pair in the future.

Elk Loop (2182O): Under Alternative 3, there would be no difference in the acres treated in the nest patch compared with Alternative 2, but 1 percent more of the core and home range would be treated commercially than under Alternative 2, bringing the total percent NRF up to 69 percent and 43 percent in 40 years in the core and nest patch respectively. These changes are relatively minor and are unlikely to increase the likelihood of a successful pair occupying the site compared with Alternative 2.

Brownson Headwaters (2318O): Under Alternative 3, there would be no difference in the acres treated in the nest patch. Approximately 1 percent less of the core would be treated than under Alternative 2, while 2 percent more of the home range would be treated commercially than in Alternative 2, bringing the total percent NRF up to 48 percent and 37 percent in 40 years in the core and nest patch. The nest patch would be treated commercially under Alternative 2, bringing the total percent NRF up to 69 percent in the core and 43 percent in the nest patch in 40 years. These changes are relatively minor and are unlikely to increase the likelihood of a successful pair occupying the site compared with Alternative 2.

If surveys determine that the Kincheloe Quarry or Remote site are occupied, the BLM would drop all commercial harvest in these units, with the exception of the proposed regeneration harvest unit, The Belieus, which is on the edge of the home range of both sites, separated from BLM land by nearly a mile of private timberland. Because the impact of non-commercial treatments in the inner riparian zone is small due to the limited number of trees cut and the narrow band where it occurs, non-commercial treatments in the riparian zone outside of the core areas would go forward in the Remote home range with seasonal timing restrictions (PDF 41).

Kincheloe Quarry (3167O): The proposed project would decrease the amount of NRF available in the nest patch by 34 percent, at the core scale by 9 percent and at the home range scale by 1 percent compared with the no-action and Alternative 2. The proposed project would remove approximately 2 percent of dispersal habitat from the nest patch 3 percent from the core and less than 1 percent from the home range. With 32 percent of the home range and 41 percent of the core in NRF/RF, the site is already below the minimum that the Service considers the amount of NRF necessary for supporting a reproductive spotted owl pair at both scales (summarized in USDI-USFWS 2009, USDI-USFWS 2011). These reductions would further reduce the likelihood that a spotted owl pair could successfully nest in the home range if Alternative 3 were implemented.The BLM has committed to continuing full 6-visit surveys in the home range until the Rock Slide units, which overlap the Kincheloe Quarry nest patch and core, are sold. In addition, the would offer the Rock Slide and Lower Frenchie units (which overlap the Remote home range) as the last two HLB sales, after other HLB harvest units have been sold or deferred.

Remote (3169O): The proposed regeneration harvest is the same under Alternative 3 as Alternative 2. Under Alternative 3 approximately 1 percent of the core would be treated with commercial thinning and 1 percent with non-commercial thinning to promote NRF development compared with 2 percent treated non-commercially in Alternative 2. As noted in the Alternative 2 discussion, the core and home range would still be below the minimum percentages that make the home range more likely to support a successful reproductive pair.

Cumulative Effects:

Other than on-going timber harvest on private land, the only reasonably foreseeable future action that would impact spotted owl nesting habitat within impacted home ranges is the proposed PCGP which would remove NRF or RF habitat from three home ranges: McKinley Road, Elk Loop, and Brewster Valley (Table 13).

Table 13. Acres of NRF/RF removed by the proposed PCGP in spotted owl home ranges that also overlap BWE timber sales.

Site IDNO	Site Name	Physiographic Province	Acres NRF/RF Removed	
			0.5-mile Core	1.5-mile Home Range
2117O	McKinley Road	Coast	0	2
2182O	Elk Loop	Coast	3	7
2317A	Brewster Valley	Coast	0	9

These additional acres of removal would result in a change of less than one percent in the amount of NRF/RF available in all three home ranges. As shown in Table 36 (Appendix G), with only 2 percent of the core and 6 percent of the home range currently in NRF habitat, the McKinley Road site is currently below the minimum thought likely to be able to support a spotted owl pair as discussed in the Affected Environment Section above. The Elk Loop site, with 63 percent NRF at the Core and 40 percent at the home range is above the minimum thought necessary to support a spotted owl pair. With 33 percent of the core and 32 percent of the home range in NRF habitat, the Brewster Valley is below the minimum thought necessary to support a spotted owl pair. Table 40 (Appendix G) summarizes the differences in acres treated in home ranges between alternatives.

In the LSR and RR, with implementation of the proposed project, even if the proposed PCGP project were constructed, the proposed commercially treated areas in six of the home ranges would provide higher quality NRF habitat in 40 years, with more larger diameter trees, more multi-layered canopy layers, and more trees with structure compared with if treatment did not occur. As shown in Table 40 (Appendix G), the number of acres treated are similar between Alternative 2 and Alternative 3, with marginally more acres treated commercially under Alternative 3 which would result in improved NRF development at the stand scale by 40 years. As discussed above, while non-commercial treatments would promote structural complexity at a localized scale, modeling does not show a difference between stands treated non-commercially in 40 years compared with the No Action alternative (Tables 64-67, Appendix H).

In the units proposed for regeneration harvest within home ranges, there would be minor differences in the McKinley Road (17 acres of regeneration harvest/new road construction at the edge of the home range in Alternative 3 compared with no proposed harvest in Alternative 2) and Remote (42 additional acres of regeneration harvest/new road construction and 19 acres commercially rather than non-commercially thinned at the home range scale under Alternative 3 compared with Alternative 2) between the alternatives. These differences would not affect spotted owl's ability to recolonize the site.

The major difference between alternatives is the proposed Rock Slide sale in the Kincheloe Quarry site which would not occur if Alternative 2 were implemented. Under Alternative 3, if the Rock Slide sale were implemented, 47 acres of NRF/RF would be removed from the core, including 24 acres of NRF/RF at the home range scale. This treatment would make it very unlikely that the home range would be reoccupied because of the amount of NRF removed from the nest patch and core would make the site unusable. As discussed above, the home range is already below the minimum amount of NRF that the best available science suggests is necessary to support a successful pair of spotted owls at the core and home range scale (summarized in USDI-USFWS 2009, USDI-USFWS 2011), and the proposed harvest would likely not leave sufficient NRF to support a reproductive pair. Direct impacts to owls would be avoided with the commitments designed to avoid take as discussed above. Spot checks, and additional years of 6-visit surveys as needed would continue until the sales are complete.

4 Consultation and Coordination

Endangered Species Act Consultation

The BLM conducted wildlife, fisheries, and botanical reviews for the proposed harvest units. The BLM would manage Special Status Species sites discovered consistent with the Special Status Species policy and ROD/RMP requirements.

Consultation with U.S. Fish and Wildlife Service

The BLM began formal consultation with the South Coast Interagency Level 1 Team (terrestrial subgroup), which included a representative of the U.S. Fish and Wildlife Service (Service) in May 2019. The BLM also included a field visit during this time. Project discussions continued during subsequent Level 1 Team meetings with a more formal initiation discussion in January 2020 and April 2020. The BLM submitted draft biological assessments (BA) for review to the Level 1 Team on May 14, 2020. The BLM completed the final BA and submitted it to the Service on August 4, 2020. The Service responded on December 12, 2020, to the BLM's formal consultation request with a Biological Opinion, as provided in Section 7 of the ESA (16 U.S.C. 1536 (a)(2) and (a)(4), as amended (16 U.S.C. 1531 et seq.). In the summary, the Service's Biological Opinion stated the BWE project:

- Is not likely to jeopardize the continued existence of the murrelet and is not likely to destroy or adversely modify murrelet critical habitat (USDI USFWS 2021 p. 134).
- Is not likely to jeopardize the continued existence of the northern spotted owl or to destroy or adversely modify critical habitat (USDI USFWS 2021 p. 134)
- May affect, but is not likely to adversely affect Coastal Martens (USDI USFWS 2021 p. 134)

Consultation with National Marine Fisheries Service

The BLM completed consultation with the National Marine Fisheries Service (NMFS) under Section 7 of the ESA (16 U.S.C. 1536 (a)(2) and (a)(4)), as amended. The Regional Administrator for NMFS signed the Programmatic Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the BLM's Forest Management Program for Western Oregon (WCR-2017-7574) on October 28,2020 (USDC-NMFS 2018b). The BLM would follow the review and verification process for timber sale activities, per the Biological Opinion, including submitting project notifications to NMFS.

Tribal Consultation

The BLM provided two-week advance notice to the Tribes via Certified Mail prior to public scoping, and included a formal consultation request, along with the project scoping document and a map of the area. The notified Tribes included the Confederated Tribes of Grand Ronde Indians, the Confederated Tribes of the Siletz Indians, and the Coquille Indian Tribe. The BLM mailed these consultation letters to the Tribal chairpersons on April 15, 2019. The BLM received a response from one Tribe.

In July and August, the BLM provided the above listed Tribes with an additional opportunity to review and comment on the EA and unsigned FONSI.

State Historic Preservation Office Consultation

The BLM anticipates a finding of no adverse effect on significant cultural resources. Based on the BLM staff archaeologist's review, investigations, and findings, the BLM is in compliance with Section 106 of the National Historic Preservation Act under the guidance of the National Programmatic Agreement (USDI-BLM, ACHP and NCSHPO 2012) and the Oregon State Protocol. Appendix D (USDI BLM and Oregon SHPO 2015), and no further consultation is required.

List of Preparers

Planning and Environmental Coordinator	Ryan Desliu (Team Lead)
Planning Forester	Matthew Wells (Project Lead for HLB)
Wildlife Biologist	Jennifer Kirkland (Project Lead for LSR)
Fish Biologist	Jeff Jackson (Project Lead for RR)
Botanist	Tim Rodenkirk
Hydrologist	Teague Mercer
Geologist	Greta Krost
Invasive Species/Noxious Weeds	Jim Kirkpatrick
Silviculture	Andrew Spencer
Port-Orford-cedar Coordinator	Jim Kirkpatrick
Fire/Fuels	Joanie Lawrence
Archaeologist	William Kerwin
Engineering/Roads	Tony Aguilar
Reciprocal Rights-of-Way	Eva Bailey
Realty	Eva Bailey
GIS	Tristan Holland
ACEC Coordinator	Kip Wright
Recreation Planner	Tom Sill

Appendix A: Issues Considered but Not Analyzed in Detail

Comments received during public scoping, and from the project IDT, brought forward the following additional concerns related to resources that had potential of being affected by the BWE project. The interdisciplinary team conducted substantial analysis, including inventory and assessment, before concluding that no detailed presentation of the issue was warranted in this EA. For reasons described in this section, these issues were not carried forward to be presented in detail.

ACEC

> *How would ground disturbance from logging activities and removal of trees directly affect ACECs and the relevant and important values for which they were established?*

Rational for elimination: This issue was considered but not analyzed in further detail because there are no ground disturbing activities proposed in the ACEC and the relevant and important values for which the ACECs were established would not be affected, therefore there is no potential for significant effects.

> *How would the proposed action indirectly affect the potential to spread Phytophthora lateralis (PL) Port Orford cedar root disease in uninfected stands of cedar?*

Rational for elimination: The BLM considered this issue but did not analyze it in detail because of the Port-Orford-Cedar Risk Key identified in the Decision and Resource Management Plan Amendment for Management of Port-Orford-cedar in Southwest Oregon, Coos Bay, Medford, and Roseburg District (USDI BLM, 2004). The BLM Silviculturist used this key to evaluate the project area (see Appendix E). All proposed units are outside the boundaries of the ACECs. However, there are several proposed units or haul routes that are adjacent to two ACECs (Brownson Ridge and Euphoria Ridge). The BLM proposes to remove the Port-Orford-Cedar (disease host) from the above EA units. By doing this, the risk of introducing the pathogen into the ACEC would be reduced. PL can be transferred in spore-contaminated soil by machinery and people the MFO have identified BMPs and PDFs to reduce the risk of the proposed actions and minimize the risk for negative effects to the ACECs Relative and Important Values (USDI BLM, 2016b, pp. 223-229). The BLM eliminated this issue from further analysis because the removal of host species from above the ACECs and adhering to the BMPs and PDFs identified in this document would remove the potential for significant impacts to the ACEC.

Botanical Species

> *How would ground disturbance from logging activities and removal of trees affect endangered (T&E), proposed T&E, or candidate plant species?*

Rationale for elimination: This issue was considered but not analyzed in further detail because there are no T&E, proposed T&E, or candidate plant species known or suspected to occur within any of the proposed units on the BWE analysis area therefore there is no potential for significant effects.

> *How would ground disturbance from logging activities and removal of trees affect Bureau Sensitive vascular plants, lichens, and bryophytes?*

Rationale for elimination: This issue was considered but not analyzed in further detail because there is no potential for significant effects to any Bureau Sensitive vascular plants, lichens and bryophytes. All proposed timber sale units have been surveyed for Bureau Sensitive vascular plants, lichens, and bryophytes by a Coos **B**ay District Botanist experienced in plant ID of Bureau Sensitive vascular plants, lichens, and bryophytes. All Bureau Sensitive sites located within the project area would be managed such that the species would persist at the site and therefore not increase the likelihood that the species would be listed (PDF # 66-68, Appendix B). Application of buffers, incorporated in a PDFs, where needed, would maintain microsite conditions, is in accordance with NCO PRMP/FEIS and the BLM Manual 6840 – for Special Status Species Management (USDI BLM, 2016c, pp. 529-530).

How would ground disturbance from logging activities and removal of trees affect Bureau Sensitive fungi?

Rationale for elimination: The BLM considered this issue but did not analyze it in detail because this issue has previously been analyzed in detail and there is no potential for significant effects. There are seven Bureau sensitive species that have habitat in the proposed EA project area and that are also within the range of the species (Table 10). However, fungi are considered impractical to survey for (Cushman & Huff, 2007) so no surveys have or would be done on any of the proposed EA units. All seven Bureau Sensitive fungi were formally considered Survey and Manage species. The 2000 Final Supplemental EIS for Amendment to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines (USDA FS and USDI BLM, 2003) no longer applies to BLM-administered lands in western Oregon, and thus, it is not possible for project-level analyses to tier to the 2000 Survey and Manage FSEIS. However, the 2000 Survey and Manage FSEIS does contain useful analytical information that may still be relevant to project-level analyses.

These species were managed under BLM's previous (1995) RMPs as Survey and Manage species (USDA-FS and USDI-BLM, 1997). Protection of known sites was required under those Plans as were "equivalent-effort surveys" for habitat-disturbing projects proposed in old-growth forests. Although those mitigations resulted in a moderate level of uncertainty that there will be inadequate habitat to maintain these species, this management was intended to "provide a reasonable assurance of species persistence" within the Northwest Forest Plan area of Oregon, Washington, and Northern California.

Under the PRMP/FEIS, known sites for these species are protected, as are all the old-growth habitats within LSRs (USDI BLM, 2016c, p. 520). Although no formal surveys would be completed for fungi, any special status fungus found incidentally during special status plant surveys would be recorded (USDI BLM, 2016c, p. 519). Such sites would be protected similarly to known sites such that the species would persist at the site.

Based on similar management of these species under the two plans, including higher amounts of reserve lands and old-growth reserved under the RMP FSEIS, the effects to these seven former survey and manage BLM Bureau Sensitive fungi are incorporated by reference from the 2000 FSEIS and 2001 Record of Decision (USDA-FS R-5/6 and USDI-BLM OR/WA/CA, 2001, pp. 241-252). Although there is uncertainty of effects, the approach (manage sites, protect old-growth habitat) provides for a reasonable assurance of species persistence.

Table 14. Bureau Sensitive vascular plants, lichens, and bryophytes with potential habitat within the BWE analysis area.

Scientific and Common Name	Documented (D) or Suspected (S) on Coos Bay District	Likelihood of Occurring in the Big Weekly Elk Project Area*
VASCULAR PLANTS		
Adiantum jordanii (California maidenhair fern)	D	**High. One site found in Frenchie Creek in the proposed Big Weekly Elk EA project area**
Erigeron cervinus (Siskiyou daisy)	S	Low. No known sites on District. None found during surveys.

Scientific and Common Name	Documented (D) or Suspected (S) on Coos Bay District	Likelihood of Occurring in the Big Weekly Elk Project Area*
Iliamna latibracteata (California globe mallow)	D	Low. No known sites on District. None found during surveys.
Pellaea andromedifolia (Coffee fern)	D	Low. Only one known site on Coos Bay BLM. None found during surveys.
Polystichum californicum (California sword fern)	D	Low. Only one known site on Coos Bay BLM. None found during surveys.
Romanzoffia thompsonii (Thompson's mist maiden)	D	Low. Only one known site on Coos Bay BLM. None found during surveys.
Scirpus pendulus (drooping bulrush)	S	Low. No known sites on District. None found during surveys.
Trillium kurabayashii (=T. angustipetalum)(giant purple trillium)	S	Low. No known sites on District. None found during surveys.
LICHENS		
Bryoria bicolor	S	Low. No known sites on District. None found during surveys.
Calcium adspersum	S	Low. No known sites on District. None found during surveys.
Lobaria linata	S	Low. No known sites on District. None found during surveys.
Microcalicium arenarium	D	Low. Only one known site on Coos Bay BLM. None found during surveys.
Niebla cephalota	D	Low. Several District sites but all on outer coast; however, further north in Oregon Coast Range it has been found inland. None found during surveys.
Usnea nidulans	S	Low. No known sites on District. None found during surveys.
BRYOPHYTES		
Blepharostoma arachnoideum	D	**Low- previously unknown on the District. Two sites found, one in Frenchie Creek and one in Belieu Creek in the Big Weekly Elk EA project area**
Cryptomitrium tenerum	S	Low. No known sites on District. None found during surveys.
Entosthodon fascicularis	S	Low. No known sites on District. None found during surveys.
Haplomitrium hookeri	S	Low. No known sites on District. None found during surveys.
***Phymatoceros** phymatodes*	D	**High- 10+ sites on District. Two sites were found, one in Frenchie Creek and one in Belieu Creek within the Big Weekly Elk EA project area.**
Porella bolanderi	S	Low. No known sites on District. None found during surveys.
Tetraphis geniculata	S	Low. No known sites on District. None found during surveys.
FUNGI (surveys not practical)		
Chamonixia caespitosa	S	Low. No known sites on District.

Scientific and Common Name	Documented (D) or Suspected (S) on Coos Bay District	Likelihood of Occurring in the Big Weekly Elk Project Area*
Cortinarius barlowensis (=C. azureus)	S	Low. No known sites on District.
Cortinarius pavelekii	S	Low. No known sites on District.
Lactarius siliviae	D	Low. Two sites on District.
Phaeocollybia oregonensis	D	Low. Only one known site on District.
Rhizopogon exiguus	S	Low. No known sites on District.
Sarcodon fuscoindicus	S	Low. No known sites on District.

Carbon Emissions and Carbon Storage

How would the proposed harvest and associated activities affect carbon storage and greenhouse gas emissions?

Rationale for elimination: The BLM considered this issue but did not analyze it in detail because the issue is not related to the project's purpose and need, and there would be no reasonably foreseeable significant effects of the proposed action regarding carbon storage and greenhouse gas emissions beyond those disclosed in the 2016 Final Environmental Impact Statement.

On August 5, 2016, the BLM issued the Northwestern and Coastal Oregon Record of Decision and Resource Management Plan (USDI-BLM 2016b) (ROD/RMP) revising the 1995 RMP for Coos Bay District. The BLM based the ROD on the analysis conducted in the Proposed Resource Management Plan/Final Environmental Impact Statement: Western Oregon (USDI-BLM 2016c). The 2016 Final Environmental Impact Statement (FEIS) analyzed the effects of timber harvesting, prescribed burning, and livestock grazing on greenhouse gas emissions and carbon storage, and the potential impacts of climate change on major plan objectives.

The effects of the proposed action (i.e., timber harvest activities) on carbon storage and greenhouse gas emissions tiers to the analysis in the FEIS. As described below, the proposed action is consistent with the Northwestern and Coastal Oregon ROD, and the proposed action is not expected to have significant effects beyond those already analyzed in the FEIS. While analysis of the project-specific and site-specific conditions could give greater specificity to the analysis in the FEIS, there is no potential for reasonably foreseeable significant effects of the proposed action beyond those disclosed in the FEIS. The analysis in the FEIS addressed the effects on carbon storage and greenhouse gas emissions of implementing the entire program of work in the forestry program based on high quality and detailed information (pp. 165–180; 1295–1304). The information available on project-specific and site-specific conditions, while more specific, is not fundamentally different from the information used in the FEIS analysis of effects on carbon storage and greenhouse gas emissions, and thus cannot reveal any fundamentally different effects than that broader analysis.

The FEIS upon which the ROD/RMP was based examined the most recent science regarding climate change, carbon storage, and greenhouse gas emissions. The analysis in Volume 1 on pages 165–211 are relevant to this project and are incorporated by reference.

The key points from PRMP/FEIS analyses include (p. 165):

- Net carbon storage would increase.
- Annual greenhouse gas emissions would increase although annual emissions would remain less than 1 percent of the 2010 statewide greenhouse gas emissions.
- Climate change increases the uncertainty that reserves will function as intended and that planned timber harvest levels can be attained, with the uncertainty increasing over time.
- Active management provides opportunities to implement climate change adaptive strategies and potentially reduce social and ecological disruptions arising from warming and drying conditions.

The FEIS concluded that the approved RMPs support the State of Oregon's interim strategy for reducing greenhouse gas emissions (p. 173). Both the State of Oregon's strategy and Federal climate change strategies have goals to increase carbon storage on forest lands to partially mitigate greenhouse gas emissions from other sectors of the economy. Assuming no changes in disturbance regimes such as fire and insects (acres affected and severity of impact) from the recent past, timber harvesting is the primary activity affecting carbon storage (p.169).

The FEIS estimated the effects of implementing actions consistent with the Northwestern and Coastal Oregon and the Southwestern Oregon RMPs as follows in Table 15:

Table 15. Estimated current and future carbon storage and greenhouse gas emissions from the PRMP/FEIS.

	Current	2033	2063
Carbon Storage	336 Tg C	404 Tg C	482 Tg C
Green House Gas	123,032 Mg CO_2e/year	256 Mg CO_2e/year	230,759 Mg CO_2e/year

The carbon storage and greenhouse gas emissions analysis were based on assumptions concerning the level of management activity:

- The FEIS assumed an average annual harvest level of 278 MMbf per year (205 MMbf from the HLB and 73 MMbf from non-ASQ related harvest) over the entire decision area (FEIS pp. 307, 353). The expected average annual harvest for the Coos Bay District is 30 MMbf (12 MMbf from the HLB and 18 MMbf from non-ASQ related harvest).
- Activity fuels treatments are aligned with the harvest program with estimated acres of prescribed fire treatment type provided by the Woodstock model (FEIS p. 1300). The decadal average of activity fuels prescribed burning for the first 20 years of the RMP would be an estimated 64,806 acres over the entire decision area (FEIS p. 362). For the Coos Bay District, the expected decadal average activity fuels program covers 5,589 acres.

The FEIS assumed that the non-commercial hazardous fuels (natural fuels) treatment levels would not differ from the 2003–2012 period although there is substantial year-to-year variability in the size of the program over the planning area and within any one District (p. 270). Approximately 173,300 acres of natural fuels treatment is expected to occur on average each decade across the planning area (FEIS p. 167). The expected natural fuels treatment program for the Coos Bay District is 4,713 acres per decade, on average (FEIS p. 270).

Under the Northwestern and Coastal Oregon ROD/RMP, no allotments would be available for livestock grazing through the issuance of a grazing lease (p. 84). As a result, no greenhouse gas emissions from a regular grazing program would occur.

The amount of activity fuels prescribed burning is the primary driver of greenhouse gas emissions (FEIS p. 178). Greenhouse gas emissions would increase substantially largely due to the projected increases in activity fuels prescribed burning. The PRMP/FEIS assumed no change in the natural fuels prescribed burning program from the recent past. Greenhouse gas emissions analyzed included those from grazing, prescribed burning, and harvest operations (PRMP/FEIS p. 174).

There is no new information, or changed circumstances, which would substantially change the effects anticipated in the PRMP/FEIS. This is because:

- The harvest levels remain within the range of that analyzed in the PRMP/FEIS. For the Coos Bay District, the harvest level was 28.8 MMbf in 2019 (16.0 MMbf in non-ASQ and 12.8 MMbf in ASQ). These levels are within the analysis of the PRMP/FEIS and the numbers are annual averages +/- 40 percent, which means the Coos Bay District is on track to be within the decadal average of +/- 20 percent.
- The acres (2,149 acres for Alt. 2 and 2,490 acres for Alt. 3) of activity fuels prescribed burning and expected tonnage of no more than consumed remains within the range analyzed in the FEIS. For the Coos Bay District, the activity fuels prescribed burning was 1,040 acres (3,214 tons) in FY 2019, which is within the PRMP/FEIS (p. 362) projection of 5,589 acres within the first decade of RMP implementation. These levels are within the analysis of the PRMP/FEIS.
- The acres of natural fuels prescribed burning and expected tonnage consumed does not exceed the levels analyzed in the FEIS. For the Coos Bay District, the natural fuels prescribed burning was 194 acres (1,930 tons)[10] in FY 2019, which is in conformance with the ROD/RMP. These levels are within the analysis of the PRMP/FEIS and the numbers mean the Coos Bay District is on track to be within the decadal average.

Based on this information, and because the level of management activity that has occurred to date, and is reasonably foreseeable, is within the levels disclosed in the PRMP/FEIS, the project effects on carbon storage and greenhouse gas emissions are within the analysis in the PRMP/FEIS. Thus, there is no potential for significant effects beyond that analysis.

Cultural Resources

How would the proposed timber harvest, road building, and waste/disposal sites affect cultural resources?

The BLM considered this issue but dismissed it from further analysis because the majority of the BWE project Area of Potential Effect (APE) have been subject to timber harvest activities ranging from post-fire salvage harvest, selective harvest, and conventional clear-cutting of mature or old-growth forests, and some have not been previously harvested. Clear-cut stands have been regenerated by planting trees with the intent for future timber sales. Amount of disturbance associated with these actions will vary throughout the project area and are dependent on local conditions (soil type, time of year) but may reach depths of 30cm or more. The BLM acknowledges that ground disturbance from road construction and waste disposal sites and other heavy equipment operation in support of timber harvest has the potential to damage and displace cultural artifacts resulting in the loss of their scientific and heritage values. However, the likelihood of major National Register of Historic Places (NRHP) eligible resources being located within the project area would be negligible.

The BLM used GIS LiDAR to classify terrain as High, Moderate and Low probability (Appendix D Potential Zones), and as one method of assessing presence/absence of significant cultural resources in the current (APE) (Table 16; USDI-BLM and Oregon SHPO 2015). Other methods that direct the BLM's analysis of cultural resources in the project area include site location and distribution based on analysis of

[10] Includes Sudden Oak Death (SOD) treatments of 73 acres (1,420 tons)

environmental and cultural factors, previous research, ethnography, relevant literature, and tribal consultation.

Table 16. Cultural resource potential zones within the BWE project units (LiDAR GIS acres)

BWE Harvest Units	Low Potential Zone (26 or > percent slope) (Acres)	Moderate Potential Zone (16–25 percent slope) (Acres)	High Potential Zone (0–15 percent slope) (Acres)
Total Acres	3,296	57	247

The BLM's cultural resources field survey conducted to date within BWE project units, resulted in locating one piece of logging machinery, one historic era trash scatter and a single isolate milk jug within a High Potential Zone; however, the BLM expects that any additional prehistoric sites or isolates, if encountered in the projects High Potential Zones, would be similar in nature, related to short duration or seasonal occupation, and historic era sites or isolates associated with logging activities and road construction, would not typically be eligible for inclusion in the NRHP. Effects of previous surface disturbance stated above, as well as recreational and pedestrian collection of prehistoric and historic era artifacts, has potential to diminish integrity that would make these site types eligible for NRHP inclusion. Furthermore, BLM's incorporation of PDFs as part of the proposed action if cultural resources are present or discovered during project implementation would either be avoided, or project activity suspended in the vicinity of the site until an evaluation can be made by a qualified archaeologist to determine appropriate actions preventing loss of significant cultural or scientific values, therefore there is no potential for significant effects.

Tribal Consultation for the BWE project area did not result in comments regarding concerns for known cultural resources, or that the project would interfere with Traditional uses. Tribal response included a request for information if cultural resources were located during project implementation. BLM regularly communicates with Tribal Historic Preservation Officers and tribal staff regarding cultural resources and would consider additional tribal concerns or information associated with this project, were they brought forward in the future.

Economics

What are the effects of management actions on supply, demand, and value goods, economic activity and stability, and county payments?

Rationale for elimination: The effects of the BWE project's timber harvest on the socioeconomics of the region is not analyzed in detail because there would be no potential for significant effects beyond those analyzed in the PRMP/FEIS.

The ROD/RMP was based on the analysis conducted in the Proposed PRMP/FEIS. The FEIS analyzed the effects of timber harvesting, recreation and visitation, special forest products, energy and minerals production, livestock grazing, and other resource programs on the socioeconomics of local county and western Oregon economies. The PRMP/FEIS also analyzed the potential impacts major plan objectives would have on the value of goods and services from BLM-administered lands, economic activity, county payments, economic stability, and the capacity and resiliency of communities.

The effects of the BWE project's proposed timber harvest on socioeconomics tiers to the analysis in the PRMP/FEIS. The proposed project is consistent with the ROD/RMP.

The analysis in the PRMP/FEIS addressed the effects on socioeconomics of implementing the entire program of work for timber resources based on high quality and detailed information (USDI BLM, 2016c, pp. 585-738).

The COVID-19 pandemic and the subsequent shelter in place orders, issued both federally and locally, had a negative effect on the US economy. While of deep concern for the local economy, the social and economic effects from the pandemic, in and of themselves, cannot be significant under 40 CFR §1508.14. Regulation 40 CFR §1508.14 requires the human environment to be "interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment. This means that economic or social effects are not intended by themselves to require preparation of an environmental impact statement."

The effects of timber harvest on the socioeconomics of the region are not related to the BWE project purpose and need, and there would be no potential for significant effects. Therefore, there is not a requirement for the BLM to analyze social and economic effects in detail in this EA.

Hydrology/Fisheries

> *How would proposed road activities and harvest methods such as new road construction, improvement, renovation, maintenance, decommissioning, landing construction and yarding in the harvest units affect sediment delivery to fish habitat?*

Rationale for elimination: This issue was considered but not analyzed in detail because the FEIS concluded that sediment delivered to stream channels from roads in the first decade would be less than a 1 percent increase from the current amounts (FEIS p. 298) to which the document tiers. In the Biological Assessment for the Western Oregon Proposed Resource Management Plan issued by the BLM for the ROD/RMP, the BLM concludes that meaningful measurable amounts of fine sediment may be delivered from several sources, including new construction for road segments within 200 feet of stream channels, roads used for wet season haul, and from ground-disturbing activities occurring within the RR(USDI BLM, 2016c, p. 339) short-term (duration of harvest activity including road construction and haul) increases in turbidity. Utilizing BMPs and following the management direction (defined in the ROD/(USDI BLM, 2016c, p. 339)), the BLM proposes to decommission all new construction in the RR. Another important project benefit is the improvement in wood delivery, hydrologic connectivity and natural substrate movement restored via road renovation. The BLM will add, replace, and increase the size of several culverts and cross drains within the project area. In addition to the benefits listed previously, these actions would also reduce the risk of infrastructure becoming plugged and failing, which can cause a major road failure. Additional cross drains allow transport energy to dissipate and allow sediment to filter out in vegetated areas away from streams. It is anticipated that road actions initiated due to timber sales in the project area will have a long-term beneficial effect to fish habitat due to an overall reduction in sediment inputs to fish habitat.

Sediment from the proposed harvests would have a negligible effect on fish habitat. The NTZs would maintain a buffer between harvest activities and stream channels. The NTZs would maintain areas of non-compacted soils and undisturbed vegetation and duff layers to filter fine sediment before it would reach streams. Rashin et al. (2006) studied the effectiveness of stream buffers to prevent sediment delivery to streams for two years following clear cuts and partial cuts in Washington. Yarding systems included ground-based and cable and some lower intensity tree harvesting occurred in some buffers. They found that a buffer width of approximately 33 feet was effective at preventing sediment delivery to streams. The NTZs for the analysis areas far exceed that for perennial and fish-bearing (120 feet) and intermittent and non-fish-bearing streams (50 feet). Ground-based equipment operations would operate on slopes ≤ 35%

(BMP TH 13), during periods of low soil moisture (BMP TH 11), and designate skid trails in locations that channel water away from waterbodies (BMP TH 15). Erosion control measures would be applied to skid trails and other disturbed areas with potential for sediment delivery to waterbodies (BMP TH 16). The implementation of the BMPs mentioned above would prevent sediment delivery to streams. There is little potential for measurable significant effects of the RR new road construction and use on sediment delivery to stream channels.

The proposed road and landing construction would not result in measurable sediment delivery to surface waters, therefore minimizing the effects to fish habitat due to road and landing construction. The wet season for roads is generally November through May but could start or end earlier depending on seasonal precipitation influences (USDI BLM, 2016a, p. 307). Commercial road use would occur during the wet season and during wet periods of the dry season for roads, generally June through October (USDI BLM, 2016a, p. 294) as long as road surfaces that drain to wetlands and streams are not deteriorating as indicated by vehicular rutting or the development of a mud layer on running surfaces, there is no standing water on these road surfaces, and turbid road runoff is not entering wetlands or streams. Commercial road use would be suspended by BLM staff following management direction (USDI BLM, 2016b, p. 80) if the above criteria for wet season/wet period commercial road use are not satisfied.

The BLM would implement BMPs as described in Appendix B; however, maintenance and improvement of roads may result in sediment run-off during the first winter, but the amount of sediment to reach fish habitat would be short-term and unmeasurable compared to background levels and the BMP's will and have been proven to mitigate measurable sediment to streams in the future.

Sediment input from new road and landing construction would not be measurable in fish-bearing streams because:

- New road design and construction would feature proper drainage construction techniques so that any sediment-laden surface water would quickly infiltrate forest soils.
- New construction would implement BMPs to reduce or eliminate erosion and sediment input to streams.
- Natural surface roads:
    - Will be rocked 200' from the crossing dependent on review by project specialists (timber, road engineering, hydrology).
    - The BLM contract administrator would monitor road conditions and suspend commercial road use when road surfaces that drain to wetlands and streams become rutted, developing a mud layer on running surfaces, developing areas of standing water, or turbid road runoff is entering wetlands or streams; and
    - The BLM will apply water or approved road surface stabilizers/dust control additives to reduce surfacing material loss and buildup of fine sediment that can enter into wetlands, floodplains and waters of the State (BMP R 68).

All-natural surface roads with perennial stream crossings would be evaluated by key IDT members (engineering, forestry, hydrology) and rocked a minimum of 200' either side of the crossing if needed. Brake et al. (1997) observed that the maximum sediment travel distance below cross drains (ditch relief culverts) was 132 feet on new roads, with a mean travel distance of 31 feet. The BLM conservatively uses a 200-foot sediment delivery distance for its modeling of sediment yield from roads (USDI BLM 2016, pg. 316). Seventeen (17) new roads are planned within the RR closer than 200 feet, for a total length of 6,538 feet. All road segments are adjacent to intermittent streams. Of the road segments within close proximity, two include stream crossings and are 1,053 and 2,516 feet, respectively, from fish habitat. The

BLM would implement BMPs to minimize the amount of sediment generated from road and landing construction that would reach streams (BMPs R 02, 07, 08, 11, 13, 17, 26, 29, 39, 48, 50, 62, 63, 64, 66). See Table 17 for information regarding newly constructed road segments within 132 feet of streams in the project area.

Table 17. New Construction Within 200' of Streams[11]

EA Road Number	EA Unit Number	Length (FT)	Stream Periodicity	Stream Crossing	Distance to Fish Habitat (feet)
NC-1-2	1	298	Intermittent	Yes	1,053
NC-105-1	105	610	Intermittent	Yes	2,516
NC-45-1	45	12	Intermittent	No	N/A
NC-24-1	24	48	Intermittent	No	N/A
NC-32-1	32	66	Intermittent	No	N/A
NC-31-1	31	132	Intermittent	No	N/A
NC-34-2	34	244	Intermittent	No	N/A
NC-107-1	107	431	Intermittent	No	N/A
NC-38-1	38	324	Intermittent	No	N/A
NC-105-1	105	610	Intermittent	No	N/A
NC-107-2	107	399	Intermittent	No	N/A
NC-25-1	25	170	Intermittent	No	N/A
NC-30-2	30	496	Intermittent	No	N/A
NC-4-1	4	204	Intermittent	No	N/A
NC-107-4	107	699	Intermittent	No	N/A
NC-107-3	107	1623	Intermittent	No	N/A
NC-25-1	25	170	Intermittent	No	N/A
	TOTAL	**6,538**			

The proposed action includes approximately 21 landings within the RR. However, distances between landings and fish habitat are greater than sediment can normally travel when factoring in the sedimentary buffers created by vegetated no-treatment zones. The closest proposed landing to a stream is located in EA Unit 18 and is approximately 145 feet from fish habitat; this landing would not contribute sediment to fish habitat because of road renovation project BMPs.

As previously mentioned, roadwork including maintenance, renovation, and improvement would occur during the dry season when intermittent streams are not flowing and would minimize sediment delivery to streams and fish habitat before, during, and after harvest activities. This roadwork would divert road drainage away from stream channels and toward the forest floor where it would infiltrate into the soil. Renovation activities may include, but are not limited to, surfacing with rock, stabilizing cut banks and fill slopes, restoring out slope or crown sections, and providing adequate drainage. Installation of new ditch relief culverts would also route road water onto the forest floor and away from streams. In some areas, the road crown would be graded and shaped to prevent water from flowing down the road to stream crossings. Seeding and mulching of bare soil areas before the onset of winter rains, if needed, would

[11] Stream locations and density, road locations and distances current as of 21 January 2020. Road locations are approximate and based on LiDAR and other GIS-derived information. Exact locations of streams and roads will be verified at the time individual timber sales are laid out. All values are approximate.

prevent sediment delivery to streams. Roadwork activities would reduce the potential sediment input to streams in the short- and long-term. Cleaning plugged stream and ditch relief culverts would reduce the risk of culvert and road failure. The road maintenance, renovation, and improvement would provide a slight, long-term (many years) benefit to flow routing and water quality.

A planned road renovation in T. 30 S., R.11 W., Sec. 1 (SW of NW) will require installation of a new stream crossing (bridge or culvert) and replacement of an existing culvert in Coho CCH/EFH. The new structure will be temporarily installed, while the culvert upgrade will be a permanent structure. Both structures will be designed to exceed current NMFS standards of 1.3 times Active Channel Width (ACW). This project feature has the potential to impact listed fish habitat. It is anticipated that the use of BMPs previously identified (R 02, 07, 08, 11, 13, 17, 26, 29, 39, 48, 50, 62, 63, 64, 66) will reduce impacts to fish habitat, and PDF of installing fish stream crossings at 1.5 times ACW would result in long-term benefits to fish habitat.

To reduce potential negative effects to fish habitat, the BWE IDT dropped commercial treatment of units accessed via Axe Creek (Big Creek Road). Those units were dropped from commercial treatment due to the proximity of Axe Creek to the access road, the condition of the road, and the inability to restrict haul and vehicle use to summer use only.

Additionally, the BLM has identified several cross drains and culverts that would be added or replaced during road improvement activities. These improvements will protect infrastructure, improve hydrologic connectivity, reduce the likelihood of road failure and resultant fine sediment from entering the stream network. For a list of cross drains and culverts identified for addition or replacement, please see Table 23.

The maintenance, renovation, and improvement of roads would result in sediment run-off during the first winter, but the amount of sediment to reach fish habitat would be short-term and indistinguishable from background levels. Well-vegetated ditch lines found within the majority of the analysis area would capture and store sediment and reduce the amount of sediment reaching stream channels. BMP R 70 would be implemented which requires effective road surface drainage maintenance prior to the wet season. This BMP also states that vegetation would be re-established, or sediment entrapment measures utilized after ditch cleaning and prior to road shoulder work. Ground cover in ditch lines would be retained except where sediment deposition or obstructions require maintenance (BMP R 70). Slide material obstructing road surfaces and ditch lines would be disposed of on stable ground outside of RRs and seeded with native seed and mulched with weed-free mulch (BMP R 73). Implementing these BMPs would prevent sediment from entering streams during road maintenance, renovation, and improvement activities.

The road activities would include cross drain installation. Cross drains would be located to prevent or minimize runoff and sediment conveyance to waters of the State. Sediment reduction techniques will be implemented, and cross drains will be located to route ditch flow onto vegetated and undisturbed slopes (BMP R 39). The BLM may identify other culverts for replacement while the timber sale contract is prepared. Stream culvert replacements may occur on streams containing fish habitat. Replacing the culverts would reduce the risk of culvert failure and subsequent sediment input to streams containing fish habitat. The BLM expects sediment input to fish habitat from culvert replacements to be unmeasurable and indistinguishable because:

- Stream culvert replacements would follow ODFW instream timing guidelines, which is from July 1-September 15 (BMP R 48). During this time there would be very little if any flow in the streams proposed for culvert replacements.

- Culverts would be installed consistent with ODFW fish passage criteria and in streams with ESA-listed fish, follow the Forest Management Biological Opinion fish passage criteria and state fish passage criteria (BMP R 17).
- When replacing stream culverts, the BLM would divert stream flow around the work area, contain sediment using appropriate filters or barriers, and pump turbid water from the excavation site onto a vegetated terrace or hill slope (BMP R 48).

There are seven stream crossings on renovated roads that will be decommissioned, and no stream crossings planned on newly constructed roads; therefore, there are transport mechanisms for sediment to reach fish habitat. However, BMPs for road construction and renovation are likely to greatly reduce any sediment reaching streams and capture what is mobilized. One perennial stream crossing culvert removal is proposed for removal, approximately 220 feet above fish distribution. Brake et al. (1997) observed mean and maximum sediment travel distances of approximately 17 feet and 77 feet below ditch relief culverts on existing roads in the Oregon Coast Range. Sediment from the removal of ditch relief culverts during road decommissioning would not affect fish habitat because fish distribution is approximately 3 times further away than the maximum sediment travel distance observed by Brake et al. (1997).

BLM would remove temporary stream crossings during the ODFW in-water work window (BMP R 48 and 49), without overwintering, unless designed to accommodate a 100-year flood event (BMP R 86). Excavated material from removed stream crossings would be placed on stable ground outside of RRs (BMP R 87). Stream crossings would be reestablished to natural stream gradient and side slopes excavated back to the natural bank profile (BMP R 88). Following culvert removal and prior to the wet season, erosion control and sediment trapping measures would be applied (BMP R 90). Decommissioning would include installation of a suitable barrier to block vehicular access (BMP R 84). Roads proposed for full decommissioning would receive similar treatment after closure as decommissioned roads. Fully decommissioned roads may be subsoiled if needed to restore water infiltration and natural hydrologic flow (BMP R 91). If the road is tilled, unstable road fill would be pulled back and end-hauled or contoured to the natural slopes (BMP R 92).

The BLM proposes fully decommissioning approximately 0.7 miles of newly constructed roads in RRs, which is the total to be constructed, and decommissioning all newly constructed roads (outside of RRs) after harvest activities are complete, except for those road segments located outside of RRs and that are needed for post-harvest silviculture activities and/or fuels treatments. Further, the BLM proposes to decommission 0.75 miles of renovated roads in RRs, including road segments that cross perennial streams in T28S, R11W, Sect. 29. There are 7 stream crossings on renovated roads that will be decommissioned, and no stream crossings planned on newly constructed roads; therefore, there are transport mechanisms for sediment to reach fish habitat. However, BMPs for road construction and renovation are likely to greatly reduce any sediment reaching streams, and capture what is mobilized. One perennial stream crossing culvert removal is proposed for removal, approximately 220 feet above fish distribution. Brake *et al*. (1997) observed mean and maximum sediment travel distances of approximately 17 feet and 77 feet below ditch relief culverts on existing roads in the Oregon Coast Range. Sediment from the removal of ditch relief culverts during road decommissioning would not affect fish habitat because fish distribution is approximately 3 times further away than the maximum sediment travel distance observed by Brake *et al.* (1997).

Implementation of best management practices (BMPs; Appendix B) is a primary reason that BLM-controlled roads currently result in a minor portion of the total sediment delivery to streams from roads. The BLM has decommissioned about 900 miles (6 percent) of the road system (i.e., the BLM has closed the road to vehicles and left the road in an erosion-resistant condition). A small percentage of these decommissioned roads are within the 200-foot sediment delivery distance. The process of decommissioning includes the application of BMPs, including blocking the road, out-sloping and adding waterbars for drainage control, applying erosion control, and ensuring stream hydrologic conductivity, all features that reduce the potential sediment delivery from roads.

Forest management activities require adherence to management direction and the application of applicable BMPs in designing and constructing permanent and temporary roads under all alternatives and the Proposed RMP to maintain or improve water quality. The BMPs include methods that either avoid or minimize the delivery of sediment to streams. Specific BMPs have been developed for timber harvest, road construction, maintenance, and decommissioning, energy and mineral development, fuel reduction treatments, and other forest activities.

The effects of road related actions on sediment delivery to fish habitat as part of BWE has no potential for significant effects due to PDFs and BMPs identified in Appendix B.

How would the proposed vegetation management and new road construction in the Riparian Reserve affect channel-changing peak flow?

Rationale for elimination: The BLM eliminated this issue from detailed analysis because the issue is not related to the project's purpose and need, and because detailed analysis is not necessary to determine the significance of impacts. There is little risk that the proposed vegetation management and new roads in the RR would increase peak flows to the detriment of channel form and aquatic habitat. Grant et al. (2008 pp. 40, Figure 12). The BLM is proposing less than 0.7 miles of new roads in the RR with no surface connection to streams, regeneration with units dissected by topographic breaks and Reserve or thinning with interspersed group selection openings, and wide RR (200–220 feet); therefore, the BLM expects a lower likelihood of peak flow increase. Grant et al. (2008) also found that peak flow effects on channel morphology are likely to be minor (i.e., little potential to affect channel structure but may affect transport and deposition of fine sediment) in most step-pool channels. Step-pool channels typical within the proposed vegetation management units contain large wood resistant to hydrologic movement, even with increasing flow. Given the lower likelihood of peak flow increase and the high probability of maintaining channel form and function, the BLM does not anticipate detrimental aquatic habitat changes.

The BLM also eliminated this issue because the proposed analysis area subwatersheds are in the rain hydroregion and are therefore less susceptible to detectable peak flow increase with vegetation management and new road construction in the RR. The PRMP/FEIS analyzed the effect of timber harvest and road construction on peak stream flow in the rain-on-snow hydroregion only because this hydroregion, generally above 2000 feet in elevation in the Coast Range, is more susceptible than the lower elevation rain hydroregion to detectable peak flow increase with increasing open area (USDI BLM, 2016c, pp. 384-394). This analysis is incorporated here by reference. Analysis area subwatersheds, located in the rain hydroregion and not specifically identified in the PRMP/FEIS as subwatersheds currently susceptible to peak flow increase (USDI BLM, 2016c, p. 391; USDI BLM, 2016c), do not warrant additional analysis. *How would the proposed regeneration harvest affect water quantity for downstream surface water points of diversion for domestic use?*

Rationale for elimination: The BLM eliminated this issue from detailed analysis because the issue is not related to the project's purpose and need, and because there would be no significant impact to water quantity or water quality from harvest or haul.

There would be no significant impact to water quantity because of the anticipated moderate[12] flow effects associated with harvest, the proximity of the surface water points of diversion (PODs) for domestic use (domestic POD) to the proposed harvest units, and the location of the domestic POD on the landscape. Regeneration as proposed would produce a moderate change in summer surplus and deficit streamflow compared to clearcutting and establishing densely planted plantations and the harvest-related streamflow response would be less evident in the higher order streams outside of the proposed harvest units where the domestic POD are located. According to the Oregon Water Resources Department Water Rights Mapping Tool https://apps.wrd.state.or.us/apps/gis/wr/Default.aspx there are eight domestic PODs within or adjacent to harvest units in the BWE analysis area. The PODs within proposed harvest units will not likely have measurable changes in water availability and sediment because the streams the PODs are on would be buffered with a full site potential tree which has been shown to mitigate flow and sedimentation changes from BLM proposed harvests as analyzed previously in this section.

Table 18. Describes the PODs in relation to BLM proposed harvest units and explains why there will not be measurable changes in flow volume and sedimentation as analyzed.

Township, Range, Section	Harvest Sale Name	Unit Number	Explanation
28S, 11W, 16	New Yankee	100	Within RR buffer. No new roads. Cable Yarding only.
28S, 11W, 23	South Elk 23	101	Drains to downstream of closest POD less than half a mile west.
28S, 11W, 29	Elk Creek Ridge CT	2	POD is upstream from drainage of unit. Unit is a thinning.
28S, 11W, 31	Casey Jones CT	31, 32, 33	Unit is a thinning. PODs are along Big Creek outside of unit where there is numerous non-BLM agricultural and timber lands.
28S, 11W, 33	Elk Creek Ridge CT	3	POD is Upstream of drainage from BLM unit.
28S, 11W, 36	South Elk 23	8	POD is upstream from drainage of BLM harvest unit.
29W, 11W, 25	The Belieus	104	Unit is upstream about half a mile. Stream will have RR buffer.
30W, 11W, 01	Rock Slide	107	POD is downstream in a non-BLM rock quarry. Streams are intermittent.

How would the proposed wet season commercial haul affect sediment delivery to fish habitat?

Rationale for elimination: This issue was considered by not analyzed in further detail because the BLM acknowledges that timber haul "may result in measurable fine sediment deliver to streams occupied by ESA-listed fish" (USDI BLM, 2016a, p. 337). The BLM would suspended commercial road use where the road surface is deteriorating due to vehicular rutting or standing water, or where turbid runoff is likely to reach stream channels(USDI BLM, 2016c, p. 80) and the implement BMPs R 94 to R 99 (see Appendix B. Sediment derived from haul would not measurably a Natural surface roads and landings would receive seasonal preventative maintenance prior to the onset of winter rains to prevent sediment from reaching stream channels (Appendix B, BMP R 69, 70, 73). Hauling on paved roads during the wet season would not deliver sediment to streams because paved roads would not produce sediment (Reid and Dunne 1984). All-season haul on rocked roads has the potential to deliver sediment to stream channels; however, ditches and ditch relief culverts would route sediment to the forest floor in the same way as natural surface roads. The BLM contract administrator would monitor road conditions during winter use to prevent rutting, require operators install additional lifts of gravel and sediment filters if necessary, and suspend haul if rain accumulations have the potential to deliver sediment to stream channels. Road

[12] Moderate is defined as a summer low flow response moderate in intensity (i.e., some low flow effect, at times positive (surplus) and negative (deficit), that would persist for a decade or more.

maintenance during the life of the project would minimize road drainage problems and reduce the possibility of road failures and sediment delivery to streams. Prior to winter hauling activities, implement structural road treatments such as: increasing the frequency of cross drains, installing sediment barriers or catch basins, applying gravel lifts or asphalt road surfacing at stream crossing approaches, and armoring ditch lines (Appendix B, BMP R 93). Additionally, prior to winter hauling activities, the BLM would implement structural road treatments such as: increasing the frequency of cross drains, installing sediment barriers or catch basins, applying gravel lifts or asphalt road surfacing at stream crossing approaches, and armoring ditch lines (Append B, BMP R 94). Please refer to Table 23 for more information regarding new cross drain locations and culvert replacement locations.

The wet season for roads is generally November through May but could start or end earlier depending on seasonal precipitation influences (USDI-BLM 2016c pg. 307). Commercial road use would occur during the wet season and during wet periods of the dry season for roads, generally June through October (USDI BLM, 2016a, p. 294) as long as road surfaces that drain to wetlands and streams are not deteriorating as indicated by vehicular rutting or the development of a mud layer on running surfaces, there is no standing water on these road surfaces, and turbid road runoff is not entering wetlands or streams. Commercial road use would be suspended by management direction (USDI BLM, 2016b, p. 80) if the above criteria for wet season/wet period commercial road use are not satisfied. Haul during the wet season does not mean that haul would occur during or immediately after larger rainfall events. Oregon Department of Forestry (ODF 2003) found statistically significant turbidity increases with concurrent wet season road use and three-day precipitation totals between 1.5–3.0 inches. As a PDF, If the ground is already saturated from rains and more than 1 inch of precipitation is predicted in the project area over the next 24 hours, then haul would be suspended. Operations would resume after the 24-hour suspension, except when another storm (exceeding 1 inch) is forecasted.

Ditch lines would primarily direct sediment derived from haul to the forest floor via ditch relief culverts before the sediment could reach stream channels. Brake et al. (1997) found that on established logging roads within the Oregon Coast Range the maximum observed distance sediment traveled below a ditch relief culvert with vegetation filtering was typically not more than 16.7 feet. Any sediment generated because of the haul would be immeasurable and not outside levels that presently occur during rain events. The amount of sediment reaching fish habitat from haul would be indistinguishable from background levels and would not cause a measurable effect to fish habitat.

The Myrtlewood fish biologist and hydrologist reviewed the fish-habitat-proximate midslope and valley bottom roads most likely to deliver sediment during potential wet season haul. The hydrologist and fish biologist assessed culvert and cross drain needs to better disconnect roadside ditches from fish habitat. ODF (2003) found statistically significant turbidity increases with wet season use of road segments with over 250 feet of ditch draining directly to stream channels, and the proposed installations would keep contributing ditch lengths to less than 200 feet.

Many of the proposed all season haul routes are on or near ridges well away from fish habitat, and the all-season haul routes tie into county-maintained paved and aggregate roads. All season haul routes that are proximate to fish habitat are currently equipped to reduce or eliminate road sediment delivery to streams or would be made so with minimal drainage upgrades. These conditions together with mandatory management direction to suspend road use, when necessary, preclude effects to fish habitat from haul-related sediment delivery.

The effects of haul related actions on sediment delivery to fish habitat as part of BWE has no potential for significant effects due to PDFs and BMPs identified in Appendix B. Therefore, there is not a requirement for the BLM to analyze haul related effects in detail in this EA.

Fuels

How would the resulting changes in forest stand structure affect fire hazard within close proximity to developed areas?

Rationale for elimination: This EA proposes to harvest timber from the HLB, LSR and RR within the MFO. In addition to these commercial harvest actions, non-commercial restoration activities within the LSR and RR is also proposed. **Alternative 2** would treat timber on up to 2,667 acres of BLM land. It would include approximately 520 acres of regeneration harvest treatments, 1,629 acres of commercial thinning treatments and 518 acres non-commercial restoration treatments. **Alternative 3** would treat timber from 3,077 acres of BLM land. It would include approximately 727 acres of regeneration harvest treatments, 1,763 acres of commercial thinning treatments and 587 acres of non-commercial restoration treatments.

The largest direct change to fire hazard from harvest and restoration treatments is increased surface fuel loading resulting from harvest and removal of trees. The BLM would evaluate each treatment area to determine the need for follow-up fuel reduction treatments based on residual fuel load and adjacent values at risk. Fuels treatments could include mechanical and/or prescribed fire treatments such as cutting and piling slash and brush followed by chipping or pile burning to reduce hazardous fuels and wildfire hazard. Fuel reduction activities would focus on fuel sizes (1/2" – 6" diameter) and types (brush and slash) that contribute the most to fire behavior, with the objective to reduce surface fuel loading to pre-harvest levels (or lower) and prepare the regeneration units for planting.

Following fuels treatments, it is reasonably foreseeable that regeneration harvest units in the Harvest Land Base would be planted using the Coos Bay District's Young Stand Management CX (DOI-BLM-ORWA-C000-2019-0002-CX). This would result in indirect changes to fire hazard as these plantations are established, grow, and are maintained over time. **Alternative 2** would result in up to 520 acres of even-aged plantations in nine widely spaced, irregularly shaped and bisected units over a 5-year period. The largest single plantation would be 193 acres and the average plantation size would be 58 acres. Under **Alternative 3,** plantation area is up to 727 acres within 12 units, with the largest being 230 acres and an average size of 61 acres. No planting would occur in LSR restoration treatments.

Fire Hazard definition: For the purposes of this discussion, fire hazard refers to the ease of ignition, potential fire behavior and resistance to control of a given forest structural stage. Fire behavior is driven in part, by fuel loading and arrangement, which varies as stands are harvested, planted and maintained over time (Appendix H, Tables H-6 and H-7, pg. 1321-1322).

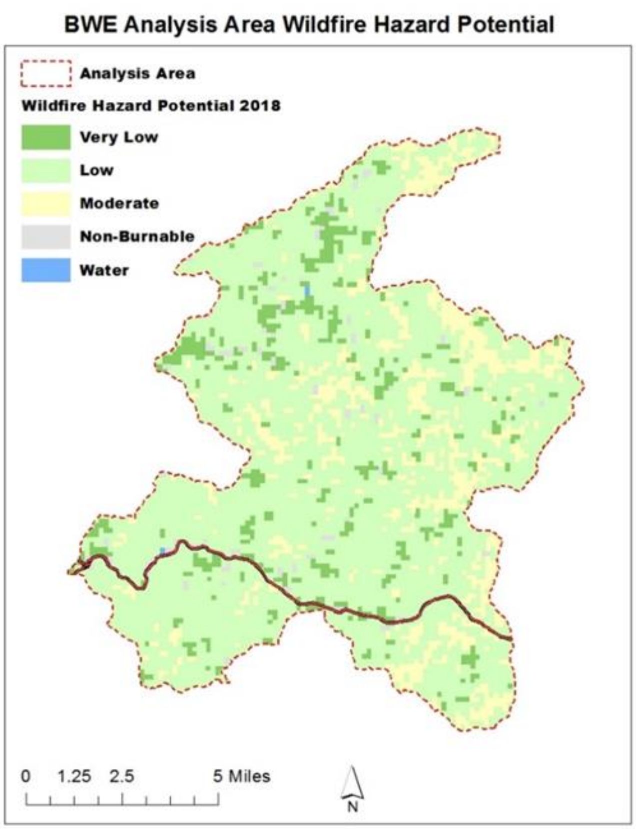
The PRMP/FEIS analysis assigns a stand-level fire hazard rating based on forest stand structure (Table 3-34, pg. 254). The differences in stand structure is determined by stand age as well as characteristics such as tree size and relative density. A rating of High to Moderate hazard indicates fires would be relatively difficult to control, while Low hazard indicates fires would be relatively easy to control. Mixed fire hazard indicates the potential to exhibit the full range of fire behavior and difficulty of control (Low to High).

The RMP/FEIS notes that fuel arrangement is only one of the many factors that influence fire behavior. RMP/FEIS analysis could not account for all the complex interactions among fuels, topography and weather that influence fire behavior, resultant burn severity and fire effects. However, the relative ranking of stand-level hazard using forest structural stage, does provide a consistent basis for comparing treatment effects over time.

Current Conditions: All stands identified for regeneration treatment under this plan are characterized as either Mature, Single- or Multi-Layered Canopy, or Structurally Complex stands which have fire hazard ratings of Low to Mixed. Stands identified for thinning and restoration treatments are generally either Young, High-Density stands which have a fire hazard rating of High, or Mature, Single-Layered Canopy stands which have fire hazard ratings of Low.

The BWE Analysis Area is characterized as an area of very low to moderate Wildfire Hazard Potential (WHP), (Dillon, G. see Figure 4). WHP depicts the relative potential for wildfire that would be difficult for suppression resources to contain (categories range from Very Low to Extreme). Nearly all the BWE Analysis Area (83%) falls into either the Low or Very Low categories. Areas mapped with higher WHP values represent fuels with a higher probability of experiencing torching, crowning, and other forms of extreme fire behavior under conducive weather conditions, based primarily on landscape vegetation conditions at the end of 2012.

Figure 4. Wildfire Hazard Potential within the Big Weekly Elk Analysis Area



Very Low	5,965	8.6
Low	51,763	74.3
Moderate	10,739	15.4
Non-Burnable	1,134	1.6
Water	38	0.1

Assumed Stand-Level Changes - Thinning and Restoration Treatment Units: Stands identified for thinning begin with High, Moderate or Low fire hazard ratings. Once thinning occurs, they would initially have elevated fire hazard due to increased surface fuel loading resulting from harvest activities. After 3 to 5 years, activity fuels would break down and begin to decay, and surface loading would return to pre-harvest levels. The removal of trees from thinning units would result in wider tree spacing, lower crown bulk densities and less fuel continuity. This would generally result in stand structures with lower fire hazards (Young, Low-Density; Mature, Single-Layer Canopy; or Mature, Multi-Layer Canopy) of Mixed or Low.

Specifically, the younger LSR units (40-50 years of age), identified for thinning treatment Type 1 under this plan, would be considered Young, High-Density stands with High fire hazard ratings. The restoration treatments proposed under this plan would affect up to 1,629 acres under **Alternative 2** or 1,763 acres under **Alternative 3**. These treatments would result in stands with the characteristics of Young, Low-Density stands which are characterized by Moderate fire hazard. In addition to improving habitat for endangered species, the proposed treatments could help these stands persist over time by reducing the chance of large-scale wildfires.

The non-commercial restoration treatments proposed under this plan (Type 3, EA pp. 15-16) are unlikely to alter stand structures enough to result in changes to stand-level fire hazards. The BLM would evaluate each treatment unit to determine if follow-up fuels reduction activities are necessary when non-commercial restoration activities are planned adjacent to private property, public roadways or other infrastructure. The BLM would reduce or remove smaller-diameter slash and brush in these areas to reduce fire intensities, protect private property and aid in wildfire suppression efforts.

The Wildland Development Area: The BLM focuses special attention on activities and impacts within a one-mile buffer of the Wildland Development Area (WDA), as defined in the West Wide Wildfire Risk Assessment (WWRA, 2013). As explained in the RMP/FEIS, this one-mile buffer represents the geographic scope of possible immediate risks to the public and firefighter safety within close proximity to communities located within the Wildland Urban Interface across the planning area (RMP/FEIS, pg. 253). This designation can be thought of as similar to the Wildland Urban Interface (WUI). The Healthy Forest Restoration Act (2003) identifies Wildland Urban Interface as an area within or adjacent to structures and other human development that meet or intermingle with undeveloped wildland.

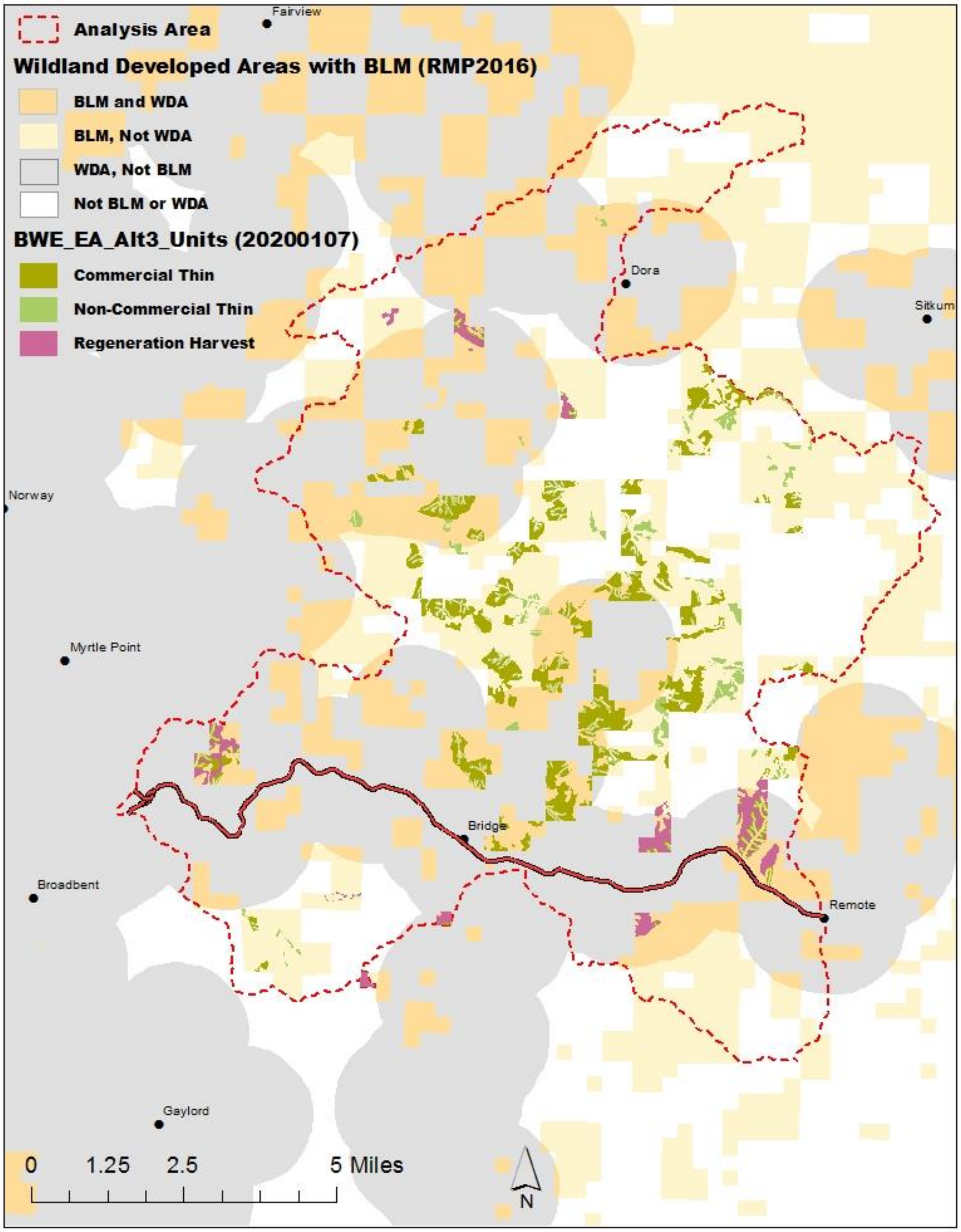
The reason for the focus on the area within the WDA is twofold. First, fires occurring within this area pose a greater risk of negative impacts to people, houses and other infrastructure. Second, more fires start within the WDA due to increased human activities. For instance, the average annual number of human-caused ignitions that occurred on the Coos Bay District between 1984 and 2013 is 67. Of these fires, 56 occurred within the WDA and only 11 occurred outside the WDA (RMP/FEIS, Figure 3-34, pg. 254).

WDA and the proposed project: Of the acres selected for harvest under **Alternative 2**, 1,934 treatment acres overall, and 408 acres of regeneration harvests fall within the WDA. Under **Alternative 3**, 2,140 acres overall and 594 acres of regeneration harvests fall within the WDA. (See Table 20 for a comparison of acres treated by alternative.)

Another change in fire hazard from this project is the result of the establishment of even-aged plantations following regeneration harvest activities. As stated above, the proposed regeneration harvest areas are located in relatively small, scattered units that are widely dispersed within the Analysis Area and most sales are separated by at least one mile. (See Figure 5 below) The small size and spatial discontinuity of harvest units as proposed under this plan results in lower potential for negative effects when compared to larger, contiguous and homogenous units.

Figure 5**.** Alternative 3 Harvest Units in relation to the Wildland Developed Area. (Alternative 2 Harvest Units are slightly smaller in some units.)

BWE Analysis Area - Alt 3 Harvest Units and WDA



An important factor to consider when evaluating relative fire hazard is the topographic position of the plantations relative to infrastructure and human values. All regeneration units proposed under this plan are located uphill from developments and infrastructure. In fact, there is virtually no private land located uphill from any of the proposed BLM regeneration harvest units. This means there is lower relative hazard to private investments and infrastructure from a fire emerging from a BLM plantation since fire burning downhill has lower intensity compared to a fire burning uphill. In the context of fire suppression, it is relatively easy to defend a location from fire if the fire is moving downhill towards the values to be protected. This is the most likely scenario if a wildfire were to occur in one of the proposed BLM plantations.

RMP/FEIS Analysis: RMP/FEIS analysis compares current conditions to conditions after 50 years of management under the RMP. The changes in fire hazard within the WDA of the Coos Bay District are shown in Table 19, below. Overall fire hazard within the WDA is improved across the district over the 50-year time frame, with the number of acres in Low hazard nearly doubling and a 33% reduction in acres of High hazard.

Table 19. Change in fire hazard for the Coos Bay District (within the WDA)

Stand-level Fire Hazard	Current Condition	Year 2063
Low	12,875 acres (17%)	23,056 acres (31%)
Moderate	2,852 acres (4%)	3,245 acres (4%)
Mixed	23,089 acres (30%)	37,237 acres (49%)
High	36,737 acres (49%)	12,016 acres (16%)

BWE Treatment Areas: The BWE Analysis Area is defined by 6th field watershed divides. These divides (ridges) can serve as fire/fuel breaks so it makes sense to use the same physical boundaries to define the Analysis Area for fuels and fire discussions. Within this Analysis Area, BLM lands comprise 42.9 percent of the area, private land occupies over half the land (52.3percent) and the remaining acres are Indian Trust Lands (4.7 percent) and water (0.2 percent). See Table 20 for a comparison of acres treated by alternative.

Under Alternative 2, the proposed treatments would affect 8.9 percent of BLM lands, but regeneration harvests would only affect 1.7 percent of BLM lands within the Analysis Area. Further, under this alternative, regeneration harvests would affect only 3.0 percent of BLM lands within the WDA. Only 3.8 percent of the entire Analysis Area would be affected by the proposed actions under this alternative (considering all BLM, tribal and private lands together).

Under Alternative 3, the proposed treatments would affect 7.9 percent of BLM lands, but regeneration harvests would affect just 2.4 percent of BLM lands. Regeneration harvests would affect 4.4 percent of BLM lands within the WDA. Only 3.4 percent of the entire Analysis Area would be affected by the proposed actions under this alternative (considering all BLM, tribal and private lands together).

Table 20**.** Summary Table – Acres Affected

		Alternative 2		Alternative 3	
	Acres Within Analysis Area	**Total Treatment Acres**	**Regen Acres**	**Total Treatment Acres**	**Regen Acres**
BLM Total	**29,856.1** (42.9%)	**2,667** (8.9%)	**520** (1.7%)	**2,350** (7.9%)	**727** (2.4%)
BLM in WDA	**13,456.8** (19.3%)	**1,934** (14.4%)	**408** (3.0%)	**2,140** (15.9%)	**594** (4.4%)
Private	**36,407.2** (52.3%)				
Indian Trust Lands	**3,241.1** (4.7%)				
Water	**130.2** (0.2%)				
Total Analysis Area	**69,634.6** (100%)	**2667** (3.8%)	**520** (0.7%)	**2,350** (3.4%)	**727** (1.0%)

Summary: The BLM acknowledges that plantations established following regeneration harvests would increase fire hazard on approximately 1 to 2 percent of the BLM-lands within the Analysis Area and approximately 1 percent of the overall land base of the Analysis Area under either proposed alternative. However, the fire hazard would change over time and is expected to be Low to Mixed for at least half of the life of the stand.

Low to Moderate Wildfire Hazard Potential within the Analysis Area indicates that stands are likely to be able to grow over time and achieve maturity, resulting in Low fire hazard stands. In addition, the relatively low historic fire occurrence in these locations could indicate that future fire occurrence is also less likely. The low fire occurrence, in combination with the Low to Moderate WHP, further increases confidence in the likelihood that a particular stand will be able to grow to maturity. As stated above, achieving maturity results in stands with Low fire hazard ratings and lower risk to the public and surrounding communities.

When reviewing literature related to fire hazard as it relates to managed plantations, some key differences in management between private timberlands and BLM timberlands become apparent. BLM plantations, as proposed under either alternative in this EA, are relatively small, irregularly shaped, and bisected by untreated riparian reserves. This heterogeneity contributes to reduced fire impacts by disrupting fire spread with shaded areas and pockets of mature trees. In addition, the BLM applies silvicultural treatments such as manual maintenance and pre-commercial thinning, in order to achieve stand maturity as quickly as possible. These actions not only result in high-quality stands, they also may reduce the amount of time the stand is in the High fire hazard stage of development. (Zald, Stone)

However, the fact that some of these harvest activities are located inside the WDA contributes to increased concern. The BLM would apply more aggressive fuel reduction treatments in units where there may be higher risk to adjacent developments or structures. In areas with greater public access or more values at risk, treatments may also include expanded roadside fuel treatments that would reduce fire behavior adjacent to access roads, thus increasing the chances for responders to successfully control a wildfire.

The BWE project includes sample tree falling, and there is the potential for these sample trees to remain on the ground if a timber sale does not occur. The number of proposed sample trees (up to one tree per 2.5 acres) is not expected to contribute significantly or cumulatively to increased fire risk because one tree per 2.5 acres would not provide a continuous fuel bed that would allow the fire to move across the landscape, thus not increasing fire risk to neighboring private land and structures. The number of sampled trees is not expected to increase fire risk any more than the number of windfall or natural mortality events.

The issue was considered but not analyzed in further detail because it has been fully analyzed and considered under the RMP/FEIS. The RMP/FEIS has established the HLB timber management objective for the Coos Bay District is to manage the HLB at rotations of 90 to 110 years, which means on average, about 1 percent of the district's HLB (approximately 350 acres a year) would be regeneration harvested annually (PRMP/FEIS, pp. 1163-1227). This annual acreage adds up to approximately 1,750 acres of new plantations (with High fire hazard) over a five-year period.

This plan proposes to implement up to 727 acres of regeneration harvests over approximately 5 years. In addition, the Catching EA from the Umpqua Field Office proposes 841 acres of regeneration harvests over nearly the same five-year period. This results in approximately 1,349 or 1,555 acres across the district over a five-year period. An additional 1,108 acres of regeneration harvests are currently being sold and harvested under the Upper Rock Creek EA. These sales are being implemented over the 5-year period spanning from 2019 through 2023, resulting in an annual average of 222 acres. These ongoing and planned harvest activities are well within the parameters of the fire hazard assumptions and determinations of the PRMP/FEIS. At these rates, the Coos Bay District is actually generating fewer acres of High hazard stands than what was analyzed in the PRMP/FEIS. For these reasons, the BLM recognizes no potential for significant impacts from the proposed actions on fire hazard within the project area.

Recreation

How would the proposed forest management treatments and road construction activities affect visual resources?

Rationale for elimination: Geographic Information System (GIS) review of the Big Weekly Elk project showed the analysis area to be in Visual Resource Management (VRM) Class IV. The management practices on scenic quality values for VRM Class IV are described as follows: Manage Visual Resource Management Class IV areas for high levels of change to the characteristic landscape. Management activities dominate the view and will be the major focus of viewer attention (USDI-BLM 2016b pp. 93-94) and are consistent with the analysis completed in the PRMP/FEIS (USDI-BLM 2016c pp. 813-823). The analysis assumption in the PRMP/FEIS regarding forest management practices on scenic quality values for Visual Resource Inventory (VRI) Class IV is described as follows:

> All harvest types could take place within VRI Class IV areas without degrading their visual resource values. The PRMP/FEIS analyzed the effects to visual resources from forest management and determined that “regeneration timber harvest would not diminish the existing visual values of areas that are VRI Class IV.” The PRMP/FEIS further states that “under all alternatives and the Proposed RMP, the largest designated VRI class of the Harvest Land Base would be VRI Class IV; timber harvest would not degrade the overall visual values of these areas.”

Compared to regeneration timber harvest, thinning is generally less impactful; therefore, thinning would also not diminish the existing visual values of the areas that are designated Class IV.

BLM Manual H-8410-1 (Visual Resource Management) defines the objectives of Class IV as follows:

> The objective of this class is to provide for management activities which require major modifications of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements (USDI-BLM 1986, p. 7).

It is my judgement that there are no potential or significant effects from implementation of the proposed forest management treatments and road construction activities because they align with the Coos Bay District’s management direction for Visual Resource Management Class IV areas. As described on page 93 of the ROD/RMP (USDI-BLM 2016b) management objectives allow for major modifications of the existing character of the landscape and therefore the BLM is eliminating the issue from further analysis as there is no potential for significant effects.

How would the proposed forestry treatments and road construction activities affect designated recreation management areas?

Rationale for elimination: There are no designated Recreation Management Areas (Extensive Recreation Management Area, ERMA or Special Recreation Management Area, SRMA) within the analysis area. Therefore, the BLM is eliminating this issue from further analysis because there is no potential for significant effects.

How would the proposed forest management treatments and road construction activities affect public access and safety?

Rationale for elimination: Due to the checkerboard nature of public and private land ownerships, some but not all proposed treatment areas have legal road access for the public. Access to public lands across roads where public access is not guaranteed may be restricted due to 'no trespassing' signs and/or locked gates. General forest access may also be temporarily restricted for public safety due to active logging and hauling of timber on forest roads. During active logging and hauling operations, operators are required to follow State and Federal OSHA regulations that require signs and flaggers during timber harvesting and road construction operations. Assuming contractors follow all OSHA safety regulations for public notification of activities operating in the area, there would be no additional risk of injury to the public beyond that which currently exists on landscapes managed for timber production. Temporary delays due to flaggers stopping traffic or detours may be an inconvenience but will not prevent public access, and in the professional opinion of the BLM's Outdoor Recreation Planner there is no potential for significant effects; therefore, the BLM is eliminating this issue from further analysis.

Typical dispersed recreation use on the Coos Bay District includes, among other activities, hunting, fishing, and nature viewing. Dispersed recreation use data is not known or gathered specific to the planning area. This is common to all alternatives and would not provide measurable change to inform a decision.

Soil productivity/Slope Stability

How would proposed timber harvest, sample tree falling, fuels treatments, and road and landing construction and decommissioning for the commercial activity affect soil productivity in the treatment areas?

Rational for Elimination: This EA tiers to ROD/RMP, which provides management direction to apply BMPs, as needed, to maintain or restore soil functions and soil quality, and limit detrimental soil disturbance (USDI BLM, 2016b, p. 89). The ROD/RMP also provides direction to "limit detrimental soil disturbance from forest management operations to a total of < 20 percent of the harvest unit area" and "detrimental soil disturbance can occur from erosion, loss of organic matter, severe heating to seeds or microbes, soil displacement, or compaction" (pp. 89–90).

The PRMP/FEIS to which this analysis tiers, describes soil quality as follows:

> *Soil quality is the innate capacity of any soil to function within natural or managed ecosystem boundaries, to sustain plant and animal productivity, to maintain or enhance water and air quality, and to support ecosystem health. Land management practices more often reduce soil quality through declines in two ecosystem properties: site organic matter and soil porosity* (Powers, 1990) (USDI BLM, 2016c, p. 745).

The BLM Geologist completed site-specific pre-disturbance soil monitoring using the US Forest Service Forest Soil Disturbance Monitoring Protocol on 10% (32 acres) of the potential ground-based harvest units (Page-Dumroese, 2009). The geologist chose the units based on conversations with the BLM timber sale planner, for which units met the size requirement for monitoring and which units were most likely to be ground based. The geologist focused on detrimental soil disturbance for ground-based units because cable-yarding operations incur less ground disturbance and therefore if ground base units are below 20 percent detrimental disturbance than so would cable yarding units. Disturbance features are soil disturbances typical to operations in timber sale units such as skid trails, landings, roads from past logging, and shallow landslides.

From field observations showed that both units have zero exiting detrimental soil disturbance and soils are healthy and have recovered from past harvest activity. For the proposed actions, new detrimental disturbance would occur from in-unit equipment, loss of cover from harvest (including sample tree falling), and fuels treatments. The geologist recommends BMPs identified in this EA (Alternative B) be incorporated into each timber sale contract. Annually, the BLM would complete post-harvest and fuel treatment soil monitoring on 10% of the treatment units to determine the level of detrimental soil conditions and reported to meet the requirements in the ROD/RMP (USDI-BLM 2016b, pp 127).

The Soil Productivity and Slope Stability Report (pp. 1-4), hereby incorporated by reference, analyzed the soil types, reviewed TPCC, analyzed completed field work, investigated pre-disturbance soil monitoring, and reviewed LiDAR/aerial images/GIS analysis to determine impacts and recommend BMPs for all the proposed actions and alternatives. The soils within the project area are resilient to management actions due to the soil texture (minimal clay) and the high organic matter. The BLM did not analyze this issue in detail because the nature of disturbance associated with all alternatives and employing the best management practices would not create significant effects to soil productivity and would not create detrimental soil disturbance over greater than 20% of the harvest unit area.

How would proposed commercial timber harvest (including sample tree falling), fuel treatments, and road construction affect the shallow and deep landslide regime in the treatment areas?

Rational for Elimination: The ROD/RMP provides Management Direction which requires the BLM to “Avoid road construction and timber harvest on unstable slopes where there is a high probability to cause a shallow, rapidly moving landslide that would likely damage infrastructure (e.g., BLM or privately owned roads, State highways, or residences) or threaten public safety” (USDI BLM, 2016b, p. 90).

The BLM geologist reviewed 47 areas in their specialist report, hereby incorporated by reference, deep-seated slides and shallow slides with potential slope stability concerns with a downslope risk to Highway 42, residences, county roads, or mainline roads based on slope thresholds and protocol from Oregon Department of Forestry for high hazard landslide areas (Oregon Department of Forestry, 2003).

Deep-seated slide deposits, defined as greater than 16 feet deep are common in this sedimentary rock. Tectonic uplift and earthquakes are likely the most common triggers. In the analysis area, the deep slides range in size from one to 100+ acres and most are over 300 years old. They fail fast or slow. Failures typically correspond to the bedrock dip direction and increase as the dip angle increases (Roering, 2004).

Shallow slides are common and defined by being less than 16 feet deep. For this area, the Oregon Department of Forestry (ODF) defines high hazard landslide areas on any slope where it is steeper than 80 percent and any headwall or draw that is steeper than 70 percent (Oregon Department of Forestry, 2003). Only 30–70 percent of landslides deliver sediment and other material to streams. Once a slide enters a stream channel, it can pick up velocity, and travel long distances. These rapidly moving landslides are extremely dangerous to whatever is in its path. Slides deposit their loads at low gradient valley floors. On steep slopes, forests provide partial stability from the lateral spread of tree roots, by protecting the slope from rainfall, by providing ground cover, and by transpiring water, which helps to lower soil water, which is a causative factor in slope failures (USDI-BLM 2016c, p. 394).

Each area was rated for potential risk: including likeliness a shallow rapid landslide would occur and impact the downslope risk and the feature and rated the risk level. The specialist made recommendations for proposed commercial treatments and road work. Of the 47 areas, 24 areas were rated as ‘as proposed’ or were deferred units and no recommendations were necessary. The remaining 23 reviewed areas required site specific PDFs which are listed in Appendix B. There were not any deep-seated active slides found. Applying these PDFs and BMPs would ensure the BLM would avoid or retain treed slopes where there is a high probability to cause a shallow, rapidly moving landslide that could damage infrastructure.

The BLM did not analyze this issue in detail because there would be no significant effects, because the geologist worked with the IDT to design a project where the BLM would avoid road construction and timber harvest on unstable slopes where there is a high probability to cause a shallow, rapidly moving landslide that would damage infrastructure (e.g., BLM or privately owned roads, State highways, or residences) or threaten public safety.

Noxious Weeds and Invasive Plants

> *How would the proposed harvest treatments and associated activities affect the introduction and spread of invasive plants, including noxious weeds?*

Rationale for elimination: The BLM reviewed prior years noxious weed survey information within the project area and data stored in the Noxious and Invasive Species Information Management System (NISIMS) (the BLM’s corporate database for weed data). Noxious weed species mapped within the Big Weekly Elk analysis area include gorse, Canada thistle, French broom, Scotch broom, Himalayan blackberry, English ivy, false brome, biddy-biddy, knapweed, and Japanese knotweed.

The BLM eliminated this issue from further analysis because there is not potential for significant effects beyond what was analyzed in the PRMP/FEIS, to which this project tiers to (USDI BLM, 2016c, pp. 419-437), which determined that timber harvest, road construction and road use along with other ground-disturbing activities increased the risk of invasive plant introduction and spread. The BLM “would implement measures to prevent, detect, and rapidly control new invasive species infestations based on management direction. Because of this management direction, all alternatives and the PRMP/FEIS would be expected to apply mitigation against introduction and spread of invasive plant species” (USDI BLM, 2016c p. 437; USDI BLM 2016b p. 80). Although all proposed activities have the potential to introduce or spread noxious weeds and invasive plants, all project activities would implement PDFs intended to minimize the risk of introducing noxious weeds and invasive plant propagules (seeds and reproductive vegetative material) and the spread of existing infestations into the harvest areas, access roads, and waste and stockpiling areas. Additionally, BLM developed a site-specific Risk Assessment, which is attached. Because the risk assessment determined that most proposed activities have a moderate or high risk of introducing or spreading noxious weeds and invasive plants, this project has been modified with PDFs to reduce the risk level through preventative measures. These PDFs are consistent with Standard Operating Procedures in the Integrated Invasive Plant Management Environmental Assessment for the Coos Bay District Appendix A (USDI BLM 2018). For example, the BLM would require project contractors to wash all equipment and vehicles to remove soil, mud, vegetative materials, and excess oil, grease or other materials that could contain seed before moving onto BLM-managed lands, including all project areas. Additionally, the BLM would require the use of weed-free materials (including soil, gravel, rock, seed, plants, and mulch) to prevent the introduction of non-desirable plant propagules.

The BLM currently treats noxious weed and invasive plant infestations on BLM-managed lands under the Integrated Invasive Plant Management for the Coos Bay District EA (DOI-BLM-ORWA-C000-2017-0003-EA, USDI-BLM 2018). The BLM treats known noxious weed and invasive plant sites as early as possible prior to ground disturbance to reduce available propagules that could be moved into the project area. Monitoring and noxious weed treatments, combined with PDFs, would minimize the introduction, and spread of noxious weeds and other invasive plants.

Wildlife

How would the proposed management activities affect spotted owl and marbled murrelet critical habitat units (CHU) within the project area?

Rationale for elimination: This issue was considered but not analyzed in detail because it does not address the purpose and need and is not associated with significant impacts beyond those analyzed in the Final PRMP/FEIS (USDI BLM, 2016c, pp. 907, 990-993) to which this EA tiers. With implementation of the PRMP/FEIS analysis for murrelets, the BLM would develop more nesting habitat and high-quality nesting habitat within designated critical habitat for the marbled murrelet in 50 years across the entire CHU units. In addition, timber harvest would not affect the functionality of murrelet critical habitat above the stand-scale at any time during the next 50 years because of the limited extent of timber harvest. For the spotted owl, there will be some loss of critical habitat with ROD/RMP implementation, but the large amount of LSR (approximately 80% of the BLM land base in western Oregon), will support the function of critical habitat, and small localized impacts will not affect the overall utility of critical habitat to support spotted owl recovery.

The BLM eliminated this issue from further analysis because the proposed actions are within the scope of the PRMP/FEIS (USDI BLM, 2016c, pp. 907-909, 932-947) to which this document tiers. Treatment on LSR would retain all physical and biological features (PBFs) described as spotted owl and murrelet critical habitat, and all actions on HLB would not limit the functionality or recovery actions of the CHU.

The BLM evaluated the proposed project's effects under both the 2012 (50 CFR 71876) and 2021 (86 CFR 4820) proposed CHU rule.

Spotted Owl 2021 Critical Habitat Analysis

In the 2021 proposed spotted owl CHU revision, the proposed project would not intersect any CHU units and therefore there would be no effects to CHU.

Spotted Owl 2012 Critical Habitat Analysis

The proposed project is in the USFWS designated Oregon Coast Range critical habitat Unit 2, subunit ORC-6. This subunit is approximately 81,900 acres (33,144 ha) in Coos and Douglas Counties, Oregon and is exclusively comprised of BLM managed land (USDI USFWS 2012a). The USFWS anticipated that the ORC-6 subunit would function primarily for "demographic support to the overall population and for north-south connectivity between subunits and critical habitat units (USDI FWS 2012a)." The final rule identified the need for increasing and enhancing habitat in this unit to provide for viable populations of spotted owls over the long term by providing for population growth, successful dispersal, and buffering from competition with the barred owl. To evaluate the effects of the proposed project on critical habitat, the BLM evaluated the how the proposed timber sales would affect the function of critical habitat subunit, ORC-6.

Approximately 93 percent of ORC-6 is in a protected land class (Congressionally Reserved Lands, District Designated Reserve, LSR, or RR), and approximately 68 percent of ORC-6 is classified as LSR.

Spotted owl critical habitat on BLM land will be managed following the ROD/RMP, as analyzed in the PRMP/FEIS (USDI BLM, 2016c, pp. 990-998). The PRMP/FEIS determined that both dispersal habitat and NRF habitat in ORC-6 would increase over the next 50 years due to the large amount of the unit in LSR habitat despite some harvest within the critical habitat unit (USDI BLM, 2016c).

The specific impacts from the reduction in NRF/RF habitat and dispersal habitat are addressed in Issues 1 and 2 respectively in the PRMP/FEIS (USDI BLM, 2016c, pp. 932-947). Issues 1 and 2 address conservation needs identified by Thomas et al. (1990):

1. Large blocks of nesting, roosting, and foraging habitat that support clusters of reproducing owls, are distributed across a variety of ecological conditions, and are spaced to facilitate owl movement between the blocks, and;
2. Habitat conditions within and surrounding large blocks of nesting, roosting, and foraging habitat that facilitate owl movement between the blocks and ensure the survival of dispersing owls.

A discussion of the conservation needs of spotted owl critical habitat is provided in the BA (USDI BLM 2020, p. 115), which is incorporated by reference.

The restoration treatments are modeled to accelerate growth of NRF habitat for spotted owls and would contribute to the increase of habitat available in this large block. While much of the project is not in large block LSR, the restoration efforts would improve conditions locally by providing more NRF habitat, making it more likely that spotted owls would be able to successfully establish territories and breed.

No Action Alternative

If the proposed project did not go forward, no work would occur in these locations in the CHU unit, although timber sales elsewhere would occur instead. As discussed above, while specific locations were not included in the PRMP/FEIS analysis, the effects of harvesting in spotted owl CHU were analyzed in (USDI BLM, 2016c, pp. 932-947), and the BLM determined that the CHU would continue to function as designed. Thus, the BLM assumes that the CHU would also continue to function were a different project elsewhere to be implemented instead.

Alternative 2:

The proposed treatment actions would overlap 2,047 acres of CHU of which 203 acres are in HLB, 1,242 acres are in LSR, and 611 acres are in RR. Under alternative 2, the BWE project has no treatments planned within NRF habitat that overlap the CHU.

Within the critical habitat unit, the BLM would treat 1,240 acres of dispersal habitat which would continue to function as dispersal post-project. The HLB treatments would not remove RF but would downgrade 10 acres of RF habitat and 192 acres of dispersal habitat within CHU. Proposed treatments in the LSR and RR would accelerate the growth of NRF within 40 years (see issue question 3.1.7). The entire footprint of the project is about 2.5% of the CHU sub-unit, with the removal of less than one percent of the CHU (approximately 0.25%); the remaining 2.25% would contribute to restoration of stands for owl NRF within 40 years.

Alternative 3:

The proposed treatment actions would overlap 2,155 acres of CHU of which 298 acres are in Harvest Land Base (HLB), 1,242 acres are in LSR, and 616 acres are in Riparian Reserve (RR). Alternative 3 has no treatments planned within NRF habitat that overlap the CHU.

Within the CHU, the BLM would treat 1,698 acres of dispersal habitat which would continue to function as dispersal post-project. The HLB treatments would remove 0 acres of NRF, 45 acres of RF habitat and 253 acres of dispersal from the CHU (Appendix G). Proposed treatments in the LSR and RR would accelerate the growth of NRF within 40 years (see issue question 3.1.7). The entire footprint of the project is about 3 percent of the CHU, with the removal of less than 1 percent of dispersal resulting in approximately a 1 percent reduction to the CHU unit; the remaining 2 percent would contribute to restoration of stands for owl NRF within 40 years.

Conclusions:

The PRMP modelled HLB to achieve sustainable timber harvest over time. Because the units in critical habitat are all in Low Intensity Timber Area (LITA), there would be 15-30 percent retention of the stand, allowing the CHU to continue to provide dispersal function between subunits and critical habitat units (USDI BLM, 2016c). Therefore, while the project would alter habitat conditions within CHU, it would not limit the functionality of the CHU and subunit for demographic support or dispersal.

Under both alternatives, while the proposed project would alter habitat conditions within the CHU, it is not expected to limit the functionality of the CHU and subunit. Alternative 2 would not remove NRF or RF. Under Alternative 3 the BLM proposes to remove 75 acres of NRF, 118 acres of RF for HLB treatments. The implementation of either alternative would not alter the functionality of CHU unit.

While NRF and RF habitat would be removed through HLB treatments with and without CHU, totaling 111 acres in Alt 2 (Table 40) and 188 acres in Alt 3 (Table 43), the majority of the proposed project is in the LSR and RR where treatments would accelerate NRF habitat development. Because of the large amount of LSR in the area, the retention in the HLB units, and the RR, there is sufficient habitat remaining across the landscape that would be managed to promote spotted owl nesting, roosting, and foraging for demographic support of the critical habitat. The entire footprint of the project is about 3 percent of the critical habitat unit, with the RF and dispersal removal resulting in approximately a less than 1 percent reduction to the critical habitat unit. This critical habitat change would not limit the critical habitat's ability to function even immediately after harvest. As discussed above, the proposed project would benefit owls by accelerating better NRF habitat in 80 acres in Alt 2 and 72 acres in Alt 3 within 40 years.

The CHUs were designed to ensure the spotted owl's ability to disperse across the landscape and for demographic support. Even with the loss of habitat acres in CHU, spotted owls would continue to be able to disperse across the landscape. Spotted owls would continue to be able to disperse across the landscape as modelled in the PRMP/FEIS (USDI BLM, 2016c, pp. 932-947).

Marbled Murrelet Critical Habitat

The action area of 0.25 miles out from the proposed harvest units lies within critical habitat subunit OR-06 within subunits b and c and located primarily in Coos County, OR. The subunits are 57,612 acres (sub-unit b is 52,851 acres and sub-unit c is 4,762 acres), all on BLM administered land. No portions of the project are proposed in critical habitat sub-unit b, so we focus here on subunit c. The purpose of the critical habitat unit is to support nesting. Under the PRMP/FEIS, 3,288 acres of the critical habitat subunit are mapped as LSR and management would be conducive to develop and maintain murrelet nesting habitat into the future (USDI BLM 2016c, pp. 907-909). An additional 514 acres are mapped as RR and 162 acres are District Defined Reserve. In total, 3,964 acres, 83 percent of the subunit, are in a protected class under the RMP and would be managed in a way that would support murrelet nesting into the future. The remaining 770 acres are designated as HLB. The FEIS/PRMP evaluated the impact on critical habitat from implementation compared with the no-timber harvest as a reference and determined that as a whole, the FEIS/PRMP would support 99 percent as much of the high-quality nesting habitat under the FEIS/PRMP as compared with the no-harvest reference alternative and that critical habitat would continue to function as anticipated with implementation of the FEIS/RMP (USDI BLM, 2016c, pp. 895-918).

Alternative 2:

There are no proposed actions in murrelet CHU under Alternative 2.

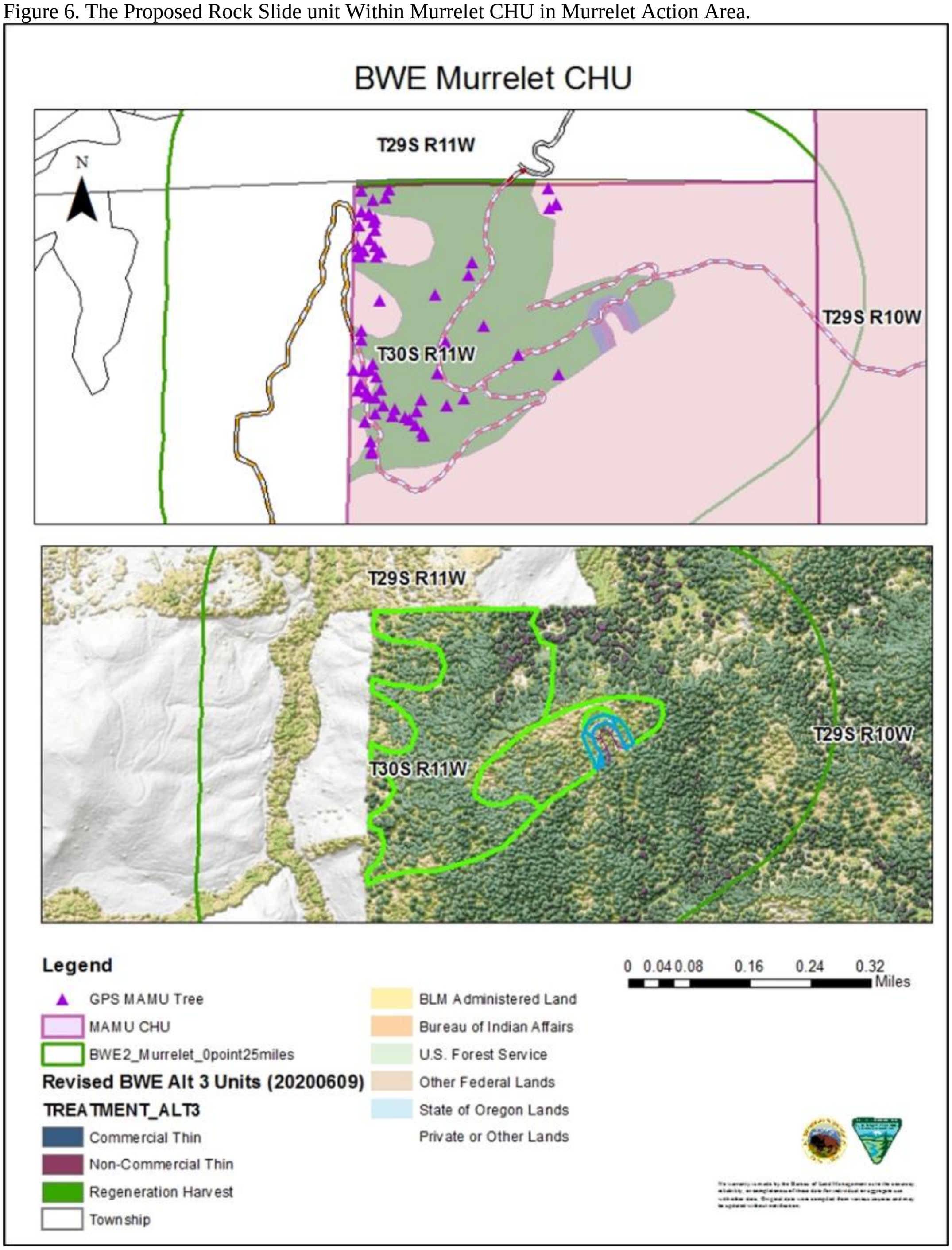
Alternative 3:

Under Alternative 3, approximately 58 acres of the proposed Rock Slide unit overlap Critical Habitat unit OR-06-c, of which approximately 57 acres are in the HLB and proposed for regeneration harvest (Figure 6), and one acre is in the RR and proposed for thinning. Of these, 40 acres are currently suitable murrelet nesting habitat. This unit is being surveyed for marbled murrelets. If surveys determine occupancy, all BLM land within a quarter mile of the detection would be delineated as an occupied stand and would be managed under the ROD/RMP management direction (USDI BLM, 2016b, pp. 4, 52, 98). Figure 6 displays the proposed Rock Slide unit within the murrelet CHU in the murrelet action area. Field-identified murrelet trees are purple triangles on the top map.

Conclusions:

Under Alternative 2, there is no treatment proposed on critical habitat. Under Alternative 3, the proposed HLB sale units would directly affect approximately 58 acres of critical habitat, of which only about 40 acres are suitable; all in the proposed Rock Slide sale. The stand has characteristics that could support nesting, and protocol surveys are planned for 2020 and 2021. The regeneration harvest represents an approximately one percent reduction within the OR-06-c subunit. While the proposed harvest and road construction would remove murrelet nesting habitat, approximately 99 percent of the subunit would continue supporting murrelet nesting and would continue functioning as CHU. Treatments in the HLB and LSR were evaluated in the FEIS/RMP, and the BLM determined that these activities would not affect the function of marbled murrelet critical habitat during the next 50 years due to the limited timber harvest and since a majority of designated critical habitat would be within reserves. (USDI BLM, 2016c, pp. 907-908)

Figure 6. The Proposed Rock Slide unit Within Murrelet CHU in Murrelet Action Area.



How would the proposed management activities of vegetation removal affect Special Status wildlife species, Bald and/or Golden Eagles, and migratory birds and their habitat?

Rationale for elimination: This issue was considered but not analyzed in detail because it does not address the purpose and need and is not associated with significant impacts beyond those analyzed in the Final PRMP/FEIS (USDI-BLM 2016c, pp 830-851, 881-886). The PRMP/FEIS analysis concluded that habitat availability for Bald Eagles, Special Status wildlife and land bird focal species, dependent on forest stands like those in the BWE analysis area, would increase in 50 years. BLM would comply with the PRMP/FEIS and have activity restrictions near Golden Eagle nests during the breeding season. (USDI BLM, 2016c, pp. 825, 830, 885) The Western Bumble Bee was included in this section, since it a question was raised about it during the initial comment period and it is a Bureau Sensitive species.

Special Status Species

There are eight Bureau Sensitive species (1 amphibian, 2 birds, 3 invertebrates, 2 mammals, and 1 reptile) documented or suspected on the Coos Bay District that may occur in the proposed project area: Foothill yellow-legged frog (*Rana boylii*), Purple martin (*Progne subis*), Bald Eagle (*Haliaeetus leucocephalus*), Broadwhorl tightcoil (*Pristiloma johnsoni*), Pacific walker (*Pomatiopsis californica*), Western bumblebee (*Bombus occidentalis*), Fringed myotis (*Myotis thysanodes*), Townsend's big-eared bat (*Spermophilus townsendii*), and Western pond turtle (*Actinemys marmorata*) (Table 48). The BLM eliminated this issue from additional analysis for several reasons, including that any potential beneficial or adverse effects would be speculative, non-quantifiable, or negligible. The species that may experience more than discountable effects (either beneficial or adverse) from the proposed area are discussed below.

Bald and Golden Eagles

There are no records of bald or golden eagles within the analysis area, although no specific surveys for bald and golden eagles were conducted for the project. Both species are large and readily recognized. Despite many hours over several years in the project area, neither BLM staff nor biologists contracted to perform spotted owl and murrelet surveys reported observations of either eagle species. While either species could nest or roost in or near the proposed sales, the BLM considers use unlikely because of the relative paucity of suitable habitat within the project area. If either species is documented to be nesting or roosting within the analysis area, BLM will implement buffers as described in the ROD/RMP to ensure that they are protected (USDI BLM, 2016b, p. 97).

Migratory Birds

The BLM considered migratory birds but did not analyze this issue in detail because there is not potential for significant effects beyond those analyzed in the PRMP/FEIS, to which this analysis tiers. While the data is not available to predict future populations for these species, the PRMP/FEIS modeled the changes in habitat availability for Bureau Sensitive and Strategic species (as of 2015) and Focal Landbird species (USDI BLM, 2016c, pp. 1667-1697) as a proxy for effects to these populations. The proposed Alternatives for HLB would alter stand conditions from one forest cover class (Young Forest) to another (Early Successional). As described in the PRMP/FEIS and incorporated by reference here, approximately 69–73 percent of analyzed Bureau Sensitive and Focal Landbird species associated with Early Successional habitat would have an increase in habitat, and 92 percent of these species associated with Young Forest would see an increase in habitat as compared to conditions at the time of the analysis (USDI BLM, 2016c, p. 841). The PRMP/FEIS (USDI BLM, 2016c, pp. 1667-1697) concludes that the implementation of the ROD/RMP would lead to an increase in available habitat for most Bureau Sensitive and Focal Landbird species within the analysis area.

Under Alternative 2, the proposed harvest would thin approximately 520 acres of HLB to an early successional stage. Under Alternative 3, the proposed harvest would convert approximately 727 acres of HLB to an early successional stage though HLB treatments. All effects discussions are based solely on changes to the primary habitat for these species. The BLM did not conduct surveys for presence of Bureau Sensitive Species and Focal Landbird species; however, Bureau Sensitive Species are unlikely to occupy the Forest types within the project area, as the stands lack the legacy features site specific species require for life history functions. Two Bureau Sensitive species, the Western bumblebee and the purple martin, would benefit from the stand conversion to early successional.

The PRMP/FEIS included review of 25 Focal Landbird species found within the action area. Of these, 13 are associated with early successional forest, including the olive-sided flycatcher—a Bird of Conservation Concern (USDI USFWS, 2008), and eight are associated with young forest (USDI BLM, 2016c, pp. 1691-1697). While the harvest would negatively impact individual birds nesting in the forest during harvest operations, riparian and retention areas would provide habitat function, and under the RMP, the landscape-level habitat availability would be expected to increase for all young forest species found in the analysis area (USDI BLM, 2016c, pp. 1691-1697). The proposed actions under both alternatives would increase the early successional habitat available in the action area, benefiting the two Bureau Sensitive and 13 Focal Landbird species potentially found within the project area.

Habitat across BLM-managed lands is anticipated to increase for the young forest-associated species under the PRMP/FEIS (USDI BLM, 2016c, pp. 1691-1697), and the proposed actions under the BWE project would potentially benefit the 15 analyzed species (both BSS and Focal Landbird) associated with early successional stands. For these reasons, the proposed action alternatives are within the effects analyzed in the PRMP/FEIS and have no potential for significant effects on the populations of Bureau Sensitive or Migratory Bird species or their habitats beyond those discussed in the PRMP/FEIS.

Western Bumble Bee

The BLM is eliminating this issue because the effects would be minor outside of the stand scale and because there would be no additional impacts beyond those described in the PRMP/FEIS, to which this document tiers (USDI BLM 2016c, pp. 833-852). Proposed treatments for HLB would result in forest stand removal and the creation of complex early seral habitat that is ideal for pollinators. In addition, the LSR treatments would provide smaller patches of early succession vegetation that can contribute to habitat for forest pollinators (Taki et al. 2018).

To better evaluate the effects of the project on pollinators, including the western bumble bee, the district is conducting official grid cell surveys adjacent to the project area and opportunistic surveys within the project area in collaboration with the PNW bee atlas (Hartfield & Sauder, 2020). The PNW bee atlas data contributes to landscape level research of bee species abundance and distribution. The information gathered from this area and others across western Oregon would help the BLM evaluate future harvest affects pollinator species.

How would the noise and/or smoke from activities cause disturbance or disruption for the coastal marten, spotted owl, or marbled murrelet?

Rationale for elimination: The analysis of the issue is not necessary to determine the significance of impacts because the impacts are of the same kind and magnitude of those already disclosed in the PRMP/FEIS for spotted owls and murrelets (USDI BLM 2016c, pp 899-918). The Biological Assessment includes a detailed analysis of effects for the coastal marten (USDI BLM 2020, pp. 127, 135, 145-146), which is incorporated by reference.

The disturbance distance is the distance from the project boundary outward within which the effects to listed species from noise, human intrusion, and mechanical movement are discountable or insignificant and incidental harm or harassment is not expected. Thus, between the disruption distance threshold and disturbance distance threshold, effects would not adversely affect listed species (NLAA). The unit wildlife biologist may increase or decrease these disturbance distances based on the best available scientific information and site-specific conditions. Beyond the disturbance distance threshold, no effects to listed species are expected. The BLM determined whether roadwork would cause disruption or disturbance by evaluating the duration and extent of the roadwork in relation to species' habitat. To help in this analysis, the Coos Bay BLM developed a memo defining and describing the effects of road construction, renovation, and haul (Aron C. and Bailey M. 2020).

Coastal Marten

The coastal marten is a medium-sized carnivore in the weasel family that is associated with mature complex forests in coastal northern California and coastal Oregon. The USFWS listed the Coastal Distinct Population Segment (DPS) of marten as threatened on October 8, 2020 (85 FR 63806). There is no known population for the marten within the analysis action area, nor any detections during district surveys. There are no known disturbance and/or disruption distances for coastal marten identified at the time of this project. Only 26 acres of the proposed units are modeled as potentially providing potential habitat, and these are isolated, in an area modelled to have insufficient habitat to support a population (USDI-BLM 2020, pp. 69-75, 124-127, Slauson et al. 2019b, Schrott and Shinn 2020). A newer model with data specific to Oregon found the entire proposed project area to be in an area with a low probability of supporting marten (Moriarty et al. in review). In addition, the project is located 13 miles from the closest extant population area. Therefore, the BLM concludes there is not likely a marten population within the BWE project area and the effects were analyzed which found there is no potential for significant impacts.

Spotted Owl

Proposed activities located within NRF habitat may disturb nesting owls within the disturbance distance of the nest patch, but would not cause disruption, due to the implementation of seasonal restrictions, as analyzed in detail in the Biological Assessment (USDI-BLM 2020, pp.17-19). The BLM has not documented spotted owl occupancy (resident or pair) within the owl action area to date (winter 2020). Surveys will continue until timber sales are complete. Should surveys result in an occupied activity center, any of the proposed action's activities that could disrupt spotted owls would be seasonally restricted to avoid disruption. The analysis of the issue is not necessary to determine the significance of impacts because the impacts are of the same kind and magnitude of those already disclosed in the PRMP/FEIS (USDI BLM, 2016c, pp. 928-989).

Murrelet

The BLM eliminated this issue from further analysis because the proposed seasonal and daily timing PDFs would restrict proposed activities that would create noise or generate activity levels above ambient conditions in occupied or unsurveyed nesting habitat within the disruption distance ensuring disruption does not occur in any alternative. The BLM does not expect the proposed actions would alter the success of nesting murrelets because of the seasonal restrictions described in the PDF's (Appendix B), as described in detail in the Biological Assessment (USDI BLM 2020, pp.17-19). Proposed activities that would occur within the disruption/disturbance distances of murrelet known occupied sites or unsurveyed nesting habitat would be conducted outside the breeding season and thus would have no disruption /disturbance effects on the murrelet. The analysis of the issue is not necessary to determine the significance of impacts because the impacts are of the same kind and magnitude of those already disclosed in the PRMP/FEIS (USDI BLM, 2016c, pp. 895-918).

How would the proposed management activities of vegetation modification affect marbled murrelet nesting habitat and/or marbled murrelet nesting structures post treatment and into the future?[13]

Rationale of elimination: This issue was considered but not analyzed in detail because it is not relevant to the Purpose and Need nor is analysis of the issue necessary to determine the significance of impacts because the impacts are of the same kind and magnitude of those already disclosed in the PRMP/FEIS (USDI BLM, 2016c, pp. 895-918). In the PRMP/FEIS models, the HLB treatments show a response of a one percent loss of high-quality nesting habitat in the first decade but this loss would be offset by the reserve treatments which would improve high-quality nesting habitat in the following decades. In 50 years, the PRMP/FEIS models show that there would be an increase to the nesting habitat above current levels and that the project is within the bounds of the analysis.

The ROD/RMP defines suitable murrelet structure as having all the following characteristics:

- A Diameter at Breast Height (DBH) of at least 19.1" and a height greater than 107 feet
- A nest platform at least 32.5 feet above the ground (a nest platform is a relatively flat surface at least 4" wide, with nesting substrate (e.g., moss, epiphytes, duff), and an access route through the canopy that a murrelet could use to approach and land on that platform)
- A tree branch or foliage, either on the tree with potential structure or on an adjacent tree, which provides protective cover over the platform (USDI BLM, 2016b, p. 98).

The BLM eliminated this issue from detailed analysis because:

- Stand retention buffers incorporated through project layout and PDFs would minimize indirect effects such as increased predation, altered microclimate, and windthrow risks to nesting habitat and,
- in the LSR, the BLM would identify and buffer murrelet trees before implementing the proposed actions (see PDFs, Appendix B)

The analysis the BLM completed for evaluating stand response in the spotted owl nesting habitat issue (See Issue 3.1.7) applies to evaluating the stands for murrelet nesting structure. Modeled metrics provide estimates of future tree height and DBH, but do not describe crown conditions. The BLM evaluated the effects of the alternatives on crown and limb development using current silvicultural research (See Issue 3.1.4).

Reducing competition within the stand and opening the canopy allows for greater limb development (Garman et al. 2003, Davis et al. 2007). FVS modeling of the harvest prescriptions demonstrate the treatments would produce trees with slightly larger DBHs over the un-thinned stand within 20 to 60 years. Treated stands would have fewer TPA in comparison to the no action stands. The reduced competition would increase crown and limb development; however, the exact development is unknown (See issue 3.1.4).

HLB

Under Alternative 2, the proposed regeneration timber sale activities would remove 143 acres of suitable murrelet nesting habitat in the HLB and 377 acres of stands capable, but not currently suitable for murrelet nesting in the LSR and RR. Under Alternative 3, the proposed regeneration timber sale activities

[13] Effects of vegetation on spotted owls is discussed in Issue 3.1.7 and 3.1.8.

would remove 230 acres of suitable murrelet nesting habitat in the HLB (Appendix G) and 499 acres of stands capable, but not currently suitable for murrelet nesting in the LSR and RR.

Regeneration harvest would only occur if surveys do not determine occupancy. For this reason, the proposed regeneration harvest is not expected to harm or harass murrelets but would remove suitable habitat from the landscape that may have otherwise supported nesting in the future. If surveys conclude the proposed HLB units are occupied, they would become designated as LSR per the ROD/RMP (USDI BLM 2016b, pp. 4, 52). Portions of the occupied stand that do not currently support nesting habitat may be thinned to improve habitat conditions, as discussed below. Under the ROD/RMP (USDI BLM 2016b, pp.59-63), HLB acres would be harvested repeatedly, so it is unlikely that the acres proposed for regeneration harvest would ever develop the characteristics to support murrelet nesting.

LSR Commercial

Under Alternative 2, the proposed treatment in the LSR includes 1,328 acres of commercial thinning and 498 acres of non-commercial thinning. Under Alternative 3, the proposed treatment in the LSR includes 1,525 acres of commercial thinning and 300 acres of non-commercial thinning.

As discussed in Section 3.1.4 above, the BLM modelled stands aged 40 to 90 to identify stands that, if thinned, would be on a faster trajectory to develop complex stand conditions including large trees that could support murrelet nesting. Additionally, reducing competition within the stand and opening the canopy allow for greater limb development, particularly along small openings such as the group selections (Garman et al. 2003, Davis et al. 2007). The proposed project includes acres that are mapped as suitable murrelet habitat. These acres are in stands with individual murrelet trees or pockets of murrelet trees in a portion of the stand but remainder of the stand generally contains single-age, monoculture trees which are not on a trajectory to develop trees with murrelet structure or with the multi-story features of NRF habitat for spotted owls. Treatment would only occur in that portion of the stand which does not contain murrelet habitat. Impacts to potential nesting murrelets would be minimized by following the buffer and timing restrictions to protect existing murrelet nesting structure as described in the PDFs (Appendix B). The proposed action would not affect existing occupied habitat within the harvest units because the BLM would either survey areas to ensure that they are not occupied or buffer trees with murrelet structure.

If LSR stands are surveyed as unoccupied, the BLM would thin adjacent to murrelet trees, leaving the murrelet tree and trees with interlocking branches. While thinning this close to murrelet trees may have a temporary negative impact on the ability of those trees to support successful murrelet nesting, in the long run, treatments in the LSR are designed to improve habitat for spotted owl, which would also benefit murrelet since openings in the stand will promote large limb development. This would occur on approximately 56 acres of unsurveyed suitable murrelet habitat. Under Alternative 3, the BLM is also proposing to treat 46 acres mapped as suitable habitat by non-commercial thinning; compared to 95 acres proposed for non-commercial thinning under Alternative 2. As described in the PDFs (Appendix B), trees or stands of trees with murrelet structure would be protected with interlocking branches and seasonal and daily timing restrictions would be implemented within the disruption zone of trees with murrelet structure unless the area is surveyed as unoccupied. In addition, gaps larger than 0.25 acres will be located 150 ft from trees with murrelet platforms. Non-commercial treatments would create snags and cut some individual trees or small groups of trees (up to one acre, averaging 0.25 acre) to enhance complexity for spotted owl nesting habitat. These small openings would also promote future limb development within neighboring trees, and thus would further the development of murrelet nesting structure. Non-commercial treatments do not require road construction or yarding corridors. Non-commercial harvest would not affect murrelet nesting habitat within the harvest units.

The 2,836 acres proposed for treatment under alterative 2 of proposed commercial and non-commercial thinning, compared to with 2,878 acres proposed under Alternative 3, would not modify murrelet nesting habitat within the project footprint due to commitments to survey or buffer murrelet habitat. Additionally, the proposed harvest is expected to accelerate the development of larger trees and complex stands, ultimately accelerating the amount of available nesting habitat over a no- treatment scenario.

Riparian Reserve

Under Alternative 2, the BLM is proposing to commercially thin 442 acres in the outer riparian zone, to non-commercially thin 544 acres of non-commercial thinning in the outer and middle riparian zone, and to do up to18 acres of tree-tipping in the inner zone (Appendix H). Of these, 23 acres are in stands with portions that have been identified as suitable for murrelet nesting.

Under Alternative 3, the BLM is proposing to commercially thin 526 acres in the outer riparian zone, to non-commercially thin 513 acres in the outer and middle riparian zone, and to do up to15 acres of tree-tipping in the inner zone (Appendix H). Of these, 25 acres are in stands with portions that have been identified as suitable for murrelet nesting.

As discussed in PDF 23 (Appendix B), tree selection will follow the design features in ARBO II (USDI USFWS, 2013, pp. 28-30) which should minimize potential impacts to murrelets. Stands in the outer zone may be thinned down to 30 percent canopy cover, below the 66-68 average percent canopy cover near nests in Oregon (Nelson, & Wilson, 2002). Because riparian buffers are narrow and linear, and because, per ARBO II requirements (p. 29), murrelet trees are protected and groups of greater than four trees cannot be selected from “within marbled murrelet suitable stands or stands buffering (300ft.) MM suitable stands, 2) not be buffering (300 ft) individual trees with marbled murrelet nesting structure” of critical habitat or occupied or unsurveyed suitable murrelet nesting structure. These small areas with lower canopy cover should have minimal effect on murrelets ability to nest in the vicinity. The proposed harvest in the RR would not modify the murrelet nesting habitat within the harvest units.

The purpose of work in the RR is to develop large trees. Post treatment, the thinned conditions will promote growth of large-diameter trees with big branches, which would benefit murrelet nesting in the long term.

Roads and Yarding Corridors

Alternative 2 has no new road construction proposed and thus would have no impact to habitat from vegetation modification due to new roads. However, both alternatives would include yarding corridors that may also remove some individual murrelet trees under rare circumstances. The BLM would design these features to avoid trees with murrelet structure to the extent practicable. Trees with murrelet nesting platforms, or trees with interlocking branches would be surveyed prior to removal or removal would be limited to outside the entire breeding season. The rest of the stand would continue to support nesting after removal. As the impacts due to single tree removal would be minimal at a stand scale, this action for both alternatives is not anticipated to rise to have adverse impacts to stands of murrelet habitat.

Under Alternative 3, the BLM is proposing to construct 6.7 miles of new roads within the murrelet action area. Excluding roadwork in regeneration harvest units where the stand is already proposed for removal, the longest section through murrelet suitable habitat is approximately 0.4 mile. The total new road construction for the proposed action would result in the removal of approximately 12 acres (average width of 37 feet), of which two acres are in suitable nesting habitat, and two acres are in occupied sites, only one acre of which is suitable. Proposed new roads would impact five sites, with impacts generally limited to the edges of the stands. Habitat removal outside of occupied sites is dominated by road construction to the Rock Slide HLB unit, accounting for approximately 0.4 acres of habitat removal. The remaining 1.6 acres of unsurveyed habitat removal are scattered across over five stands. The new road construction is not expected to have an effect to the overall function of the stands. In general, roads follow the edge of stands and are planned along the ridge tops where murrelets are less likely to nest (Miller and Ralph 1995), limiting the adverse effects into the adjacent stand.

The BLM would attempt to avoid removing trees with suitable nesting platforms and adjacent trees with interlocking branches, both within occupied and unsurveyed or surveyed-unoccupied suitable habitat. When trees are proposed for removal, the stand would be surveyed for occupancy or removal of the tree with nesting structure and trees with interlocking branches would be limited to outside the complete breeding season. If the stand is surveyed as unoccupied, work could occur during the murrelet breeding season. If it is surveyed as occupied, the area would be designated as occupied per the ROD/RMP (USDI BLM, 2016b, p. 98). The road would still be constructed, but with seasonal restrictions per Table 21. In instances where murrelet trees are cut, they will be left on-site. New roads and roads requiring heavy renovation would either be surveyed for occupancy or would be seasonally restricted within the disruption zone of unsurveyed suitable or surveyed occupied murrelet structure.

Proposed roads are narrow (estimated average width 37 ft) and are expected to be used only minimally post-harvest because they would not be open to the public. Because they are narrow and linear, new roads' effects on adjacent murrelet habitat's microclimate would be immeasurable. In addition to the new road construction, 37 acres would be decommissioned for roads used to access LSR units that are not planned for re-entry.

Due to the scattered locations, small acreages, construction occurring dominantly on ridge tops and stand edges, and the seasonal restrictions for nest structure removal and disruption, new road construction would not affect the functionality of occupied sites which would continue to support nesting murrelets. Additionally, most of the roads within or directly adjacent to occupied sites (12 sites) are associated with LSR units and would be decommissioned after project completion. Each new road segment or heavy renovation road was reviewed with USFWS and the BLM to minimize impacts to habitat through a detailed review process.

The exception is the habitat removal associated with the Rock Slide HLB sale. The road follows a ridgetop, but dissects a large, contiguous stand of murrelet habitat. The construction of the road would be seasonally restricted, with full seasonal restrictions required for removal of trees with nesting structure. Haul would also have seasonal and daily timing restrictions. As the proposed new road is accessing a HLB sale, the BLM presumes that the road would not be permanently decommissioned. While most other segments of new construction are not anticipated to have a measurable effect on adjacent habitat, the long new construction through the previously protected stand would degrade the habitat conditions along the road corridor. However, as this is a patch (35 acres) of nesting habitat, the stand would continue to support nesting, and with the seasonal restrictions, would not harass nesting murrelets.

Construction of roads and yarding corridors will remove patches or individual trees in murrelet habitat but is not expected to cause harm or reduce the reproductive success of nesting murrelets, as stands would have been surveyed as "probable absence" through protocol surveys or removal would occur while murrelets are not nesting within the stand. The stands would continue to support murrelet nesting into the future.

The proposed actions would impact the marbled murrelet due to habitat loss from activities on the HLB, new road construction, and commercial harvest in the LSR, although the habitat in the LSR stands would improve as a result of the proposed actions in the long term. With buffers and seasonal timing restrictions in the LSR and RR, and for new roads or heavy road renovation and therefore there would not be any significant effects to nesting murrelets and their habitat beyond those evaluated in the PRMP/FEIS (USDI BLM 2016c, pp. 895-918).

How would direct vegetation modification activities affect marbled murrelet occupied sites?

Rationale for elimination: The BLM analyzed the impacts of proposed activities on known and future occupied murrelet sites in western Oregon in the PRMP/FEIS (USDI BLM, 2016c, pp. 909-918) to which this Biological Assessment tiers. Further analysis of this issue is not necessary to evaluate how the alternatives respond to the Purpose and Need nor is analysis of the issue necessary to determine the significance of impacts because the impacts are of the same kind and magnitude as those already disclosed in the PRMP/FEIS. Following restoration activities, LSR would continue to support nesting murrelet in designated occupied or suitable habitat. The PRMP/FEIS page 914 states, "all current nesting habitat within occupied sites would be retained, and eventually 97 percent of the acreage within occupied sites would develop into nesting habitat…". In addition, due to habitat development in the reseres, the PRMP/FEIS modelled (pg. 916) that murrelet populations would increase over 50 years "due to the continued development of nesting habitat and the net increase in the number of occupied sites". The BWE project is within the bounds of the ROD/RMP, and so the occupied sites would develop as described across the landscape based on the information below.

The BLM eliminated this issue from detailed analysis because:

- No harvest is proposed within an occupied murrelet site. Surveys are being conducted at all HLB proposed units with suitable habitat that is not already designated as occupied. If occupancy is determined, the stand would become LSR and regeneration harvest would not occur.
- For LSR, no harvest is proposed within an occupied murrelet site.
- New road construction under Alternative 3 would remove two acres of occupied murrelet habitat (USDI BLM 2020, Appendix E). Road construction is on the edge of the occupied stands and would not affect the ability of the stand to support murrelet nesting and analyzed in the RMP/ROD (USDI BLM 2016b, pp. 98-99).
- For the reasons above, the BLM has determined that there is no potential for significance. The project falls within the FEIS analysis to which this document tiers (USDI BLM, 2016c, pp. 909-918).

HLB

There are no proposed timber sale activities that would occur within known murrelet occupied sites in HLB per protocol surveys. Therefore, there would not be direct impacts to occupied sites from the proposed project. Under Alternative 2, the proposed HLB harvest area includes 143 acres of suitable murrelet nesting habitat. Under Alternative 3, the proposed HLB harvest area includes 229 acres of murrelet suitable nesting habitat. Surveys are being conducted at all HLB proposed units for both alternatives in suitable habitat that is not already designated as occupied. The BLM assumes that occupied sites continue to be occupied and is not re-surveying those areas. Seasonal and daily timing restrictions would be required in sale areas adjacent to occupied sites and unsurveyed suitable habitat to ensure that disruption does not occur. As discussed in the BA (USDI BLM 2020, pp. 86) and the PDFs (Appendix B), if surveys result in occupancy, the BLM would designate the occupied murrelet site according to the

RMP/ROD (USDI BLM 2016b, p. 98) and modify the proposed action to fit the LSR management direction.

LSR

There are no proposed LSR timber activities that would occur within known murrelet occupied sites in LSR. Therefore, there would not be direct impacts to occupied sites from the proposed project.

How would vegetation modification activities affect competition between Northern spotted and barred owls?

Rationale for elimination: The BLM evaluated how timber sales in the HLB would affect competition between spotted and barred owls in the PRMP/FEIS (USDI BLM, 2016c, pp. 928-929) to which this EA tiers. The analysis concluded that because of interactions between barred and spotted owls, the spotted owl "has an even chance of being extirpated from the Coast Range within 20 years" (USDI BLM, 2016c, p. 928). BLM land in the Coast Range is important for reproduction, movement and survival within the Coast Range, and in supporting north-south movement in the Coast Range and east-west movement between the Coast Range and western Cascades (USDI BLM, 2016c, p. 928). However, ROD/RMP modelling shows that habitat management on BLM land alone would not alter the spotted owl population trajectory within the Coast Range because of the effect of barred owls (USDI BLM, 2016c, p. 928). Indeed, even with a barred owl program implemented, in the Coast Range, modelling shows the population continuing to decline (USDI BLM, 2016c, p. 961). At a broader scale, the BLM determined that there was essentially no difference in the spotted owl population response between ROD/RMP alternatives including the the no harvest scenario. Barred owl encounter rates were the biggest driver of spotted owl population response (USDI BLM, 2016c, pp. 1787-1788). All of the alterntives described in this EA are within the scope of the ROD/RMP. As discussed in the ROD/RMP (USDI BLM 2016c, p. 961), differences between the alternatives are negligable. Since the impacts of all three alternatives are within the scope of the PRMP/FEIS, to which this document tiers, there is no need for further evaluation.

How would vegetation modification activities affect the ability of spotted owl to disperse?

Rationale for elimination: The BLM analyzed the ability of spotted owl to disperse through western Oregon in the PRMP/FEIS (USDI BLM, 2016c, pp. 941-947) to which this EA tiers. The BLM concluded that current conditions do not support adequate north-south spotted owl movement between the northern and southern portions of the Oregon Coast Range Province or between the Oregon Coast Range and the other physiographic provinces. After 50 years, by 2063, modelling shows that with the implementation of the RMP, the landscape will support dispersal throughout the Oregon Coast Range Province as well as between the Oregon Coast Range and the Oregon Klamath and Oregon Western Cascades provinces. East-west movement between the Oregon Coast range and the Western Cascades provinces will not occur because the Willamette Valley presents too large of a non-habitat area for owls to disperse through (USDI BLM, 2016c, p. 944). The project is within the boundary of the ROD/RMP, and dispersal habitat would develop as described across the provinces with the project implemented. A detailed analysis is completed in the BWE Biological Assessment (pp.136-145) hereby incorporated by reference.

Thomas et al. (1990) described minimal dispersal habitat as stands with at least 40 percent canopy cover and trees with greater than an average 11-inch DBH. Immediate post-harvest modeling for LSR treatment stands indicates that at the stand level, the treated units would retain greater than 50 percent canopy cover and DBHs over 12 inches, which is above the minimum dispersal thresholds of 40 percent canopy cover and 11-inch DBH. As described in the BA, which is hereby incorporated by reference, the BLM is eliminating this issue because, post-harvest, the proposed harvest and road construction would not limit spotted owl dispersal through the action area, which is discussed in the Biological Assessment (pp. 146-155), hereby incorporated by reference.

The BLM defined dispersal habitat as areas that have been mapped as marginal, suitable, or highly suitable as defined in Davis et al. (2016). This includes habitat that is "approaching a condition that owls will nest and roost in" to habitat considered "above average" for nesting territorial pairs (Davis, et al. 2016). The BLM included dispersal habitat on all ownerships, including private property in the analysis. The BLM did not include the "unsuitable" category, which is defined as areas which spotted owls will "normally avoid" for nesting and roosting, although the BLM recognizes that in some cases these areas may provide sufficient features to support dispersal. To conservatively analyze effects, we defined all the acres in the harvest units as dispersal, although some were modelled as "unsuitable." The amount of dispersal habitat present on the landscape today primarily reflects past timber sale activities.

The BLM evaluated this issue by placing a 15.5-mile buffer around the proposed harvest units, the distance that research suggests incorporates 90 percent of dispersing spotted owls (Davis et al. 2011). Under both alternatives, the action area contains 89,895 acres (10 percent) of NRF habitat, 29,187 acres of RF (3 percent) and 233,562 acres (26 percent) of dispersal only habitat. Including NRF and RF with dispersal habitat, approximately 352,645 acres (39 percent) of the dispersal action area is in dispersal habitat. As Appendix H shows, the dispersal action area has approximately 40 percent dispersal habitat, the minimum recommended by Davis et al. (2011).

There would be a decrease in functional dispersal habitat (including NRF and RF habitat) of approximately one percent at the 15.5-mile dispersal area scale as a result of the proposed project. Most (85 percent) of the treatments would accelerate the development of NRF in 40 years and retain the dispersal function, so the decrease in dispersal would be small and temporary. Because the impacts to dispersal habitat are spread over a large area, with retention areas within HLB treatments and with many untreated riparian buffers and LSR stands intermixed with the proposed units, the BLM does not anticipate that the proposed action would reduce the spotted owl's ability to disperse across the landscape, therefore there is no potential of significant effects from the proposed actions.

How would the proposed vegetation modification activities in the HLB affect the spotted owl's ability to utilize habitat for nesting or roosting-foraging?

Rationale for elimination: The analysis of the issue is not necessary to determine the significance of impacts because the impacts are of the same kind and magnitude of those already disclosed in the PRMP/FEIS (USDI BLM, 2016c, pp. 947-973, 977-979) to which this EA tiers. The PRMP/FEIS evaluates how implementation of the actions described in the PRMP/FEIS would affect long-term spotted owl reproduction in the analysis area at a landscape/physiographic scale (Issue 4, pp. 947-973), and by evaluating how implementation would conserve spotted owl sites to provide additional demographic support (Issue 6, pp. 977-979).

While the proposed project would result in a small (111 acres in Alternative 2, 188 acres in Alternative 3) local loss of NRF/RF habitat, as discussed below, this is insignificant in relation to the overall implementation of the PRMP/FEIS which would result in an increase in the amount of habitat with the characteristics necessary to support spotted owl nesting (USDI BLM, 2016c, pp. 937-941). Additionally, ROD/RMP modelling shows that habitat management on BLM land alone would not alter the spotted owl population trajectory within the Coast Range (USDI BLM, 2016c, p. 928). At a broader scale, the BLM determined that there was essentially no difference in the spotted owl population response between ROD/RMP alternatives including the the no harvest scenario. All of the alterntives described in this EA are within the scope of the ROD/RMP. For the reasons stated above, and as described the proposed action alternatives have no potential for significant effects to spotted owl habitat, with no meaningful difference between the no action and two action alternatives.

How would the vegetation modification activities affect the functionality of coastal marten habitat in and adjacent to proposed treatment stands, and dispersal habitat within the action area? How would the proposed management activities affect the ability of coastal marten to disperse in the analysis area?

Rationale for elimination: Critical habitat has not been proposed for coastal marten; therefore, it will not be evaluated in this document. In addition to the listing decision, information within two comprehensive literature syntheses and evaluations on coastal martens are utilized herein and inform our analyses (Moriarty et al. 2019, Slauson et al. 2019). In July 2018, a species status assessment (SSA) was completed by the USFWS (USDI USFWS, 2018). We also relied on the SSA extensively in this document.

There is no known population for the marten within the project area. The nearest known population is approximately 13 miles away. No marten was detected during surveys the MFO conducted in and adjacent to proposed units, and there is little modeled habitat that intersects the project units. A detailed analysis of the marten and impacts are included in the BWE BA (pp. 129-133) and incorporated by reference. Therefore, we conclude there are likely no marten individuals within the project area.

Therefore, the BLM eliminated this issue from further analysis because:

- The BLM did not detect martens during camera surveys in the proposed units.
- The data and analysis indicate that while there is a small amount of habitat that may be suitable for marten it is not in a large enough block that it would support a population.
- For the reasons above, the BLM has determined that there is no potential for significance to coastal marten.

The project footprint was evaluated using the three evaluation methods, two published models of marten habitat (Slauson et al. 2019b, Schrott and Shinn 2020), and our own GIS analysis we are calling Managed Block Areas (MBA's), of the action area to identify areas with sufficient land in public management that could support a marten home range if all of the public land were suitable for marten. According to modelling by Schrott and Shinn (2020), the nearest area with sufficient habitat to support a marten population is approximately 15 miles away.

When combined, only 26 acres of the MBA and the Slauson et al. (2019b) habitat analysis overlap. The remainder of the proposed project for Alternative 3 (2,676 acres) was modelled as low to unsuitable habitat. The overlapping acres are on the eastern side of the action area and are in a combination of units proposed for commercial (9 acres) and non-commercial (17 acres) thinning. These acres are in the LSR and RR and range in size from 1 to 16 acres across four sale areas. Alternative 2 was not analyzed separately in the models because the units or geographic scope were the same, and the impacts would be less then Alternative 3, which as discussed above has negligible effects. While the impacts to the shrub layer in the commercially treated stands would temporarily reduce suitability for marten use post-project, when the shrub layer re-establishes, it would again provide suitable marten habitat. Since the treatments in the non-commercial units would not significantly reduce canopy cover or shrub layer, these treatments would be unlikely to affect marten's ability to use those stands. A more recent analysis that included much more Oregon-specific data determined that the entire project area was in an area with a low likelihood of supporting marten (Moriarty et al. in review).

Due to past management practices and land ownership patterns in the project area, habitat is fragmented. Over time the proposed treatments within the LSR and RR would contribute to increased habitat connectivity and stand complexity as they would promote a more robust multi-storied layer, including a shrub layer. While the MBA analysis shows a large area across the middle of the marten action area with sufficient federal and state managed lands that it could support a number of marten home ranges, when overlaid with the Slauson et al. (2019b) model, very little likely actually has habitat that could support marten and the intermixed private land likely would make it difficult for marten to move around the landscape, regardless of whether the proposed project were implemented.

Using our combined analysis of Slauson and MBAs, we conclude that about 9 acres of suitable mesic habitat would be downgraded during commercial thinning activities from three sale areas, ranging in size from 1-4 acres on LSR. Post treatment, the shrub layer in the LSR commercial thinning units would be reduced, likely limiting marten's use of the treated areas. However, because of the increased sunlight, these sites would increase in Ericaceae plant species within 10-15 years post-treatment (Kerns et al. 2004) which could increase the quality of habitat available for martens.

Many of the stands proposed for thinning are made up of a dense monoculture of trees with a poorly developed shrub layer. As the shrub layer comes in, the habitat would become more suitable for marten use. The LSR commercial and non-commercial sites would create snags and additional down wood which would provide individual structures that marten can use for resting and denning, improving habitat at the micro scale.

Non-commercial LSR treatments would fell trees that would be left on site (felling individual trees in less than one-acre groups), which would provide some microclimate features from snags and down wood that will benefit marten. However, non-commercial treatments are not considered to substantially change marten habitat because stands would retain their shrubs and understory and not measurably change the canopy cover at a stand level. The data and analysis indicate that while marten could utilize the action area, it would not likely support a population, because while there are habitat components, they are patchy and scattered, resulting in limited connectivity. While the proposed project would temporarily remove some stands with suitable marten habitat features overlapping MBA's, these areas are small and disjunct at a landscape scale.

We conclude that the proposed actions would not impact marten habitat because modelling suggests that the proposed project does not contain sufficient habitat in a large enough complex that it could support a marten population (Slauson et al. 2019b, Schrott and Shinn 2020, Moriarty et al. 2021). Camera surveys in the proposed project area did not detect any marten. Camera surveys are discussed in detail in the BA (USDI-BLM 2020, Appendix B). While the proposed project would remove some small patches containing features that will support marten, they are small, scattered, and not part of a large enough area of habitat to support a marten at a stand or home range scale.

How would indirect vegetation modification activities affect murrelet occupied sites and suitable nesting habitat adjacent to proposed stand activities?

Rationale for elimination: The Service evaluated the effects of modifying pre-2016 occupied murrelet sites from treatments in LSR and HLB and provided a memo for all of the BLM's RMP area (USDI-USFWS 2019) which is incorporated by reference. The memo modelled the number of acres that may be treated in the LSR and HLB within 300 ft of previously occupied sites over the next 50 years by zone. The memo determined that while the Service had not incorporated the effects of treatment directly adjacent to occupied sites in their jeopardy analysis, including those effects does not change the conclusion of no-jeopardy for murrelets. The proposed project is within the scope of the PRMP/FEIS, to which this document tiers. Therefore, there are no significant effects beyond those evaluated in the PRMP/FEIS (899-917).

As discussed in the BA (USDI-BLM 2020, pp. 131-134) the science around edge effects does not show a consistent edge effect. Some studies found higher nest success adjacent to edge habitat, while others found lower nest success at edges (summarized in USDI-BLM 2020, pp. 131-134). For this analysis, the BLM used a 300-foot buffer adjacent to proposed regeneration units as the Service did in the USDI-FWS (2019) analysis, and a 150-foot buffer adjacent to proposed commercial thinning units.   Because any microclimate or predation effects can be expected to be smaller for thinnings compared with regeneration harvest, the BLM determined that the smaller, 150-foot buffer adjacent to thinning treatment is appropriate.

The FWS concluded that implementation of the RMP will still result in an increased murrelet population, with a "potential 52 percent increase in the population in the action are over 50 years (USDI-USFWS 2019)." Thus, the FWS determined that even without buffers on adjacent occupied sites, the conclusions in the jeopardy analysis conducted for the RMP would not change. This analysis incorporates that document by reference.

In the murrelet Recovery Plan (USDI-USFWS 1997), the Service recommends a 300-600 ft buffer adjacent to occupied habitat to "mediate the effects of edge by helping to reduce the environmental changes within the stand, reduce loss of habitat from windthrow and fire, reduce fragmentation levels, increase the amount of interior forest habitat available, and potentially help reduce predation at the nest." While information is still limited on how timber activities affect adjacent murrelet stands, there has been additional research since the recovery plan was finalized on potential microclimate and predation edge of effects. As analyzed in the BWE BA (USDI BLM 2020, pp. 131-134), microclimate effects such as temperature, humidity, and Vapor Pressure Density (a measure of the drying power of the air that is important for plant growth) at canopy level appear to be small (Rambo and North 2008, van Rooyen et al. 2011). Predation may increase near hard edges such as regeneration harvests (Malt and Lank 2007, Malt and Lank 2009), although predation risk appears to be more closely tied to areas with sustained human activity (Raphael et al. 2002), presumably due to corvids' attraction to food waste. The timber sale activities proposed for BWE would occur over a limited period of time, would not increase public access, and crews are required to pick up trash daily, which would reduce the risk of increased predation from human presence.

Because only a few trees for snag creation are cut and left on-site for non-commercial thinning and tree-tipping, we determined that these light treatments would not cause a large enough change in the stand to affect neighboring habitat. Therefore, we do not consider non-commercial treatments or tree-tipping to result in habitat modification and thus there is no potential for significant indirect effects from vegetation modifications.

While newly identified occupied murrelet sites would be designated and buffered per the direction in the RMP/ROD (p. 98), harvest activities would occur directly adjacent to stands that were designated as occupied prior to the RMP/ROD in both the HLB and LSR. In addition, harvest activities are proposed directly adjacent to stands that have been surveyed as unoccupied. The District will conduct LSR and RR commercial and non-commercial thinning adjacent to occupied sites; however, the proposed action includes buffers around murrelet nesting structure in the LSR and around trees with suitable nesting structure in the HLB to minimize the indirect modification of the adjacent nesting habitat, unless protocol surveys determine that the area is not occupied or if a biologist determines through field review that the canopies of the proposed unit and unit with suitable habitat do not interact, for instance because of a difference in height or topography (see PDF 7).

LSR and RR

Acres adjacent to previously occupied stands

Under Alternative 3, approximately 681 acres of 48 previously occupied sites are within 150 feet of units proposed for commercial thinning (USDI-BLM 2020, pp. 91-92, Table 3-8). The effects from Alternative 2 would be similar, but with fewer acres within 150 feet. In some instances, a portion of the adjacent stand would benefit from thinning to promote characteristics to improve habitat for owls or murrelets in the future. In these cases, the BLM would follow the LSR and murrelet management direction (USDI-BLM 2016b, pp. 64-67). Actions taken to improve habitat for spotted owls are also expected to improve conditions for murrelets since development of more complex stands will also encourage development of large trees with big branches. Table 3-8 (See BA pg. 91-92) displays the acres of murrelet occupied sites affected by proposed timber harvest using a 300-foot distance from edge of regeneration harvest and a 150-foot distance from edge of commercial thinning. Acres were not double counted, so the acres reported modified by thinning are not also reported modified by regeneration harvest.

Acres adjacent to un-surveyed suitable or surveyed unoccupied stands.

Under Alternative 3, approximately 56 acres of un-surveyed suitable nesting habitat are within the relevant buffer distances; however, final harvest areas would include a 150-foot buffer adjacent to unsurveyed nesting habitat, as described in PDFs. The effects from Alternative 2 would be similar, but with fewer acres within 150 feet. For this reason, commercial thinning in the LSR is not anticipated to modify potentially occupied habitat adjacent to the harvest units. However, if the BLM determines the adjacent habitat is likely unoccupied, through completion of the protocol surveys, treatment will occur up to the edge of the suitable habitat. Trees with nesting structure and trees with interlocking branches would be retained. The BLM anticipates approximately 10 acres of unoccupied suitable nesting habitat will be within 150 feet of the harvest areas. These murrelet stands are either unsurveyed or in the process of being surveyed. At the time of this writing (fall 2020), no occupancy has been determined.

A majority of the murrelet nesting habitat adjacent to the LSR and RR proposed thinning units are currently designated as occupied habitat. Trees with nesting structure would be buffered with a 150-foot buffer or until the canopies no longer intermingle as described in the PDFs. If the BLM moves forward with surveys on these stands and determines that they are unoccupied, the final proposed thinning would be within the 150-foot buffer. However, trees with murrelet structure or trees with interlocking branches would not be removed.

Harvest Land Base

Acres adjacent to previously occupied stands

Under Alternative 3 (Alternative 2 effects are similar but with less acres), there are approximately 57 acres of occupied habitat designated prior to the RMP/ROD within 300 ft of proposed regeneration harvest units, spread across three marbled murrelet occupied sites (Appendix F). All adverse modification from regeneration harvest would occur from the proposed Sugar Rush sale and would indirectly modify 7 acres in the Elk Cr M NW site, 23 acres in the Mill Cr Trib site, and 27 acres in the Mid Fk Coquille site (Appendix F).

Acres adjacent to surveyed unoccupied stands.

Under Alternative 3, 160 acres of un-surveyed suitable nesting habitat are within 300 feet of the regeneration harvest stands. The BLM is in the process of surveying these stands and assumes for this analysis that these stands are unoccupied to analyze the largest impact proposed for MAMU habitat. As discussed in the proposed action in the BA (pp. 22-69), in HLB, the BLM would locate part of the retention adjacent to individual murrelet trees at the edge of occupied stands and therefore impacts would be reduced. Seasonal restrictions would be required, per PDFs, within the disruption distance of the closest nesting structure unless they are surveyed as unoccupied.

Roads and Yarding Corridors

Acres adjacent to previously occupied stands

If the proposed project moves forward, roads and yarding corridors would be built within the 300 ft and 150 ft modification buffers. The BLM did a site-specific review for each new road construction or heavy renovation site to reduce modification to previously occupied sites. Efforts would be made to design them so that they avoid trees with murrelet structures and trees with interlocking canopies, but in rare cases, these trees will be cut. PDF's to minimize impacts to the murrelet stand would be implemented. Since these are narrow linear features, we do not anticipate that this would result in habitat modification.

Acres adjacent to unoccupied stands

The BLM would attempt to design new roads and yarding corridors so that they are located outside of the modification buffers (300 ft for regeneration harvest, 150 ft for commercial thinning), however, in some instances these features would need to be built within these buffers. Due to the narrow, linear arrangement of these features, minimal microclimate modification is not anticipated within adjacent stands. The Unit Biologist would review projects where yarding corridors enter the buffer area to ensure the corridors.

Conclusion

The effects of indirect modification due to timber harvest adjacent to occupied murrelet stands or murrelet habitat that has not been surveyed have been analyzed in the PRMP/FEIS, to which this document tiers. There would not alter the integrity of the adjacent nesting structure. Where possible, these features would protect trees with nesting structure, as well as adjacent trees with interlocking branches, or trees providing cover to the nesting structure but in rare cases, murrelet trees or the trees with interlocking branches would be removed. There is no potential for significant effects beyond those analyzed in the PRMP/FEIS to which this document tiers (USDI BLM 2016c, pp. 899-917).

Appendix B: Best Management Practices and Project Design Features

The ROD/RMP contains measures in both management direction and BMPs designed to prevent and reduce the amount of pollution generated by non-point sources to a level compatible with water quality goals (USDI BLM, 2016b, p. 139).

The IDT incorporated an abbreviated list of BMPs (from Appendix C in the ROD/RMP) into the BWE project for actions outlined in Chapter 2. For timber sales associated with the BWE projects, the decision maker would select and apply BMPs based on site-specific conditions, technical feasibility, resource availability, water quality of those waterbodies potentially impacted, and input from BLM staff (USDI BLM, 2016b, p. 141).

The IDT also developed and incorporated PDFs to avoid, minimize or rectify effects on resources and are included as part of the proposed action. PDFs are site-specific measures, restrictions, or requirements included in the design of project in order to reduce adverse environmental consequences.

Best Management Practices:

Best management practices for roads and landings.

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
General Construction			
R 01	Locate temporary and permanent roads and landings on stable locations, e.g., ridge tops, stable benches, or flats, and gentle- to-moderate side slopes. Minimize road construction on steep slopes (> 60 percent).	USDI-BLM 2008, Appendix I – Water, R 1, p. 270 OAR 629-625-0200 (3)	OAR 629-625-0200–ODF, Road Location ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 02	Locate temporary and permanent road construction or improvement to minimize the number of stream crossings.	USDI-BLM 2008, Appendix I – Water, R 2, p. 270 OAR 629-625-0200 (3-4)	OAR 629-625-0200–ODF, Road Location ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 03	Locate roads and landings away from wetlands, Riparian Reserve, floodplains, and waters of the State, unless there is no practicable alternative. Avoid locating landings in areas that contribute runoff to channels.	USDI-BLM 2008, Appendix I – Water, R 4, p. 270 OAR 629-625-0200 (2)	OAR 629-625-0200–ODF, Road Location ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036

R 06	Confine pioneer roads (i.e., clearing and grubbing of trees, stumps and boulders along a route) to the construction limits of the permanent roadway to reduce the amount of area disturbed and avoid deposition in wetlands, Riparian Reserve, floodplains, and waters of the State. Install temporary drainage, erosion, and sediment control structures, as needed to prevent sediment delivery to streams. Storm proof or close pioneer roads prior to the onset of the wet season.	USDI- BLM 2008, Appendix I – Water, R 11, p. 271 EPA 2005, p. 3-41, Bullet 2	OAR 629-625-0410-ODF, Disposal of Waste Materials ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 07	Design road cut and fill slopes with stable angles, to reduce erosion and prevent slope failure.	USDI- BLM 2008, Appendix I – Water, R 3, p. 270 EPA 2005	OAR 629-625-0310-ODF, Road Prism ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 08	End-haul material excavated during construction, renovation, or maintenance where side slopes generally exceed 60 percent and any slope where side-cast material may enter wetlands, floodplains, and waters of the State.	USDI-BLM 2008, Appendix I – Water, R 10, p. 271 EPA 2005, p. 3-12, Bullet 5	OAR 629-625-0310-ODF, Road Prism ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 09	Construct road fills to prevent fill failure using inorganic material, compaction, buttressing, sub-surface drainage, rock facing, or other effective means.	USDI-BLM 2008, Appendix I – Water, R 13, p. 271. OAR 629-625-0310-5	OAR 629-625-0310-ODF, Road Prism ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 10	Design and construct sub-surface drainage (e.g., trench drains using geo-textile fabrics and drain pipes) in landslide-prone areas and saturated soils. Minimize or avoid new road construction in these areas.	USDI-BLM 2008, Appendix I – Water, R 19, p. 272 ODEQ 2005, RC-1, RC-6, pp.4-5, 4-6	OAR 629-625-0300-ODF, Road Design ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 11	Locate waste disposal areas outside wetlands, Riparian Reserve, floodplains, and unstable areas to minimize risk of sediment delivery to waters of the State. Apply surface erosion control prior to the wet season. Prevent overloading areas, which may become unstable.	USDI-BLM 2008, Appendix I – Water, R 80, p. 281 OAR 629-625-0340	OAR 629-625-0340-ODF, Waste Disposal Areas ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 12	Use controlled blasting techniques to minimize loss of material on steep slopes or into wetlands, Riparian Reserve, floodplains, and waters of the State.	USDI BLM 2008, Appendix I – Water, R 12, p. 271	OAR 629-625-0410-ODF, Disposal of Waste Materials ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036

R 13	Use temporary sediment control measures (e.g., check dams, silt fencing, bark bags, filter strips, and mulch) to slow runoff and contain sediment from road construction areas. Remove any accumulated sediment and the control measures when work or haul is complete. When long-term structural sediment control measures are incorporated into the final erosion control plan, remove any accumulated sediment to retain capacity of the control measure.	USDI-BLM 2008, Appendix I – Water, R 14, p. 271 ODEQ 2005, RC-11	OAR 629-625-0430-ODF, Stream Protection ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 14	Avoid use of road fills for water impoundment dams unless specifically designed for that purpose. Impoundments over 9.2-acre-feet or 10 feet in depth will require a dam safety assessment by a registered engineer. Upgrade existing road fill impoundments to withstand a 100-year flood event.	OAR 629-625-0310-5	OAR 629-625-0310-ODF, Road Prism ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
Permanent Stream Crossing			
R 15	Minimize fill volumes at permanent and temporary stream crossings by restricting width and height of fill to amounts needed for safe travel and adequate cover for culverts. For deep fills (generally greater than 15 feet deep), incorporate additional design criteria (e.g., rock blankets, buttressing, bioengineering techniques) to reduce the susceptibility of fill failures.	USDI- BLM 2008, Appendix I – Water, R 47, p. 276 OAR 629-625-0320 (1b)	OAR 629-625-0320-ODF, Stream Crossing Structures ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 16	Locate stream-crossing culverts on well-defined, unobstructed, and straight reaches of stream. Locate these crossings as close to perpendicular to the streamflow as stream allows. When structure cannot be aligned perpendicular, provide inlet and outlet structures that protect fill, and minimize bank erosion. Choose crossings that have well-defined stream channels with erosion-resistant bed and banks.	USDI- BLM 2008, Appendix I – Water, R 48, p. 276 EPA 2005, p. 3-14 Gesford and Anderson 2006, pp. 5–30	OAR 629-625-0320-ODF, Stream Crossing Structures OAR 635-412-0035–ODFW, Fish Passage Criteria ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036

R 17	On construction of a new culvert, major replacement, or fundamental change in permit status of a culvert in streams containing native migratory fish, install culverts consistent with ODFW fish passage criteria (OAR 635-412-0035 (3)), and at the natural stream grade, unless a lessor gradient is required for fish passage. On abandonment of a culvert (i.e., removal of a culvert without replacement) in streams containing native migratory fish, restore the natural stream grade, unless a lessor gradient is required for fish passage. On construction of new culverts in streams with ESA listed fish, stream crossings must also meet ARBO II (USDC NMFS 2013 and USDI- FWS 2013) fish passage criteria and state fish passage criteria.	USDI-BLM 2008, Appendix I – Water, R 49, p. 276	OAR 629-625-0320-ODF, Stream Crossing Structures OAR 635-412-0035–ODFW, Fish Passage Criteria ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 18	Design stream crossings to minimize diversion potential in the event that the crossing is blocked by debris during storm events. This protection could include hardening crossings, armoring fills, dipping grades, oversizing culverts, hardening inlets and outlets, and lowering the fill height.	USDI- BLM 2008, Appendix I – Water, R 53, p. 277	OAR 629-625-0320-ODF, Stream Crossing Structures OAR 635-412-0035–ODFW, Fish Passage Criteria ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 19	Design stream crossings to prevent diversion of water from streams into downgrade road ditches or down road surfaces.	USDI- BLM 2008, Appendix I – Water, R 31, p. 274 OAR 629-625-0330 (3)	OAR 629-625-0330-ODF, Drainage OAR 635-412-0035–ODFW, Fish Passage Criteria ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 20	Place instream grade control structures above or below the crossing structure, if necessary, to prevent stream head cutting, culvert undermining and downstream sedimentation. Employ bioengineering measures to protect the stability of the streambed and banks.	ODEQ 2005 , RC - 2 Gesford and Anderson 2006, pp 5–31 USDA FS 2002 Chapter 20	OAR 629-625-0320-ODF, Stream Crossing Structures OAR 635-412-0035–ODFW, Fish Passage Criteria ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036

R 21	Prevent culvert plugging and failure in areas of active debris movement with measures such as beveled culvert inlets, flared inlets, wingwalls, over-sized culverts, trash racks, or slotted risers.	USDI- BLM 2008, Appendix I – Water, R 59, p. 278	OAR 629-625-0320-ODF, Stream Crossing Structures OAR 635-412-0035–ODFW, Fish Passage Criteria ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 22	To reduce the risk of loss of the road crossing structure and fill causing excessive sedimentation, use bridges or low-water fords when crossing debris-flow susceptible streams. Avoid using culverts when crossing debris-flow susceptible streams, when practicable.	USDI BLM 2008, Appendix I – Water, R 70, p. 280	OAR 629-625-0320-ODF, Stream Crossing Structures OAR 635-412-0035–ODFW, Fish Passage Criteria ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 23	Utilize stream diversion and isolation techniques when installing stream crossings. Evaluate the physical characteristics of the site, volume of water flowing through the project area, and the risk of erosion and sedimentation when selecting the proper techniques.	USDI- BLM 2008, Appendix I – Water, R 50, R 51, p. 277	OAR 629-625-0430-ODF, Stream Protection OAR 635-412-0035–ODFW, Fish Passage Criteria ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 24	Limit activities and access points of mechanized equipment to streambank areas or temporary platforms when installing or removing structures. Keep equipment activity in the stream channel to an absolute minimum.	USDI- BLM 2008, Appendix I – Water, R 52, p. 277 OAR 629-625-0430 (2)	OAR 629-625-0430-ODF, Stream Protection ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 25	Install stream crossing structures before heavy equipment moves beyond the crossing area.	USDI- BLM 2008, Appendix I – Water, R 60, p. 278	OAR 629-625-0430-ODF, Stream Protection ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036

R 26	Disconnect road runoff to the stream channel by outsloping the road approach. If outsloping is not practicable, use runoff control, erosion control and sediment containment measures. These may include using additional cross drain culverts, ditch lining, and catchment basins. Prevent or reduce ditch flow conveyance to the stream through cross drain placement above the stream crossing.	USDI- BLM 2008, Appendix I – Water, R 26, p. 273, R 33 p. 274 Gesford and Anderson 2006, pp. 5–22 OAR 629-625-0330 (4)	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
Temporary Stream Crossing for Roads and Skid Trails			
R 27	When installing temporary culverts, use washed rock as a backfill material. Use geotextile fabric as necessary where washed rock will spread with traffic and cannot be practicably retrieved.	USDI- BLM 2008, Appendix I – Water, R 63, p. 279 ODEQ 2005, NS-3	OAR 629-625-0320-ODF, Stream Crossing Structures OAR 635-412-0035–ODFW, Fish Passage Criteria ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 28	Use no-fill structures (e.g., portable mats, temporary bridges, and improved hardened crossings) for temporary stream crossings. When not practicable, design temporary stream crossings with the least amount of fill and construct with coarse material to facilitate removal upon completion.	OAR 629-625-0320 (2)	OAR 629-625-0320-ODF, Stream Crossing Structures OAR 635-412-0035–ODFW, Fish Passage Criteria ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 29	Remove temporary crossing structures promptly after use. Follow practices under the Closure/Decommissioning section for removing stream crossing drainage structures and reestablishing the natural drainage.	USDI- BLM 2008, Appendix I – Water, R 65, p. 279 OAR 629-625-0430 (5)	OAR 629-625-0430-ODF, Stream Protection OAR 635-412-0035–ODFW, Fish Passage Criteria ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
Surface Drainage			

R 30	Effectively drain the road surface by using crowning, insloping or outsloping, grade reversals (rolling dips), and waterbars or a combination of these methods. Avoid concentrated discharge onto fill slopes unless the fill slopes are stable and erosion-resistant.	USDI- BLM 2008, Appendix I – Water, R 22, p. 272 EPA 2005, p. 3-41	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 31	Outslope temporary and permanent low volume roads to provide surface drainage on road gradients up to 6 percent unless there is a traffic hazard from the road shape.	USDI- BLM 2008, Appendix I – Water, R 23, R 24, p. 273 EPA 2005, p. 3-42 USDA FS 2002 Chapter 13	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 32	Consider using broad-based drainage dips or lead-off ditches in lieu of cross drains for low volume roads. Locate these surface water drainage measures where they will not drain into wetlands, floodplains, and waters of the State.	USDI- BLM 2008, Appendix I – Water, R 25, R 26, p. 273 EPA 2005, pp. 3-41 □ 3-45 USDA FS 2002 Chapter 13	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 33	Avoid use of outside road berms unless designed to protect road fills from runoff. If road berms are used, breach to accommodate drainage where fill slopes are stable.	USDI- BLM 2008, Appendix I – Water, R 27, p. 273 Gesford and Anderson 2006, pp. 3–7	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 34	Construct variable road grades and alignments (e.g., roll the grade and grade breaks) which limit water concentration, velocity, flow distance, and associated stream power.	USDI- BLM 2008, Appendix I – Water, R 28, p. 273 Gesford and Anderson 2006, pp. 5–20 OAR 629-625-0310 (1)	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 35	Install underdrain structures when roads cross or expose springs, seeps, or wet areas rather than allowing intercepted water to flow down gradient in ditchlines.	USDI- BLM 2008, Appendix I – Water, R 29, p. 273 OAR 629-625-0330 (5)	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 36	Design roads crossing low-lying areas so that water does not pond on the upslope side of the road. Provide cross drains at short intervals to ensure free drainage.	USDI- BLM 2008, Appendix I – Water, R 19, p. 272 EPA 2005, p. 3-14, Bullet 1	OAR 629-625-0320-ODF, Stream Crossing Structures ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036

R 37	Divert road and landing runoff water away from headwalls, slide areas, high landslide hazard locations, or steep erodible fill slopes.	USDI- BLM 2008, Appendix I – Water, R 29, p. 273 OAR 629-625-0330 (2)	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 38	Design landings to disperse surface water to vegetated stable areas.	USDI- BLM 2008, Appendix I – Water, R 30, p. 274	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
Cross Drains			
R 39	Locate cross drains to prevent or minimize runoff and sediment conveyance to waters of the State. Implement sediment reduction techniques such as settling basins, brush filters, sediment fences, and check dams to prevent or minimize sediment conveyance. Locate cross drains to route ditch flow onto vegetated and undisturbed slopes.	USDI- BLM 2008, Appendix I – Water, R 33, p. 274 OAR 629-625-0330 (4)	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 40	Space cross drain culverts at intervals sufficient to prevent water volume concentration and accelerated ditch erosion. At a minimum, space cross drains at intervals referred to in the BLM Road Design Handbook 9113-1 (USDI- BLM 2011), Illustration 11 –'Spacing for Drainage Lateral.' Increase cross drain frequency through erodible soils, steep grades, and unstable areas.	USDI- BLM 2008, Appendix I – Water, R 34, p. 274	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 41	Choose cross drain culvert diameter and type according to predicted ditch flow, debris and bedload passage expected from the ditch. Minimum diameter is 18".	USDI- BLM 2008, Appendix I – Water, R 35, p. 274 Johansen *et al*. 1997, p. 3	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 42	Locate surface water drainage measures (e.g., cross drain culverts, rolling dips and water bars) where water flow will be released on convex slopes or other stable and non-erosive areas that will absorb road drainage and prevent sediment flows from reaching wetlands, floodplains, and waters of the State. Where practicable locate surface water drainage structures above road segments with steeper downhill grade. Locate cross drains at least 50 feet from the nearest stream crossing and allow for a sufficient non-compacted soil and vegetative filter.	USDI- BLM 2008, Appendix I – Water, R 26, p. 273 Johansen *et al*. 1997, p. 3	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036

R 43	Armor surface drainage structures (e.g., broad based dips and lead-off ditches) to maintain functionality in areas of erosive and low-strength soils.	USDI- BLM 2008, Appendix I – Water, R 38, p. 275	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 44	Discharge cross drain culverts at ground level on non-erodible material. Install downspout structures or energy dissipaters at cross drain outlets or drivable dips where alternatives to discharging water onto loose material, erodible soils, fills, or steep slopes are not available.	USDI- BLM 2008, Appendix I – Water, R 39, R 40, p. 275 ODEQ 2005, RC-2 Gesford and Anderson 2006, pp. 5–31	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 45	Cut protruding 'shotgun' culverts at the fill surface or existing ground. Install downspout or energy dissipaters to prevent erosion.	USDI- BLM 2008, Appendix I – Water, R 41, p. 275	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 46	Skew cross drain culverts 45–60 degrees from the ditchline and provide pipe gradient slightly greater than ditch gradient to reduce erosion at cross drain inlet.	BLM Road Design Handbook H9113-1 2009	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 47	Provide for unobstructed flow at culvert inlets and within ditch lines during and upon completion of road construction prior to the wet season.	OAR 629-625-0420	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
Timing of In-water Work			
R 48	Conduct all nonemergency in-water work during the ODFW in-stream work window, unless a waiver is obtained from permitting agencies. Avoid winter sediment and turbidity entering streams during in-water work to the extent practicable.	USDI- BLM 2008, Appendix I – Water, R 44, p. 276, R 65, p. 279 Oregon guidelines for timing of in-water work to protect fish and wildlife resources ODFW 2008 OAR 629-625-0430	OAR 629-625-0430-ODF, Stream Protection ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 49	Remove stream crossing culverts and entire in-channel fill material during ODFW in-stream work period.	USDI- BLM 2008, Appendix I – Water, R 93, p. 283 Oregon guidelines for timing of in-water work to protect fish and wildlife	OAR 629-625-0650-ODF,Vacating Forest Roads ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036

		resources ODFW 2008	
Low-water Ford Stream Crossing			
R 50	Harden low-water ford approaches with durable materials. Provide cross drainage on approaches. Limit ford crossings to the ODFW in-stream work period.	USDI- BLM 2008, Appendix I – Water, R 67, p. 279 EPA 2005, p. 3-50	OAR 629-625-0430-ODF, Stream Protection ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 51	Restrict access to unimproved low-water stream crossings.	USDI- BLM 2008, Appendix I – Water, R 69, p. 280 OAR 629-625-0430 (5)	OAR 629-625-0430-ODF, Stream Protection ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 52	Use permanent low-water fords (e.g., concrete and well-anchored concrete mats) in debris-flow susceptible streams.	USDI- BLM 2008, Appendix I – Water, R 70, p. 280. EPA 2005, p. 3-50	OAR 629-625-0320-ODF, Stream Crossing Structures ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
Maintaining Water Quality – Non-native Invasive Plants, include Noxious weeds			
R 53	Locate equipment-washing sites in areas with no potential for runoff into wetlands, Riparian Reserve, floodplains, and waters of the State. Do not use solvents or detergents to clean equipment on site.	USDI- BLM 2008, Appendix I – Water, R 75, p. 280 ODEQ 2005, NS-5	OAR 629-625-0430-ODF, Stream Protection ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
Water Source Development and Use			
R 54	Limit disturbance to vegetation and modification of streambanks when locating road approaches to in-stream water source developments. Surface these approaches with durable material. Employ erosion and runoff control measures.	USDI- BLM 2008, Appendix I – Water, R 102, p. 285	OAR 629-625-0430-ODF, Stream Protection ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036

R 55	Direct pass-through flow or overflow from in-channel and any connected off-channel water developments back into the stream.	USDI- BLM 2008, Appendix I – Water, R 104, p. 285	OAR 629-625-0430-ODF, Stream Protection ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 56	Direct overflow from water harvesting ponds to a safe non-eroding dissipation area, and not into a stream channel.	USDI- BLM 2008, Appendix I – Water, R 105, p. 285	OAR 629-625-0430-ODF, Stream Protection ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 57	Limit the construction of temporary in-channel water drafting sites. Develop permanent water sources outside of stream channels and wetlands.	USDI- BLM 2008, Appendix I – Water, R 106, p. 286 ODEQ 2005, NS-1	OAR 629-625-0430-ODF, Stream Protection ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 58	Do not place pump intakes on the substrate or edges of the stream channel. When placing intakes in-stream, place on hard surfaces (e.g., shovel and rocks) to minimize turbidity. Use a temporary liner to create intake site. After completion of use, remove liner and restore channel to natural condition.	USDI- BLM 2008, Appendix I – Water, R 107, p. 286 ODEQ 2005, NS-1	OAR 629-625-0430-ODF, Stream Protection ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 59	Do not locate placement of road fill in the proximity of a public water supply intake (404(f) exemption criteria xi) in waters of the State.	USACOE (1972) 404(f) exemption criteria xi	OAR 629-625-0430-ODF, Stream Protection ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 60	Avoid water withdrawals from fish- bearing streams whenever practicable. Limit water withdrawals in ESA-listed fish habitat and within 1,500 feet of ESA-listed fish habitat to 10 percent of stream flow or less at the point of withdrawal, and in non- ESA-listed fish habitat to 50 percent or less at the point of withdrawal, based on a visual assessment by a fish biologist or hydrologist. The channel must not be dewatered to the point of isolating fish.	USDC NMFS 2013 ARBO II, p. 43 (NWR-2013-9664) USDA FS 2012, p. 146	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011
Erosion Control Measures			

R 61	During roadside brushing, remove vegetation by cutting rather than uprooting.	OAR 629-625-0430 (4)	OAR 629-625-0430-ODF, Stream Protection ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 62	Limit road and landing construction, reconstruction, or renovation activities to the dry season. Keep erosion control measures concurrent with ground disturbance to allow immediate stormproofing.	USDI- BLM 2008, Appendix I – Water, R 9, p. 271	OAR 629-625-0440-ODF, Stabilization ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 63	Apply native seed and certified weed-free mulch to cut and fill slopes, ditchlines, and waste disposal sites with the potential for sediment delivery to wetlands, Riparian Reserve, floodplains and waters of the State. If needed to promote a rapid ground cover and prevent aggressive invasive plants, use interim erosion control non-native sterile annuals before attempting to restore natives. Apply seed upon completion of construction and as early as practicable to increase germination and growth. Reseed if necessary to accomplish erosion control. Select seed species that are fast-growing, provide ample ground cover, and have adequate soil-binding properties. Apply mulch that will stay in place and at site-specific rates to prevent erosion.	USDI- BLM 2008, Appendix I – Water, R 17, p. 272	OAR 629-625-0440-ODF, Stabilization ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 64	Place sediment-trapping materials or structures such as straw bales, jute netting, or sediment basins at the base of newly constructed fill or side slopes where sediment could be transported to waters of the State. Keep materials away from culvert inlets or outlets.	USDI- BLM 2008, Appendix I – Water, R 14, p. 271, R 21, p. 272 USDA FS 2002 Chapter 18	OAR 629-625-0440-ODF, Stabilization ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 65	Use biotechnical stabilization and soil bioengineering techniques to control bank erosion (e.g., commercially produced matting and blankets, live plants or cuttings, dead plant material, rock, and other inert structures).	USDI- BLM 2008, Appendix I – Water, R 54, p. 277 USDA FS 2002, Chapters 18 and 20	OAR 629-625-0440-ODF, Stabilization ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036

R 66	Suspend ground-disturbing activity if projected forecasted rain will saturate soils to the extent that there is potential for movement of sediment from the road to wetlands, floodplains, and waters of the State. Cover or temporarily stabilize exposed soils during work suspension. Upon completion of ground-disturbing activities, immediately stabilize fill material over stream crossing structures. Measures could include but are not limited to erosion control blankets and mats, soil binders, soil tackifiers, or placement of slash.	USDI- BLM 2008, Appendix I – Water, R 57, p. 278, R 88, p. 282	OAR 629-625-0440-ODF, Stabilization ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 67	Apply fertilizer in a manner to prevent direct fertilizer entry to wetlands, Riparian Reserve, floodplains, and waters of the State.	OAR 629-625-0440 Aquatic Resources Biological Opinion NMFS-ARBO 2013	OAR 629-625-0440-ODF, Stabilization ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
Road Use and Dust Abatement			
R 68	Apply water or approved road surface stabilizers/dust control additives to reduce surfacing material loss and buildup of fine sediment that can enter into wetlands, floodplains and waters of the State. Prevent entry of road surface stabilizers/dust control additives into waters of the State during application. For dust abatement, limit applications of lignin sulfonate to a maximum rate of 0.5 gal/yd^2 of road surface, assuming a 50:50 (lignin sulfonate to water) solution.	USDI- BLM 2008, Appendix I – Water, R 76, p. 281 ODEQ 2005, EP-13 Western Oregon Programmatic 2011	OAR 629-625-0600-ODF, Road Maintenance ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
Road Maintenance			
R 69	Prior to the wet season, provide effective road surface drainage maintenance. Clear ditch lines in sections where there is lowered capacity or is obstructed by dry ravel, sediment wedges, small failures, or fluvial sediment deposition. Remove accumulated sediment and blockages at cross-drain inlets and outlets. Grade natural surface and aggregate roads where the surface is uneven from surface erosion or vehicle rutting. Restore crowning, outsloping or insloping for the road type for effective runoff. Remove or provide outlets through berms on the road shoulder. After ditch cleaning prior to hauling, allow vegetation to reestablish or use sediment entrapment measures (e.g., sediment trapping blankets and silt fences).	USDI- BLM 2008, Appendix I – Water, R 81, R 84, R 85, p. 281 OAR 629-625 0600 (2-4) EPA 2005, pp. 3-61 □ 3-62	OAR 629-625-0600-ODF, Road Maintenance ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036

R 70	Retain ground cover in ditch lines, except where sediment deposition or obstructions require maintenance.	USDI- BLM 2008, Appendix I – Water, R 86, p. 282	OAR 629-625-0600-ODF, Road Maintenance ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 71	Maintain water flow conveyance, sediment filtering and ditch line integrity by limiting ditch line disturbance and groundcover destruction when machine cleaning within 200 feet of road stream crossings.	USDA FS 2012, pp. 113–114. EPA 2005, p. 3-62	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 72	Avoid undercutting of cut-slopes when cleaning ditch lines.	USDI- BLM 2008, Appendix I – Water, R 78, p. 281 EPA 2005, p. 3-62	OAR 629-625-0600-ODF, Road Maintenance ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 73	Remove and dispose of slide material when it is obstructing road surface and ditch line drainage. Place material on stable ground outside of wetlands, Riparian Reserve, floodplains, and waters of the State. Seed with native seed and weed-free mulch.	USDI- BLM 2008, Appendix I – Water, R 79, p. 281 OAR 629-625-0600 (6)	OAR 629-625-0600-ODF, Road Maintenance ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 74	Do not sidecast loose ditch or surface material where it can enter wetlands, Riparian Reserve, floodplains, and waters of the State.	USDI- BLM 2008, Appendix I – Water, R 80, p. 281 OAR 629-625-0600 (7)	OAR 629-625-0600-ODF, Road Maintenance ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 75	Retain low-growing vegetation on cut-and-fill slopes.	USDI- BLM 2008, Appendix I – Water, R 86, p. 282 EPA 2005, EP-6	OAR 629-625-0600-ODF, Road Maintenance ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 76	Seed and mulch cleaned ditch lines and bare soils that drain directly to wetlands, floodplains, and waters of the State, with native species and weed-free mulch.	USDI- BLM 2008, Appendix I – Water, R 78, p. 281	OAR 629-625-0600-ODF, Road Maintenance ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
Road Stormproofing			

R 77	Inspect and maintain culvert inlets and outlets, drainage structures and ditches before and during the wet season to diminish the likelihood of plugged culverts and the possibility of washouts.	USDI- BLM 2008, Appendix I – Water, R 81, R 82, p. 281 OAR 629-625-0600 (3)	OAR 629-625-0600-ODF, Road Maintenance ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 78	Repair damaged culvert inlets and downspouts to maintain drainage design capacity.	USDI- BLM 2008, Appendix I – Water, R 82, p. 281 OAR 629-625-0600 (3)	OAR 629-625-0600-ODF, Road Maintenance ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 79	Blade and shape roads to conserve existing aggregate surface material, retain or restore the original cross section, remove berms and other irregularities that impede effective runoff or cause erosion, and ensure that surface runoff is directed into vegetated, stable areas.	USDI- BLM 2008, Appendix I – Water, R 84, p. 281 OAR 629-625-0600 (4)	OAR 629-625-0600-ODF, Road Maintenance ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 80	Stormproof open resource roads receiving infrequent maintenance to reduce road erosion and reduce the risk of washouts by concentrated water flows. Stormproof temporary roads if retained over winter.	USDI- BLM 2008, Appendix I – Water, R 87, p. 282 OAR 629-625-0600 (2)	OAR 629-625-0600-ODF, Road Maintenance ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 81	Suspend stormproofing/ decommissioning operations and cover or otherwise temporarily stabilize all exposed soil if conditions develop that cause a potential for sediment-laden runoff to enter a wetland, floodplain, or waters of the State. Resume operations when conditions allow turbidity standards to be met.	USDI- BLM 2008, Appendix I – Water, R 88, p. 282	OAR 629-625-0600-ODF, Road Maintenance ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
Road Closure and Decommissioning			
R 82	Inspect closed roads to ensure that vegetation stabilization measures are operating as planned, drainage structures are operational, and non-native invasive plants, including noxious weeds, are not providing erosion control. Conduct vegetation treatments and drainage structure maintenance as needed.	OAR 629-625-0650 (2)	OAR 629-625-0650-ODF, Vacating Forest Roads ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 83	Decommission temporary roads upon completion of use.	USDI- BLM 2008, Appendix I – Water, R 90, p. 283	OAR 629-625-0650-ODF, Vacating Forest Roads ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-

			0007(1), (7) Turbidity OAR 340-041-0036
R 84	Prevent use of vehicular traffic utilizing methods such as gates, guard rails, earth/log barricades, to reduce or eliminate erosion and sedimentation due to traffic on roads.	USDI- BLM 2008, Appendix I – Water, R 91, p. 283 OAR 629-625-0650 (2)	OAR 629-625-0650-ODF, Vacating Forest Roads ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 85	Convert existing drainage structures such as ditches and cross drain culverts to a long-term maintenance free drainage configuration such as an outsloped road surface and waterbars.	USDI- BLM 2008, Appendix I – Water, R 92, p. 283 OAR 629-625-0650 (3)	OAR 629-625-0650-ODF, Vacating Forest Roads ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 86	Place and remove temporary stream crossings during the dry season, without overwintering, unless designed to accommodate a 100-year flood event. See also R 49.	OAR 629-625-0430 (5)	OAR 629-625-0430-ODF, Stream Protection ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 87	Place excavated material from removed stream crossings on stable ground outside of wetlands, Riparian Reserve, floodplains, and waters of the State. In some cases, the material could be used for recontouring old road cuts or be spread across roadbed and treated to prevent erosion.	USDI- BLM 2008, Appendix I – Water, R 94, p. 284	OAR 629-625-0650-ODF, Vacating Forest Roads ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 88	Reestablish stream crossings to the natural stream gradient. Excavate sideslopes back to the natural bank profile. Reestablish natural channel width and floodplain.	USDI- BLM 2008, Appendix I – Water, R 95, p. 284	OAR 629-625-0650-ODF, Vacating Forest Roads ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 89	Install cross ditches or waterbars upslope from stream crossing to direct runoff and potential sediment to the hillslope rather than deliver it to the stream.	USDI- BLM 2008, Appendix I – Water, R 96, p. 284 OAR 629-625-0650 (3)	OAR 629-625-0650-ODF, Vacating Forest Roads ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036

R 90	Following culvert removal and prior to the wet season, apply erosion control and sediment trapping measures (e.g., seeding, mulching, straw bales, jute netting, and native vegetative cuttings) where sediment can be delivered into wetlands, Riparian Reserve, floodplains, and waters of the State.	USDI- BLM 2008, Appendix I – Water, R 97, p. 284 OAR 629-625-0650 (3)	OAR 629-625-0650-ODF, Vacating Forest Roads ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 91	Implement tillage measures, including ripping or subsoiling to an effective depth. Treat compacted areas including the roadbed, landings, construction areas, and spoils sites.	USDI- BLM 2008, Appendix I – Water, R 98, p. 285	OAR 629-625-0650-ODF, Vacating Forest Roads ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 92	After tilling the road surface, pull back unstable road fill and end-haul or contour to the natural slopes.	USDI- BLM 2008, Appendix I – Water, R 99, p. 285	OAR 629-625-0650-ODF, Vacating Forest Roads ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
Wet-season Road Use			
R 93	On active haul roads, during the wet season, use durable rock surfacing and sufficient rock depth to resist rutting or development of sediment on road surfaces that drain directly to wetlands, floodplains, and waters of the State.	USDI- BLM 2008, Appendix I – Water, R 71, p. 280 OAR 629-625-0700 (2)	OAR 629-625-0700-ODF, Wet Weather Road Use ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 94	Prior to winter hauling activities, implement structural road treatments such as: increasing the frequency of cross drains, installing sediment barriers or catch basins, applying gravel lifts or asphalt road surfacing at stream crossing approaches, and armoring ditch lines.	USDI- BLM 2008, Appendix I – Water, R 72, p. 280 OAR 629-625-0700 (2)	OAR 629-625-0700-ODF, Wet Weather Road Use ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 95	Remove snow on surfaced roads in a manner that will protect the road and adjacent resources. Retain a minimum layer (4”) of compacted snow on the road surface. Provide drainage through the snow bank at periodic intervals to allow snowmelt to drain off the road surface.	USDI- BLM 2008, Appendix I – Water, R 74, p. 280 BLM snow removal letter	OAR 629-625-0700-ODF, Wet Weather Road Use ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 96	Avoid removing snow from unsurfaced roads where runoff drains to waters of the State.	USDA FS 2012, pp. 120–123 EPA 2005, p. 3-80	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036

R 97	Maintain road surface by applying appropriate gradation of aggregate and suitable particle hardness to protect road surfaces from rutting and erosion under active haul where runoff drains to wetlands, Riparian Reserve, floodplains, and waters of the State.	USDI- BLM 2008, Appendix I – Water, R 71, p. 280 OAR 629-625-0700 (2)	OAR 629-625-0700-ODF, Wet Weather Road Use ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 98	To reduce sediment tracking from natural surface roads during active haul, provide a gravel approach before entrance onto surfaced roads.	EPA 2005, pp. 3-57 – 3-58	OAR 629-625-0700-ODF, Wet Weather Road Use ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 99	Install temporary culverts and washed rock on top of low-water ford to reduce vehicle contact with water during active haul. Remove culverts promptly after use.	USDA FS 2012, pp. 119–120	OAR 629-625-0700-ODF, Wet Weather Road Use ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036

Best management practices for timber harvest activities.

BMP Number	**Best Management Practices**	**Source**	**Water Quality Standards and Regulations**
Cable Yarding			
TH 01	Design yarding corridors crossing streams to limit the number of such corridors, using narrow widths, and using the most perpendicular orientation to the stream feasible. Minimize yarding corridor widths and space corridors as far apart as is practicable given physical and operational limitations, through practices such as setting limitations on corridor width, corridor spacing, or the amount of corridors in an area. For example, such practices could include, as effective and practicable: - Setting yarding corridors at 12–15 foot maximum widths, and - Setting corridor spacing where they cross the streams to no less than 100 feet apart when physical, topography, or operational constraints demand, with an overall desire to keep an average spacing of 200 feet apart.	USDI-BLM 2008, Appendix I – Water, TH 2, p. 287	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036 Temperature OAR 340-041-0028
TH 02	Directionally fall trees to lead for skidding and skyline yarding to minimize ground disturbance when moving logs to skid trails and skyline corridors.	USDI-BLM 2008, Appendix I – Water, TH 17, p. 289	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 03	Require full suspension over flowing streams, non-flowing streams with highly erodible bed and banks, and jurisdictional wetlands.	USDI-BLM 2008, Appendix I	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1)

		– Water, TH 3, p. 287	Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 05	Prevent streambank and hillslope disturbance on steep slopes (generally > 60 percent) by requiring full-suspension within 50 feet of definable stream channels. Yard the remaining areas across the Riparian Reserve using at least one-end suspension.	USDI-BLM 2008, Appendix I – Water, TH 5, p. 287	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 06	Implement erosion control measures such as waterbars, slash placement, and seeding in cable yarding corridors where the potential for erosion and delivery to waterbodies, floodplains, and wetlands exists.	USDI-BLM 2008, Appendix I – Water, TH 6, p. 288	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
Ground-based Harvesting			
TH 07	Exclude ground-based equipment on hydric soils, defined by the Natural Resources Conservation Service.	USDI-BLM 2008, Appendix I – Water, TH 8, p. 288	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 08	Limit designated skid trails for thinning or regeneration harvesting to ≤ 15 percent of the harvest unit area to reduce displacement or compaction to acceptable limits.	Soil Quality Standards USDA FS 1998	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 09	Limit width of skid roads to single width or what is operationally necessary for the approved equipment. Where multiple machines are used, provide a minimum- sized pullout for passing.	USDI-BLM 2008, Appendix I – Water, TH 10, p. 288	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 10	Ensure leading-end of logs is suspended when skidding.	USDI-BLM 2008, Appendix I – Water, TH 11, p. 288	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 11	Restrict non-road, in unit, ground-based equipment used for harvesting operations to periods of low soil moisture; generally from May 15 to Oct 15. Low soil moisture varies by texture and is based on site-specific considerations. Low soil moisture limits will be determined by qualified specialists to determine an estimated soil moisture and soil texture.[50]	USDI-BLM 2008, Appendix I – Water, TH 12, p. 288	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 12	Incorporate existing skid trails and landings as a priority over creating new trails and landings where feasible, into a designated trail network for ground-based harvesting equipment, consider proper spacing, skid trail direction and location relative to terrain and stream channel features.	USDI-BLM 2008, Appendix I – Water, TH 13, p. 289	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
[50] Soil moisture is the ratio of the weight of the water in the soil to the weight of the solids, expressed as a percentage.			

TH 13	Limit non-specialized skidders or tracked equipment to slopes less than 35 percent, except when using previously constructed trails or accessing isolated ground-based harvest areas requiring short trails over steeper pitches. Also, limit the use of this equipment when surface displacement creates trenches, depressions, excessive removal of organic horizons, or when disturbance would channel water and sediment as overland flow.	USDI-BLM 2008, Appendix I – Water, TH 14, p. 289	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 14	Limit the use of specialized ground-based mechanized equipment (those machines specifically designed to operate on slopes greater than 35 percent) to slopes less than 50 percent, except when using previously constructed trails or accessing isolated ground-based harvesting areas requiring short trails over steeper pitches. Also, limit the use of this equipment when surface displacement creates trenches, depressions, excessive removal of organic horizons, or when disturbance would channel water and sediment as overland flow.	USDI-BLM 2008, Appendix I – Water, TH 15, p. 289	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 15	Designate skid trails in locations that channel water from the trail surface away from waterbodies, floodplains, and wetlands, or unstable areas adjacent to them.	USDI-BLM 2008, Appendix I – Water, TH 16, p. 289.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 16	Apply erosion control measures to skid trails and other disturbed areas with potential for erosion and subsequent sediment delivery to waterbodies, floodplains, or wetlands. These practices may include seeding, mulching, water barring, tillage, and woody debris placement. Use guidelines from the road decommissioning section.	USDI-BLM 2008, Appendix I – Water, TH 18, p. 289	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 17	Construct waterbars on skid trails using guidelines in **Table C-6** where potential for soil erosion or delivery to waterbodies, floodplains, and wetlands exists.	USDI-BLM 2008, Appendix I – Water, TH 19, p. 289	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 18	Subsoil skid trails, landings, or temporary roads where needed to achieve no more than 20 percent detrimental soil conditions, and minimize surface runoff, improve soil structure, and water movement through the roadbed. See also R 91–92.	USDI-BLM 2008, Appendix I – Water, R 98, p. 285	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 19	Block skid trails to prevent public motorized vehicle and other unauthorized use at the end of seasonal use.	USDI-BLM 2008, Appendix I – Water, TH 21, p. 290	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036

TH 20	Allow harvesting operations (cutting and transporting logs) when ground is frozen or adequate snow cover exists to prevent soil compaction and displacement.	USDI-BLM 2008, Appendix I – Water, TH 12, p. 288	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 21	Minimize the area where more than half of the depth of the organically-enriched upper horizon (topsoil) is removed when conducting forest management operations.	Soil Quality Standards USDA FS 1998	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 22	Maintain at least the minimum percent of effective ground cover needed to control surface erosion, as shown in **Table C-3**, following forest management operations. Ground cover may be provided by vegetation, slash, duff, medium to large gravels, cobbles, or biological crusts.	Soil Quality Standards USDA FS 1998	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036

Soil cover based on erosion hazard ratings.

NRCS Erosion Hazard Rating*	Minimum Percent Effective Ground Cover – Year 1	Minimum Percent Effective Ground Cover – Year 2
Very Severe	60percent	75percent
Severe	45percent	60percent
Moderate	30percent	40percent
Slight	20percent	30percent

* Rating obtained from Natural Resources Conservation Services County Soil Survey information by map unit.

Silvicultural Activities

Best management practices for planting, pre-commercial thinning, and fertilization.

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
Planting and Pre-commercial Thinning			
S 01	Limit the crossing of stream channels with motorized support vehicles (e.g., OHVs) and mechanized equipment to existing road crossings or temporary ford crossings to the ODFW in-stream work period, unless a waiver is obtained from permitting agencies.	USDI- BLM 2008, Appendix I – Water, S 1, p. 291	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
S 02	Scatter treatment debris on disturbed soils and water bar any equipment access trails that could erode and deposit sediment in waterbodies, floodplains, and wetlands.	USDI- BLM 2008, Appendix I – Water, S 4, p. 291	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
Fertilization			

S 03	For streams and waterbodies that support domestic use, apply fertilizer further than 100 feet from the edge of the active channel or shoreline.	USDI- BLM 2008, Appendix I – Water, S 5, p. 291	EPA 440/5-86-001,-10 mg/L nitrate nitrogen for domestic water supply. ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Toxic Substances OAR 340-041-0033
S 04	Locate storage, transfer, and loading sites outside Riparian Reserve and separated from hydrological connections (e.g., road ditches that are linked to stream channels).	USDI- BLM 2008, Appendix I – Water, S 6, p. 291	EPA 822-R-13-001 2013,-salmonid acute criterion, 17 mg total ammonia nitrogen/L at pH 7 and temperature of 20 °C. ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Toxic Substances OAR 340-041-0033

Best management practices for fire and fuels management.

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
Underburn, Jackpot Burn, and Broadcast Burn			
F 01	Locate fire lines so that open meadows associated with streams do not burn, unless prescribed for restoration.	USDI- BLM 2008, Appendix I – Water, F 1, p. 293	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036 Temperature OAR 340-041-0028
F 02	Avoid burning of large woody material that is touching the high water mark of a waterbody or that may be affected by high flows.	USDI- BLM 2008, Appendix I – Water, F 3, p. 293	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036 Temperature OAR 340-041-0028
F 03	Avoid delivery of chemical retardant foam or additives to waterbodies, and wetlands. Store and dispose of ignition devices/ materials (e.g., flares and plastic spheres) outside Riparian Reserve or a minimum of 150 feet from waterbodies, floodplains, and wetlands. Maintain and refuel equipment (e.g., drip torches and chainsaws) a minimum of 100 feet from waterbodies, floodplains, and wetlands. Portable pumps can be refueled on-site within a spill containment system.	USDI- BLM 2008, Appendix I – Water, F 4, p. 293	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Toxic Substances OAR 340-041-0033

F 04	Limit fire lines inside Riparian Reserve. Construct fire lines by hand on all slopes greater than 35 percent and inside the Riparian Reserve inner zone. Use erosion control techniques such as tilling, waterbarring, or debris placement on fire lines when there is potential for soil erosion and delivery to waterbodies, floodplains, and wetlands. Space the waterbars as shown in **Table C-6**. Avoid placement of fire lines where water would be directed into waterbodies, floodplains, wetlands, headwalls, or areas of instability.	USDI- BLM 2008, Appendix I – Water, F 5, p. 294	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
F 05	In broadcast burning, consume only the upper horizon organic materials and allow no more than 15 percent of the burned area mineral soil surface to change to a reddish color.	Soil Quality Standards USDA FS 1998	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
Pile and Burn			
F 06	Avoid burning piles within 35 feet of a stream channel.	USDI- BLM 2008, Appendix I – Water, F 6, p. 294	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
F 07	Avoid creating piles greater than 16 feet in height or diameter. Pile smaller diameter materials and leave pieces > 12” diameter within the unit. Reduce burn time and smoldering of piles by extinguishment with water and tool use.	Soil Quality Standards USDA FS 1998	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
F 08	When burning machine-constructed piles, preferably locate and consume organic materials on landings or roads. If piles are within harvested units and more than 15 percent of the burned area mineral soil (the portion beneath the pile) surface changes to a reddish color, then consider that amount of area towards the 20 percent detrimental soil disturbance limit.	Soil Quality Standards USDA FS 1998	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
Mechanical and Manual Fuels Treatments			

F 09	Do not operate ground-based machinery for fuels reduction within 50 feet of streams (slope distance), except where machinery is on improved roads, designated stream crossings, or where equipment entry into the 50-foot zone would not increase the potential for sediment delivery into the stream. Do not operate ground-based machinery for fuels reduction on slopes > 35 percent. Mechanical equipment with tracks may be used on short pitch slopes of greater than 35 percent but less than 45 percent when necessary to access benches of lower gradient (length determined on a site-specific basis, generally less than 50 feet (slope distance)).	USDI- BLM 2008, Appendix I – Water, F 7, p. 294	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
F 10	Use temporary stream crossings if necessary to access the opposite side with any equipment or vehicles (including OHVs). Follow Temporary Stream Crossing practices under Roads section.	USDI- BLM 2008, Appendix I – Water, F 8, p. 294	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
F 11	Place residual slash on severely burned areas, where there is potential for sediment delivery into waterbodies, floodplains, and wetlands.	USDI- BLM 2008, Appendix I – Water, F 9, p. 294	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036

Water bar spacing by gradient and erosion class.

Gradient (Percent)	**Water Bar Spacing* By Erosion Class†**		
	High (Feet)	**Moderate (Feet)**	**Low (Feet)**
2–5	200	300	400
6–10	150	200	300
11–15	100	150	200
16–20	75	100	150
21–35	50	75	100
36+	50	50	50

* Spacing is determined by slope distance and is the maximum allowed for the grade.

† The erosion classes include the following rock types:

High: Granite, sandstone, andesite porphyry, glacial or alluvial deposits, soft matrix conglomerate, volcanic ash, and pyroclastics

Moderate: Basalt, andesite, quartzite, hard matrix conglomerate, and rhyolite

Low: Metasediments, metavolcanics, and hard shale

Surface Source Water for Drinking Water

Best management practices for surface water for drinking water protection.

BMP Number	**Best Management Practices**	**Source**	**Water Quality Standards and Regulations**

SW 02	Locate contractor camps outside DEQ sensitive zones in drinking water source areas for public water systems. If this is not practicable, require self-contained sanitary facilities.	USDI- BLM 2008, Appendix I – Water, SW 2, p. 299 ODEQ Drinking Water Protection Program[51]	ODEQ–Water Pollution: Bacteria OAR 340-041-0009 Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (13)
SW 03	Require self-contained sanitary facilities in surface source water watersheds, when long-term camping (greater than 14 days) is involved with contract implementation.	USDI- BLM 2008, Appendix I – Water, SW 3, p. 299	ODEQ–Water Pollution: Bacteria OAR 340-041-0009 Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (13)

Best management practices for spill prevention and abatement.

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
Operations Near Waterbodies			
SP 01	Take precautions to prevent leaks or spills of petroleum products (e.g., fuel, motor oil, and hydraulic fluid) from entering the waters of the State.	40 CFR 112 OAR 629-620-0100(2)	[40 CFR 112] – Oil Pollution Prevention. Reportable quantity is a visible sheen where waterways are involved. OAR 629-620-0100-ODF, Chemical and Other Petroleum Product Rules ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (12) and (13) Biocriteria OAR 340-041-0011 Toxic Substances OAR 340-041-0033
SP 02	Take immediate action to stop and contain leaks or spills of chemicals and other petroleum products. Notify the Oregon Emergency Response System, through the District Hazard Materials specialist, of any spill that enters the waters of the State.	40 CFR 112 OAR 629-620-0100(3), (4)	[40 CFR 112] – Oil Pollution Prevention. Reportable quantity is a visible sheen where waterways are involved. OAR 629-620-0100-ODF, Chemical and Other Petroleum Product Rules ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (12) and (13) Biocriteria OAR 340-041-0011 Toxic Substances OAR 340-041-0033
SP 03	Inspect and clean heavy equipment as necessary prior to moving on to the project site, in order to remove oil and grease, non-native invasive plants, including noxious weeds, and excessive soil. Inspect hydraulic fluid and fuel lines on heavy-mechanized equipment for proper working condition. Where practicable, maintain and refuel heavy equipment a minimum of 150 feet	USDI- BLM 2008, Appendix I – Water, SP 1, p. 311	40 CFR 112 – Oil Pollution Prevention. Reportable quantity is 42 U.S. gallons not involving waterways, a visible sheen where waterways are involved. ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (12) and (13)

	away from streams and other waterbodies. Refuel small equipment (e.g. chainsaws and water pumps) at least 100 feet from waterbodies (or as far as practicable from the waterbody where local site conditions do not allow a 100-foot setback) to prevent direct delivery of contaminants into a waterbody. Refuel small equipment from no more than 5-gallon containers. Use absorbent material or a containment system to prevent spills when re-fueling small equipment within the stream margins or near the edge of waterbodies. In the event of a spill or release, take all reasonable and safe actions to contain the material. Specific actions are dependent on the nature of the material spilled. Use spill containment booms or as required by ODEQ. Have access to booms and other absorbent containment materials. Immediately remove waste or spilled hazardous materials (including but not limited to diesel, oil, hydraulic fluid) and contaminated soils near any stream or other waterbody, and dispose of it/them in accordance with the applicable regulatory standard. Notify Oregon Emergency Response System of any spill over the material reportable quantities, and any spill not totally cleaned up after 24 hours. Store equipment containing reportable quantities of toxic fluids outside of Riparian Reserve.		Biocriteria OAR 340-041-0011 Toxic Substances OAR 340-041-0033

Best management practices for ensuring protection of cultural resources

BMP Number	Best Management Practices	Source	Regulation
Project Implementation			
CR 01	Prior to initiating or authorizing a proposed action a cultural resources specialist would review the proposed action to determine whether the action is exempted from, or requires a cultural resource inventory	USDI BLM-SHPO 2015, VI.A (1). P. 8	Identification, Evaluation and Treatment of Historic Properties: establishing the undertaking and Area of Potential Effect. 36 CFR§ 800.16(y)
CR 02	All cultural resources discovered or recorded within the Area of Potential Effect (APE) during an inventory shall be evaluated for inclusion in the National Register unless avoided as stipulated in section VI.C.1 of this Protocol.	USDI BLM-SHPO 2015, VI.C (2). P. 11.	Identification Results and Evaluations of Eligibility (UDSI-SHPO 2015) *Secretary of the Interior Standards and Guidelines for Evaluations: 48 FR 44729, and BLM Manual 8110.*
CR 03	If any cultural and/or paleontological resource (historic or prehistoric site or object) is discovered during project development or implementation, project activity would cease in the immediate vicinity and the area flagged for avoidance within 150 feet, followed by notification of the District archaeologist Field Manager. Project work would not proceed until	USDI BLM-SHPO 2015, VI.C (9). P.13	*Unevaluated Cultural Resources and Avoidance,* VI.C (9)

	evaluation and appropriate mitigations to prevent the loss of significant cultural or scientific values has been completed.		
CR 04	Damage to a cultural resource site (site) would be assessed as defined in the 2015 State Protocol, Determination of Effects to Historic Properties VI. D (4) Adverse Effects.	USDI BLM-SHPO 2015, VI.D. P.14	Determination of Effects to Historic Properties, 36 CFR § 800.5 and apply the Criteria of Effect and Adverse Effect
CR 05	The project may be redesigned to protect the cultural resource values present, or evaluation and mitigation procedures would be implemented based on recommendations from the archaeologist(s) and concurrence by the authorized officer and SHPO.	USDI BLM-SHPO 2015, VI.C (9). P.13	*Unevaluated Cultural Resources and Avoidance VI.C (9)*

Project Design Features:

Features Common to all Activities.

1. Per the RMP (pg. 62), trees ≥40” DBH and established before 1850 will be retained, except where falling is necessary for safety or operational reasons and no alternative harvesting method is economically viable or practically feasible. If such trees need to be cut for safety or operational reasons, retain cut trees in the stand. Trees which do not meet this criterion, but which have structure that may support murrelet nesting may be removed, although these trees, and the trees surrounding them that maintain their microclimate, will be prioritized for retention when possible.
2. The BLM would evaluate all proposed units and a minimum of 110 yards (330 feet) outside of proposed units to identify murrelet trees prior to treatment. (If the nearest murrelet tree is closer to the unit, evaluating the full 110 yards may not be necessary.)
3. Secure or remove food, food trash, and garbage generated by workers daily in project areas to minimize attraction of predators, specifically corvids.
4. Except as noted in PDF 15, murrelet survey protocols would be conducted prior to the removal of trees with murrelet nesting platforms, or the direct modification of murrelet nesting habitat.
    a. If the survey results in a no occupancy determination: HLB regeneration and commercial thinning would continue as proposed in this assessment.
    b. If the survey results indicate stand occupancy: The stand would be delineated per the RMP/ROD (p. 98) and no HLB treatments would occur in the occupied stand, or within 300-feet of the occupied stand.
5. Adjacent to murrelet stands occupied prior to 2016: No-treatment buffers[14] are not required.
6. Adjacent to murrelet stands occupied after 2016: No HLB treatments would occur within 300 feet when adjacent to regeneration harvest. A 150 ft. no-treatment buffer will be maintained when adjacent to commercial thinning of the delineated stand, regardless of habitat conditions.
7. If surveys are not conducted on individual murrelet trees (that will not be removed) or groups of six or less murrelet trees within a 5-acre portion of the stand, a 300-ft no treatment buffer around regeneration harvest and 150 ft. no-treatment buffer around commercial thinning will be maintained. Seasonal and daily timing seasonal restrictions would be required.

[14] No-treatment buffers means that no harvest would be conducted in the buffer including tree felling or snag creation. However, roads or yarding corridors will be located within no-treatment buffers within the parameters of the relevant Standards below.

a. Buffer could be used for basal area retention.
   i. Yarding Corridors could be approved within the buffer, but
   ii. Murrelet tree and trees with interlocking branches have a no-touch[15] protection within the buffer.

8. Adjacent to surveyed unoccupied murrelet *nesting structure*: No-treatment buffers would not be required.
9. A portion of the retention will be located preferentially adjacent to trees with murrelet structure in adjacent stands that were designated as occupied prior to the RMP/RMP when feasible.
10. Seasonal and daily timing restrictions are required as described in Section 1.6 and PDFS, for all work that may cause disruption of an occupied spotted owl nest patch, occupied murrelet nesting habitat, or unsurveyed murrelet or spotted owl nesting habitat.
11. If a single murrelet tree is identified during project implementation, the tree and trees with interlocking branches would be retained. All work would have seasonal and daily timing restrictions. This PDF would apply to no more than three trees for the entire project included in this BA (including LSR). If more than three trees are identified additional consultation with the USFWS would be required.
12. Seasonal and daily timing restrictions are required as described in Table 21 and Table 22, for all work that may cause disruption of an occupied spotted owl nest patch, occupied murrelet nesting habitat, or unsurveyed murrelet or spotted owl nesting habitat.

Table 21. Disturbance and disruption distances for marbled murrelets during the breeding period*

Disturbance or Disruption Activity (known or potential components of proposed action)	**Disturbance Distance**	**Disruption Distance**[‡]		
	Entire Breeding Period (April 1 – September 15)	**Critical Breeding Period** (April 1 – August 5)	**Late Breeding Period** (When activity occurs from two before sunset to two hours after sunrise) (August 6 – September 15)	**Late Breeding Period**[d] **With DTR** (August 6 – September 15)
Timber haul and renovation of open roads[†]	0.25 mile	NA	NA	NA
Renovation and new construction on closed roads[‡]	0.25 mile	110 yards	110 yards	NA
Chainsaw and heavy equipment operation for large culvert replacements, yarding, mechanical harvest, etc.	0.25 mile	110 yards	110 yards	NA
Pile Burning	1 mile	0.25 mile	0.25	NA
Blasting	1 mile	0.25 mile	0.25 mile (NO DTR permitted)	0.25 mile

[15] No-touch means that no work associated with the timber activity would occur within the buffer, including roads and yarding corridors.

Table 22. Disturbance and disruption distances for the spotted owl during the breeding period*

Disturbance or Disruption Activity (known or potential components of proposed action)	**Disturbance Distance**⁑	**Disruption Distance**⁑	
	Entire Breeding Period (March 1 – September 30)	**Critical Breeding Period** (March 1 – July 7)	**Late Breeding Period** (July 8 – September 30)
Timber haul and renovation of open roads†	0.25 mile	NA	NA
Renovation and new construction on closed roads‡	0.25 mile	65 yards	NA
Chainsaw and heavy equipment operation for large culvert replacements, yarding, mechanical harvest, etc.	0.25 mile	65 yards	NA
Pile Burning	0.25 mile	0.25 mile	NA
Blasting	1 mile	0.25 mile	100 yards (injury)

Common to All Late-Successional and Riparian Reserve Commercial Harvest Activities

13. A biologist will field review all units prior to layout to verify on-the-ground conditions and ensure that treatments occur in stands that meet model descriptions and will benefit from thinning.
14. Application of no-treatment buffers adjacent to (within 150 feet of) murrelet nesting structures, either inside or outside the harvest unit boundary:
    a. Adjacent to occupied (either previous or current surveys) or unsurveyed nesting structures: No timber harvest will occur within 150 ft of murrelet nesting structure, unless the biologist reviews the buffer and determines that the proposed treated and occupied or unsuitable surveyed habitat do not interact, for instance due to topography or canopy height.
    b. Adjacent to occupied (either previous or current surveys) or unsurveyed suitable habitat, proposed harvest units with an FOI age of 70 or older: a 150-foot buffer will be applied based on the actual location of the suitable occupied stand edge based on a LiDAR analysis and field verification. A no treatment buffer will be placed within 150 ft of occupied (either previous or current surveys) or unsurveyed suitable murrelet nesting habitat, unless the biologist reviews the buffer and determines that the proposed treated and occupied or unsuitable surveyed habitat do not interact, for instance due to topography or canopy height.
    c. Adjacent to surveyed unoccupied nesting structures: Thinning could occur directly adjacent to trees with nesting habitat; however, the murrelet tree and trees with interlocking branches will not be removed.
15. The BLM will attempt to place yarding corridors farther than 150 feet from trees with murrelet structure, but this may not be possible in all cases. Yarding corridors will be located as to avoid murrelet trees and interlocking trees with murrelet structure as practicable. The BLM will attempt to place yarding corridors so that the tree with murrelet structure and trees with interlocking branches are not removed. In rare cases, the corridor may be placed directly adjacent to a murrelet tree or even require murrelet tree removal. Any cut murrelet trees will be left on-site. Should a tree with nesting structure, or a tree with interlocking branches, need to be removed the following would apply:
    a. Felling would be restricted to outside the full breeding season (April 1- Sept 15) unless protocol surveys have determined the stand to be unoccupied.
    b. The stand with nesting habitat would continue to support future murrelet nesting.
    c. Yarding corridors would not be placed through stands of 6 or more murrelet trees in a 5-acre area. The yarding corridor may be placed so that it transects the buffer on the edge of a patch of 6 trees in 5-acres.

16. Seasonal and daily timing restrictions are required as described in Section 1.6 and PDFS, for all work that may cause disruption of an occupied spotted owl nest patch, occupied murrelet nesting habitat, or unsurveyed murrelet or spotted owl nesting habitat.
17. If a single murrelet tree is identified during project implementation, the tree and trees with interlocking branches would be retained. All work would have seasonal and daily timing restrictions. This PDF would apply to no more than three trees for the entire project included in this BA (including HLB).
18. In the following stand conditions only, create group selections up to 4 acres in size in no more then 25 percent of the stand area to promote the development of new cohorts of open grown conifers in the LSR in:
    a. Alder and other hardwood dominated areas of previously managed stands
    b. Insect and disease damaged areas where a site appropriate alternative tree species such as western red cedar, is more resistant to the damage.
    c. Stands where existing trees are unlikely to develop into large, >30” DBH trees because of tree form and windthrow risk. This condition includes tree height: diameter greater than 80:1 and poor crown ratios less than 20 percent.
19. When the above stand conditions do not apply; conduct variable density thinning including modified group selections in the LSR only:
    a. Achieve target RD and canopy cover at the stand level, within stand variability is desired
    b. Create modified group selects no to exceed 4 acres in size, and no more than 25 percent of the stand area. Within modified group selects retain 10-20 trees/acre on average in a variety of spatial patterns.
    c. Establish minor species though natural or artificial regeneration.

Common to all Late-Successional Reserve Non-commercial Harvest Activities

20. A biologist will field review all units prior to layout to verify on-the-ground conditions and ensure that treatments occur in stands that meet model descriptions and will benefit from treatment.
21. All trees cut will remain on site unless the fuels specialist determines that the downed material represents a fire risk, in which case it would be hand-piled and burned following fire PDFs to avoid disruption.
22. All stands would retain at a minimum 60% canopy cover at the stand level, with no more than a 10% reduction over pre-treatment conditions.
23. Individual tree felling is limited to 1 acre or smaller openings.
24. Group selects, gaps, and/or individual tree felling of a ¼ acre or larger will be at least 150 ft from trees with murrelet nesting structure.
25. Seasonal and daily timing restrictions are required as described in Section 1.6 and PDFS, for all work that may cause disruption of an occupied spotted owl nest patch, occupied murrelet nesting habitat, or unsurveyed murrelet or spotted owl nesting habitat.

Common to all Riparian Reserve Tree Tipping

26. All RR restoration work would follow ARBO II (pp. 28-30).
27. Seasonal and daily timing restrictions are required as described in Section 1.6 and PDFS, for all work that may cause disruption of an occupied spotted owl nest patch, occupied murrelet nesting habitat, or unsurveyed murrelet or spotted owl nesting habitat.

Common to Transportation Management

28. All currently open roads or roads planned for light renovation would not be seasonally restricted since vehicles can currently pass on these roads.
29. When possible, new roads will be designed to avoid removal of remnant trees, trees with platforms for murrelets, or with large cavities that may support spotted owl nesting. Should a tree with murrelet nesting structure, or an adjacent tree with interlocking branches need to be removed, the following restrictions would apply:
    a. Removal would be restricted to outside the full breeding season (April 1- Sept 15) unless protocol surveys have determined the stand to be unoccupied.
    b. The stand with nesting habitat would continue to support future murrelet nesting.
30. Seasonal restrictions are required for construction activities and haul on new roads or roads that received heavy renovation through murrelet occupied or unsurveyed suitable habitat as described in Section 1.6.
31. Natural surface roads
    a. Rocking the approaches on streams will be evaluated on a case-by-case basis by BLM project specialists (timber, road engineering, hydrology).
    b. The BLM contract administrator would monitor road conditions and suspend commercial road use when road surfaces that drain to wetlands and streams are getting rutted, developing a mud layer on running surfaces, developing areas of standing water, or turbid road runoff is entering wetlands or streams.
32. Upsizing of existing cross drains will be evaluated by BLM under the following conditions:
    a. If the cross drain is close to or adjacent to a stream crossing. This is to safeguard against other cross drains failing further up the ditch network.
    b. If there is evidence of a stream network such as channelization and sediment and water movement (includes seeps and springs).
    c. Existing cross drains with greater than 5' fill (measured at centerline of road) requiring replacement and/or showing evidence of being inundated, will be upsized. Minimum diameter is 24 inches.
    d. The following cross drains and culverts have been identified for replacement:

Table 23. Proposed Cross Drains and Culverts

Type	Location or Road Number	New or Existing	Current Diameter (Inches)	Recommended Minimum Diameter (Inches)[16]
Cross Drain	RENO-1-1	New	N/A	18
Cross Drain	RENO-1-1	New	N/A	18
Stream Crossing	RENO-105-1	Existing	N/A	24
Stream Crossing	RENO-105-1	Existing	N/A	24
Cross Drain	29-11-9.2	Existing	18	18
Cross Drain	RENO-17-2	New	N/A	18
Cross Drain	RENO-17-2	New	N/A	18
Cross Drain	T29S, R11W, Sec. 14, Big Creek County Rd.	New	N/A	24
Stream Crossing	RENO-105-1	Existing	N/A	48*
Stream Crossing	RENO-105-1	New	N/A	24
Stream Crossing	RENO-105-1	Existing	N/A	24*
Stream Crossing	29-11-9.2	Existing	N/A	24
Cross Drain	RENO-1-1	New	N/A	18
Stream Crossing	RENO-105-1	New	N/A	24
Stream Crossing	28-11-15.2	New	N/A	24
Stream Crossing	28-11-15.2	New	N/A	24

[16] Cross drain and culvert locations and sizes based on preliminary field investigations conducted by hydrology technicians and GIS analysis. Subject to change as recommended by engineers.

Type	Location or Road Number	New or Existing	Current Diameter (Inches)	Recommended Minimum Diameter (Inches)[16]
Cross Drain	RENO-17-2	New	N/A	18
Cross Drain	29-12-35.0	New	N/A	18
Stream Crossing	RENO-105-1	New	N/A	24
Stream Crossing	29-11-9.2	New	N/A	24
Cross Drain	29-12-35.0	New	N/A	18
Cross Drain	RENO-105-1	New	N/A	18
Cross Drain	29-11-5.0	New	N/A	18
Stream Crossing	RENO-105-1	Existing	N/A	24
Stream Crossing	29-10-9.3	New	N/A	24
Stream Crossing	29-10-9.3	Existing	N/A	36*
Stream Crossing	28-10-31.0	Existing	36	60
Stream Crossing	28-10-31.0	Existing	24	48
Stream Crossing	28-11-15.2	Existing	18	24
Stream Crossing	RENO-17-2	Existing	24	26
Stream Crossing	Brownson Ck. Rd. MP 0.51	Existing	24	36
Stream Crossing	Brownson Ck. Rd. MP 0.57	Existing	24	48
Stream Crossing	Brownson Ck. Rd. MP 0.71	Existing	24	48
Stream Crossing	Brownson Ck. Rd. MP 1.09	Existing	24	36
Stream Crossing	Brownson Ck. Rd. MP 1.24	Existing	N/A	24*

* size to be evaluated before replacement.

Haul

33. Hauling on natural-surfaced roads would be prohibited during the wet season, generally mid-October through May.
34. Commercial road use would also be suspended where the road surface is deteriorating due to vehicular rutting or standing water, or where turbid runoff is likely to reach stream channels (USDI-BLM 2016b p. 80).
35. The BLM contract administrator, in cooperation with BLM aquatic staff, would monitor road conditions during winter use to prevent rutting of the rock surface and delivery of fine sediment to stream networks.
36. If the ground is already saturated from rains and more than 1 inch of precipitation is predicted in the project area over the next 24 hours, then haul would be suspended. Operations would resume after the 24-hour suspension, except when another storm (exceeding 1 inch) is forecasted. Currently, precipitation predictions are based on the Quantitative Precipitation Forecast (QPF) maps from the National Weather Service, Weather Prediction Center internet site: http://www.wpc.ncep.noaa.gov/qpf/qpf2.shtml. A similar predictive model internet site may be used if this site should be unavailable in the future.

Table 24. Guide for drainage spacing by soil erosion class (road surface) and road grade.

Gradients (percent)	Road Surface	
	Natural*	Rock or Paved*
3-5	200	400
6-10	150	300
11-15	100	200
16-20	75	150
21-35	50	100
36+	50	50

* Spacing is in feet and is the maximum allowed for the grade. Drainage features may include cross drains, waterbars, ditch-outs, or water dips.

Specific to Coastal Marten

37. If a marten is observed in the BWE marten action area, by a reliable source as verified by BLM, the USFWS will be notified and additional camera traps may be utilized to confirm sighting, and if possible, to determine denning. If denning is determined, additional consultation will be coordinated between BLM and USFWS.

Specific to Marbled Murrelet

38. Avoid disruption by seasonally restricting activities within the appropriate disruption distance of occupied or unsurveyed nesting habitat, as described in Table 21. This includes chainsaw and heavy equipment use, and prescribed burning. Habitat surveyed determined unoccupied does not require seasonal restrictions.
39. Tailhold use in murrelet occupied or unsurveyed suitable sites:
    a. Seasonal and daily timing restrictions would be applied to any use of tailhold, guyline, or lift trees within a murrelet occupied site.
        i. Selection of tailhold trees would be subject to the following specifications:
            1. Select the smallest acceptable trees.
            2. As operationally feasible, avoid trees that:
                a. Have a DBH > 34 inches.
                b. Have visible nests, or nesting structures (e.g., platforms).
                c. Are the only large conifer present in a visible area.
            3. If the tailhold tree(s) would remain standing, prevent damage by using appropriate protection (i.e., tree plates, tires, or nylon straps) where possible to avoid girdling of the tree. Girdling or notching should not exceed 60 percent of the tree circumference.

Specific to Northern Spotted Owl

40. Following two years of full 6-visit surveys, spot checks, required per the USFWS protocol (USDI USFWS 2012), will continue within one-quarter mile of the proposed timber sales until the completion of the timber sales (when harvest is complete, or a decision has been made not to harvest them). Per the protocol, after two years of spot checks, BLM will discuss with the USFWS annually whether 6-visit visits should be reinitiated or whether spot checks can continue. Each year of surveys (either 6-visit or spot checks, known owl activity center will receive an activity center search.
    a. If an owl site (current known owl activity center) protocol surveys result in a resident status or pair, no treatment units will occur within the nest patch or core. A biologist will review if the unit is within the home range to determine if the treatment can occur.
    b. If future surveys document movement of an owl site center, a change in occupancy status, or a new owl site, the BLM will discuss this change with the USFWS to determine whether additional measures are necessary to ensure that take will not occur. The timber sale will be altered if necessary, to ensure that the timber sale is in compliance with the RMP (i.e., no-take).
41. If a new or moved spotted owl site becomes occupied, the BLM would consult with the USFWS to ensure compliance with section 7 consultation before implementing the proposed actions in this document.
42. If the Bear Pen, Elk Loop, or Brownson Headwaters sites were to be surveyed as occupied, the BLM would not go forward with the proposed actions within the core unless two years of

additional 6-visit surveys found the site to be unoccupied in the future. Outside of the core, the BLM would implement timing restrictions within the disruption distance of the core during the critical breeding season.

43. If the Kincheloe Quarry or Remote site were to go occupied, the BLM would drop all commercial harvest in these units, with the exception of the proposed regeneration harvest unit The Belieus, which is on the edge of the home range of both sites, separated from BLM land by nearly a mile of private timberland. Because the impact of non-commercial treatments in the inner riparian zone is small due to the limited number of trees cut and the narrow band where it occurs, non-commercial treatments in the riparian zone outside of the core areas could still occur with seasonal timing restrictions.
44. Avoid disruption by seasonally restricting activities within the appropriate disruption distance from an occupied nest patch or unsurveyed nesting habitat, as described in Table 21. This includes chainsaw and heavy equipment use, and prescribed burning. Habitat surveyed and likely unoccupied does not require seasonal restrictions.

Cultural Resources

45. The project may be redesigned to protect the cultural resource values present per the 2015 State Protocol (Protocol), VI. C (9) Unevaluated Cultural Resources and Avoidance, or if avoidance is not possible then procedures per VI. C (2) Evaluation Standards would be applied.
46. If any cultural and/or paleontological resource (historic or prehistoric site or object) is discovered during project development or implementation.
    a. Project activity would cease in the immediate vicinity and the area adequately flagged for avoidance within 150 feet, including a 25-foot buffer around the site.
    b. Notification of the find is relayed by agency staff, to District Archaeologist and appropriate Field Manager.
    c. Project work would not proceed at that location until evaluation and appropriate mitigations to prevent the loss of significant cultural or scientific values has been completed by a qualified archaeologist.
47. Damage to a cultural resource site (site) would be assessed as defined in the Protocol, Determination of Effects to Historic Properties per VI. D (4) Adverse Effects, and if warranted.
    a. BLM will consult with SHPO (and other consulting parties per 36CFR § 800.5[a] and component 4c-e of the National Programmatic Agreement (nPA)) for any undertaking resulting in an adverse effect determination.
    b. To determine if damage to a site has affected characteristics that qualify the property for listing in the National Register of Historic Places (NRHP). NRHP evaluation would be criteria applied, which may require limited data recovery per the Protocol, VI. D (5) Treatment of Adverse Effects via data Recovery.
48. Post-Harvest inventories would be conducted per the Protocol, Appendix D. Coast Range Inventory Plan.

Site Preparation

49. The BLM would supervise all burning activities and ensure compliance with BLM, state, and federal guidelines.
50. Comply with State of Oregon fire and smoke regulations and the unit-specific prescribed fire plan; a variety of smoke reduction techniques would be used, as appropriate, to minimize impacts to public health.
51. Prohibit burning activities further than 30 feet into a RR or areas reserved from harvest.

52. Fire personnel would perform mop-up activities in compliance with requirements of the Coos Forest Protective Association at the time of project implementation.

Pile Burning

53. Burn piles during the rainy season to minimize the chance of escaped wildfires and problematic fire behavior.
54. Burning would be seasonally restricted for units that are within 0.25 mile of un-surveyed suitable or occupied murrelet habitat during the critical breeding period. Daily timing restrictions would be implemented for the remainder of the breeding season (Section 1.6).
55. Should the BLM determine the presence of an occupied spotted owl nest patch or activity center through protocol survey efforts, burning would be seasonally restricted within 0.25 miles of spotted owl NRF and/or RF habitat within the occupied nest patch or activity center of the known site for the critical breeding period.
56. Seasonal restrictions are required as described in Section 1.6.
57. Piled areas would have undesired vegetation (brush, non-commercial hardwoods, prostrate and damaged conifers) slashed, either during or after harvest.
58. Landing pile construction and covering: Within thirty (30) feet of the edge of each landing, all tops, broken pieces, limbs and debris between two (2) and nine (9) inches in diameter at the large end and longer than three (3) feet in length shall be piled within fifteen (15) days of completion of hauling logs from that landing. Landing piles shall be kept free of dirt and located adjacent to roads at least twenty (20) feet from any Reserve Tree and/or as directed by the Authorized Officer.
59. Hand pile construction and covering: Skyline harvest areas that are found to have excessive residual slash will require hand piling to prepare the site for planting. Areas to be treated will be designated by the Authorized Officer. All tops, broken pieces, limbs and debris between two (2) and 6 inches in diameter and longer than 3 feet in length will be piled. Piles will be located at least 15 feet from any reserve tree or snag and as far as possible from culverts and unit boundaries.
60. Cover all piles with plastic in accordance with Oregon Department of Forestry guidance (OAR 629-048-0210), using 4 mil black polyethylene sheeting.
61. Construct piles a minimum of 15 feet from retention features (live green trees, snags, all coarse woody debris, and any no-harvest areas) to minimize the risk of the damage from excess heat or burning.

Noxious Weeds and Pathogens

62. Treat noxious weeds (mechanical or chemical) prior to harvest or road construction activities on BLM-controlled haul routes, potential landing areas, and known locations of noxious weeds.
63. Inspect and clean all vehicles and equipment of mud, soil, plant materials, excess oil or grease that may contain weed seed or pathogens using 1 gallon of bleach to 1,000 gallons of water before entering BLM lands. Vehicles that stay entirely on existing road surfaces may be exempted from this cleaning requirement.
64. Minimize all motorized travel through vegetation, especially where invasive plants are known, and avoid driving through or parking in vegetation, where feasible.
65. Minimize soil disturbance and retain native vegetation in and around project activity areas to the extent practicable.
66. Seed bare soil with BLM-approved native weed-free seed and mulch following soil disturbance. At its discretion, the BLM may supply approved native seed.

67. Use weed-free materials, such as gravel, borrow, and fill material within project areas and access roads to prevent the introduction and spread of noxious weeds and invasive plants. Use materials from sources with the highest weed-free material accreditation available.

Botany

68. If a Special Status Species is found after the contract has been awarded, the contractor would be required to follow management guidelines to protect the species. These species include threatened and endangered species, federally proposed and candidate species, and Bureau Sensitive species protected under BLM Manual 6840.
69. Bureau Sensitive plant species found during pre-disturbance surveys in any EA unit would be buffered using a circular one hectare (2.5 acre; 185-foot radius minimum) no-treatment zone which research suggests is large enough to protect the microsite, so the species persist at the site (Heithhecker & Halpern, 2007).
70. All Bureau Sensitive sites located during pre-disturbance surveys would be monitored post timber harvest on an annual basis for at least three years to determine if this buffer size was indeed adequate to maintain the persistence of the species at the site. The survey would start the year after site prep is completed and continue for a total of at least three consecutive years. One survey would be conducted each year and would be done at the best time of year to identify the particular species (e.g. spring/summer for vascular plants and late fall-early spring for lichens and bryophytes).

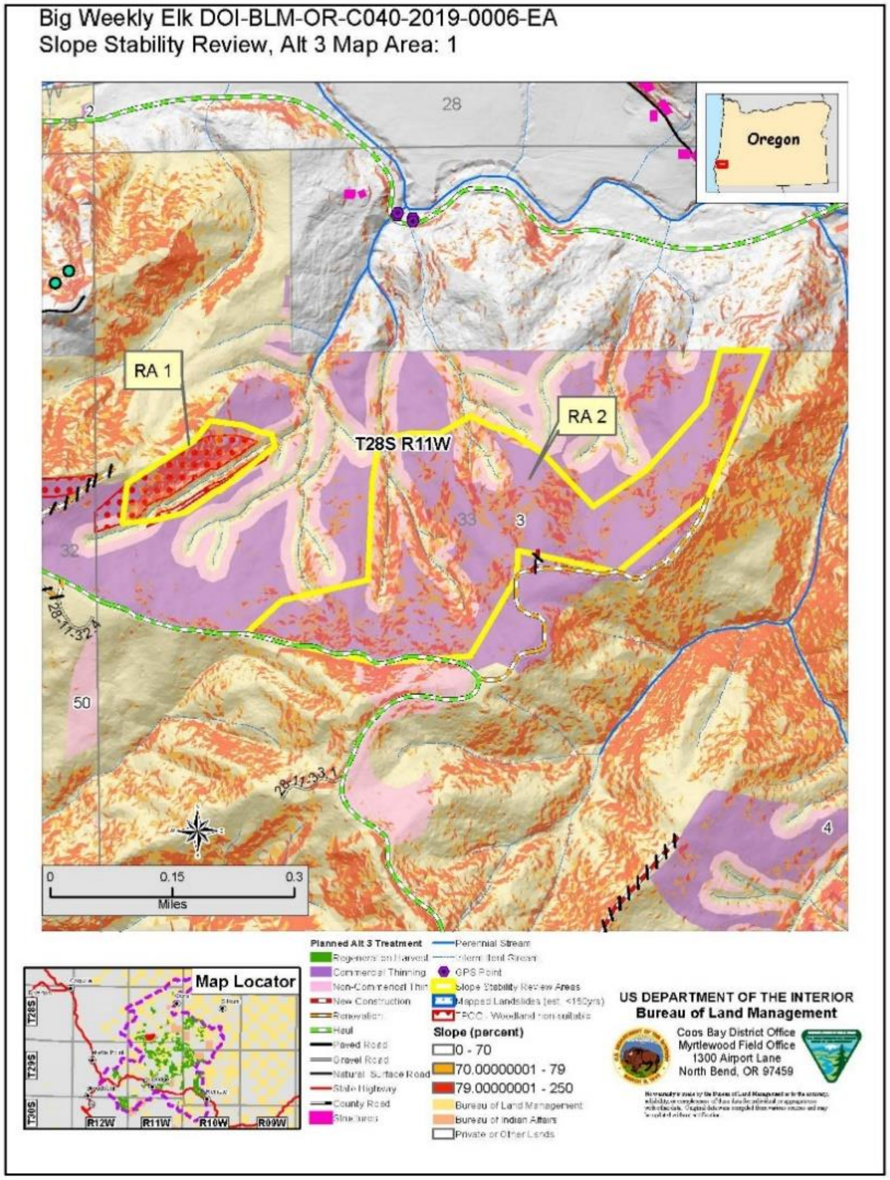
Soils/Slope Stability

71. Ground-based operations would occur only when soil moistures are below 25 percent, with consideration of compaction resistance and equipment operability. A maximum operational allowable moisture content would be 25 percent as measured by the authorized officer using a 'Speedy' moisture meter or an equivalent method. Soil moisture above 25 percent would require the discontinuation of ground-based operations in order to prevent excessive compaction to the soils and/or disruption of the soil column.
72. Site specific recommendations/Project Design Features. See Maps 1 – 8 for locations. See BMPs list for codes referenced (e.g. R01).

Table 23. Site Specific Recommendations

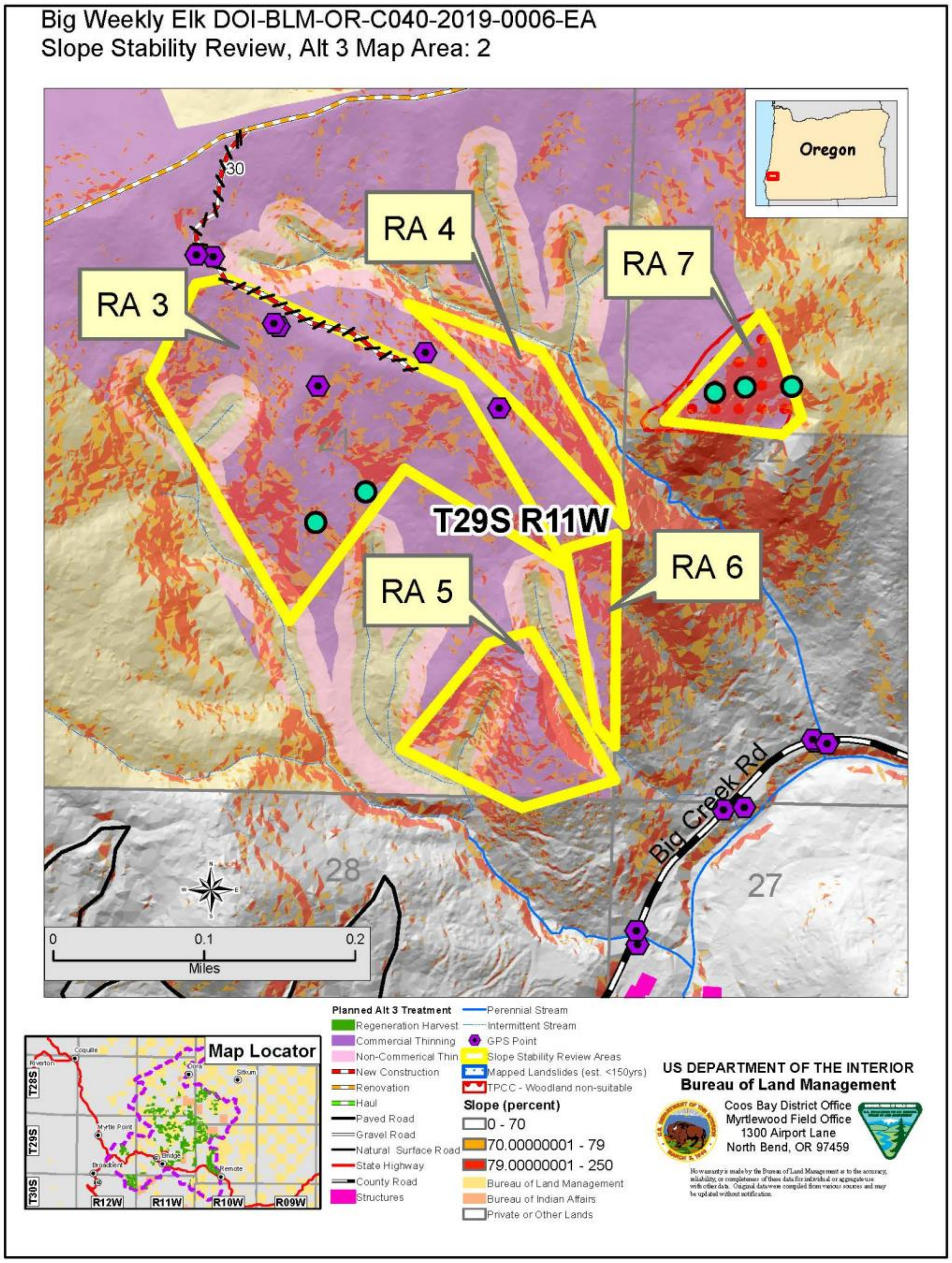
Map Area	**Review Area ID**	**EA Unit/ Land Use Allocation**	**Slope Class**	**Downslope Risk**	**Recommendations/ Project Design Features**
1	1	3 RR Outer Zone + LSR	Headwall >70%	Mainline road	No commercial harvest in TPCC withdrawn area
1	2	3 LSR+	Headwall >70%	Mainline road	Retention areas with unstable slopes >70%

Map Area	Review Area ID	EA Unit/ Land Use Allocation	Slope Class	Downslope Risk	Recommendations/ Project Design Features

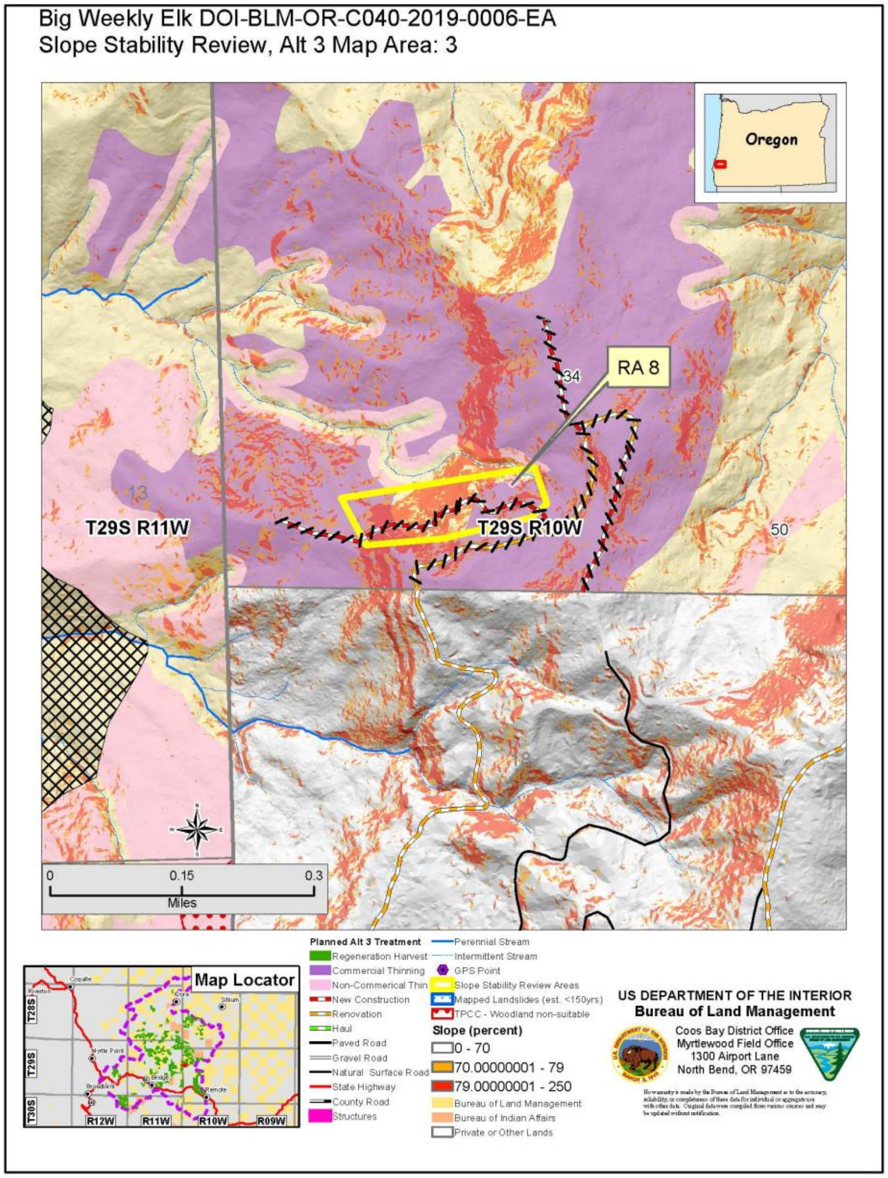


2	3	30 LSR+	Headwall >70%	County Road, Water Source	No commercial treatments in outer riparian reserve or unstable headwalls > 70%
2	4	30 RR Outer Zone	Headwall >70%	County Road	Retention areas with unstable slopes >70%
2	5	30 RR Outer Zone	Open Slope >80%	County Road, Water Source	No commercial treatments in outer riparian reserve or unstable headwalls > 70%
2	6	30 RR Outer Zone	Open Slope >80%	County Road	Retention areas in unstable slopes >70% identified in layout
2	7	30 LSR	Open Slope >80%	County Road	No commercial harvest in TPCC withdrawn area

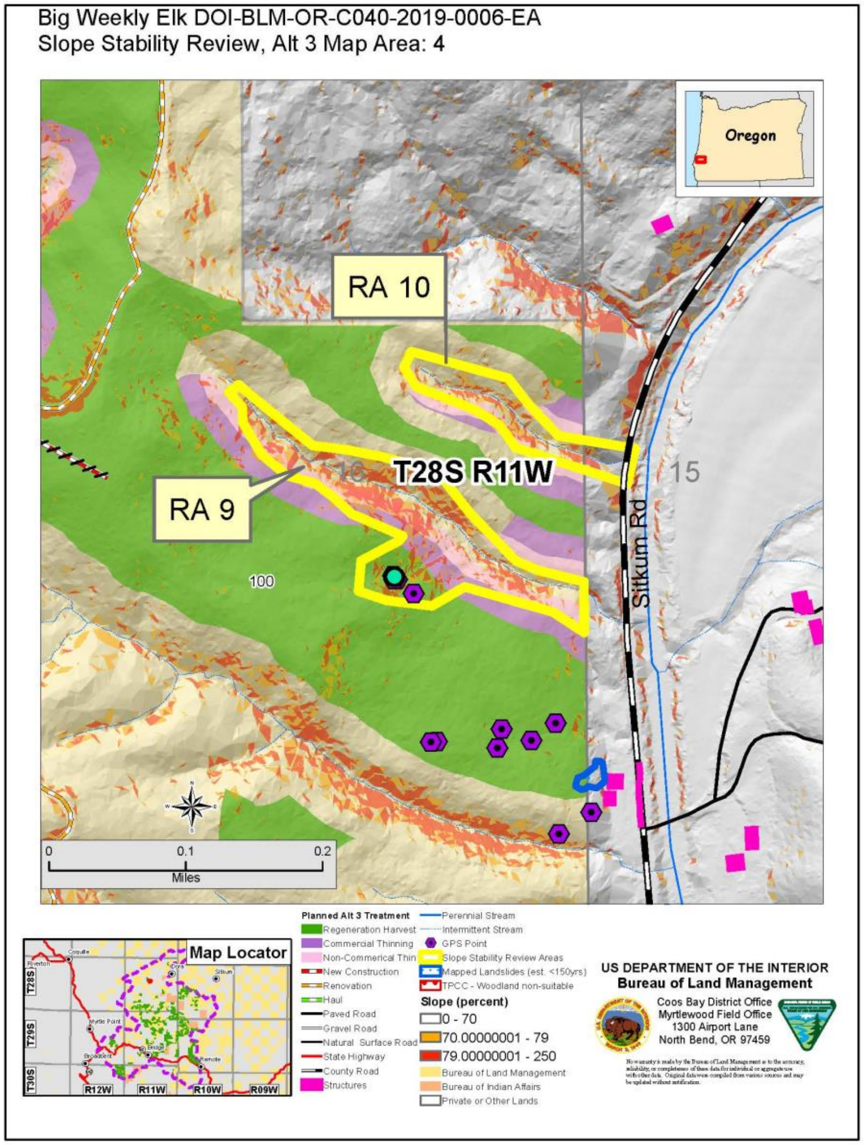
Map Area	Review Area ID	EA Unit/ Land Use Allocation	Slope Class	Downslope Risk	Recommendations/ Project Design Features



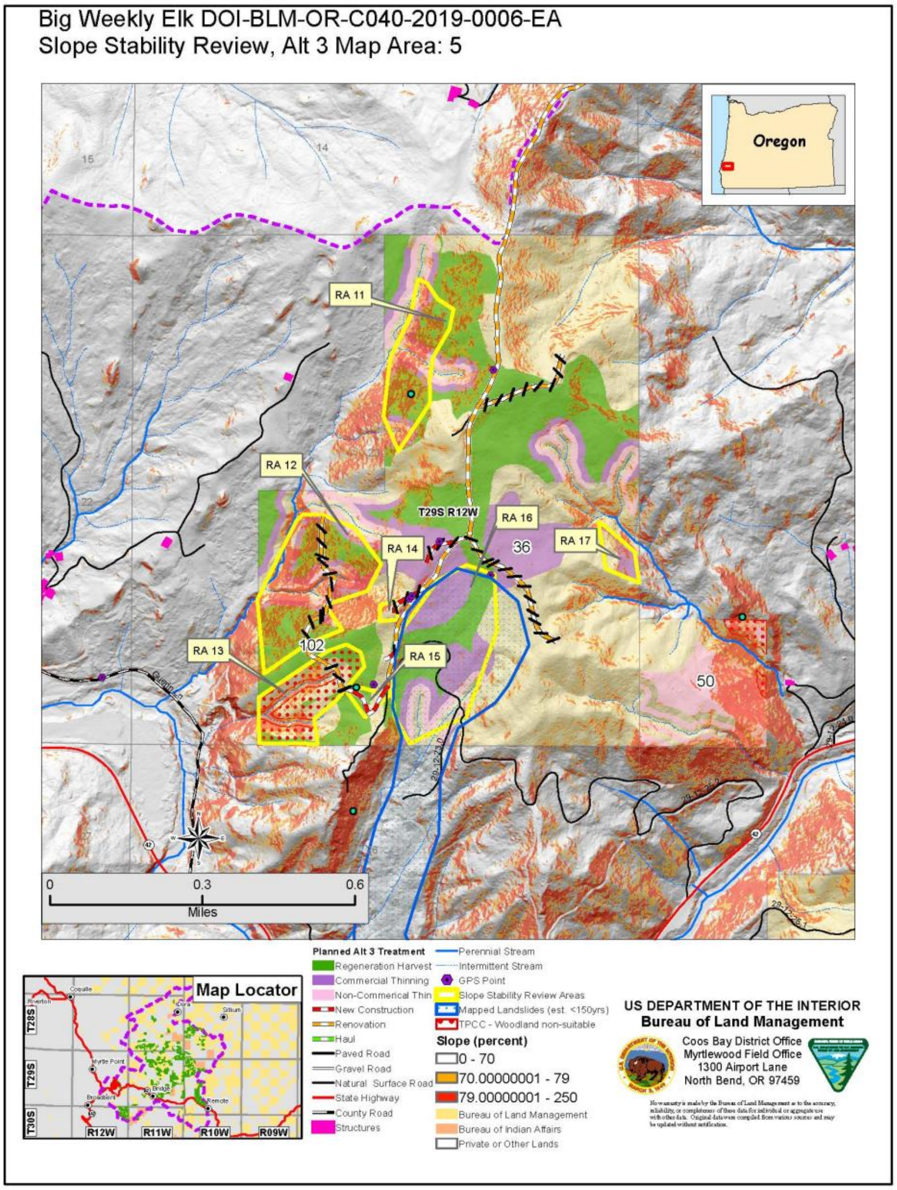
3	8	34 LSR and road decom	Headwall >70%	Mainline road	Selected Road BMPs from R 01 – R 93, notify engineering

<table>
<tr><th>Map Area</th><th>Review Area ID</th><th>EA Unit/ Land Use Allocation</th><th>Slope Class</th><th>Downslope Risk</th><th>Recommendations/ Project Design Features</th></tr>
<tr><td colspan="6">


</td></tr>
<tr><td>4</td><td>9</td><td>100 HLB</td><td>Headwall >70%</td><td>County Road, private pond</td><td>No commercial harvest in new TPCC withdrawn areas</td></tr>
<tr><td>4</td><td>10</td><td>100 - RR Outer Zone</td><td>Headwall >70%</td><td>County Road</td><td>No commercial treatments in unstable headwalls > 70%</td></tr>
</table>

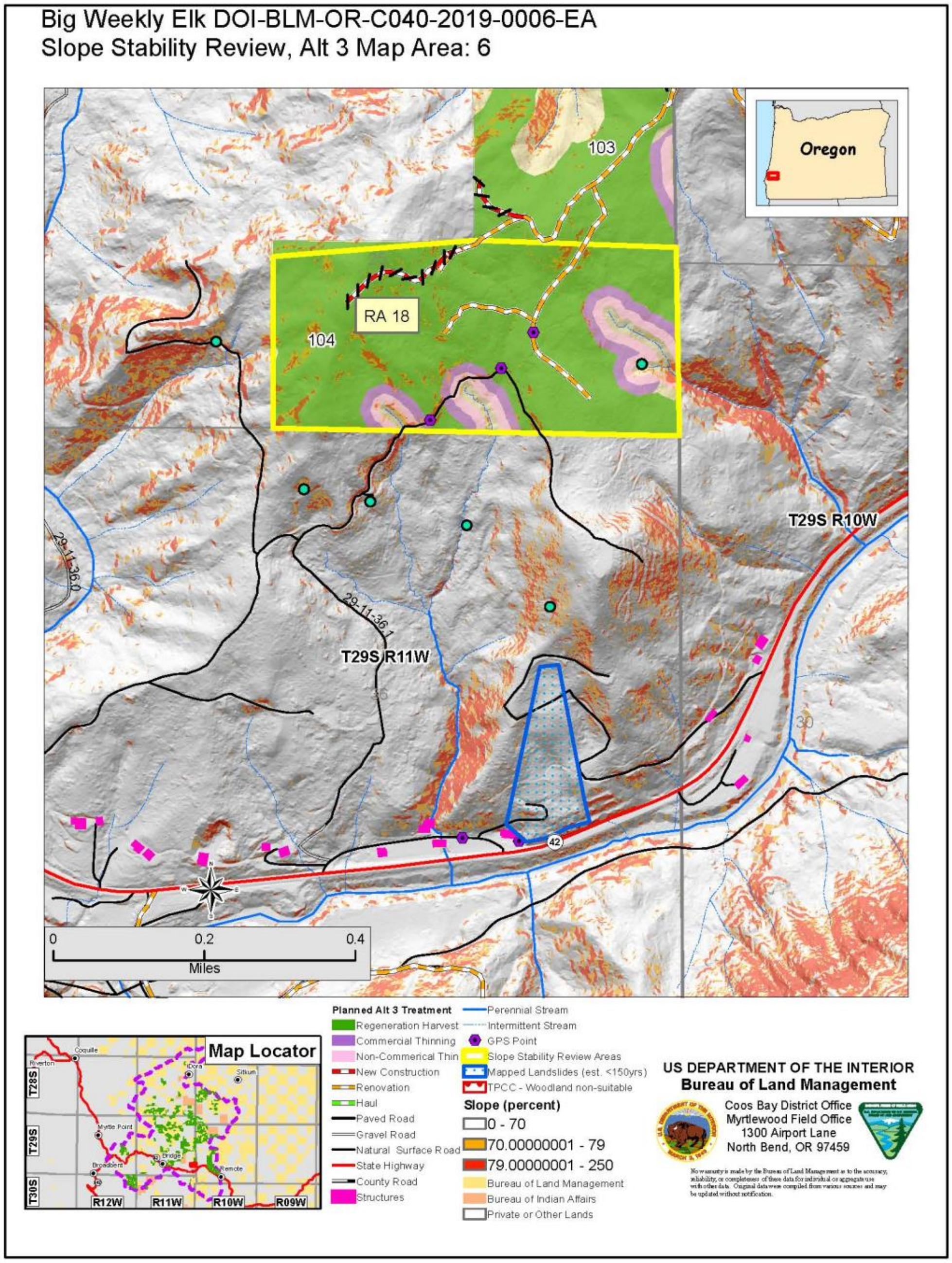
<table>
<tr><th>Map Area</th><th>Review Area ID</th><th>EA Unit/ Land Use Allocation</th><th>Slope Class</th><th>Downslope Risk</th><th>Recommendations/ Project Design Features</th></tr>
<tr><td colspan="6">
</td></tr>
<tr><td>5</td><td>11</td><td>102 RR Outer Zone + HLB</td><td>Open Slope >80%</td><td>County Road - gated</td><td>No commercial treatments in unstable headwalls > 70%</td></tr>
<tr><td>5</td><td>12</td><td>102 RR Outer Zone</td><td>Open Slope >80%</td><td>County Road - gated</td><td>No commercial treatments in outer riparian reserve or unstable headwalls > 70%, Selected Road BMPs from R 01 – R 93, notify engineers</td></tr>
<tr><td>5</td><td>13</td><td>102 HLB</td><td>Headwall >70%</td><td>Quarry, County Road - gated</td><td>No commercial harvest in TPCC withdrawn, road construction ok, but Selected Road BMPs from R 01 – R 93, notify Engineers</td></tr>
<tr><td>5</td><td>14</td><td>102 HLB</td><td>Headwall >70%</td><td>Quarry, County Road - gated</td><td>Avoid burning machine slash piles on steep slopes (>70%) that are directly upslope of private residences, quarries, highways or other downslope risk areas</td></tr>
<tr><td>5</td><td>15</td><td>102 HLB</td><td>Open Slope >80%</td><td>Quarry, County Road - gated</td><td>Selected Road BMPs from R 01 – R 93, notify engineering, past slope failure</td></tr>
</table>

Map Area	Review Area ID	EA Unit/ Land Use Allocation	Slope Class	Downslope Risk	Recommendations/ Project Design Features
5	16	36 LSR, Road 29-11-7.0	< Slope Thresholds	County Road	Selected Road BMPs from R 01 – R 93, notify engineering
5	17	36 RR Outer Zone	< Slope Thresholds	Highway	Retention area or no commercial treatments in outer riparian reserve or unstable headwalls > 70%, Road BMPs, notify engineers



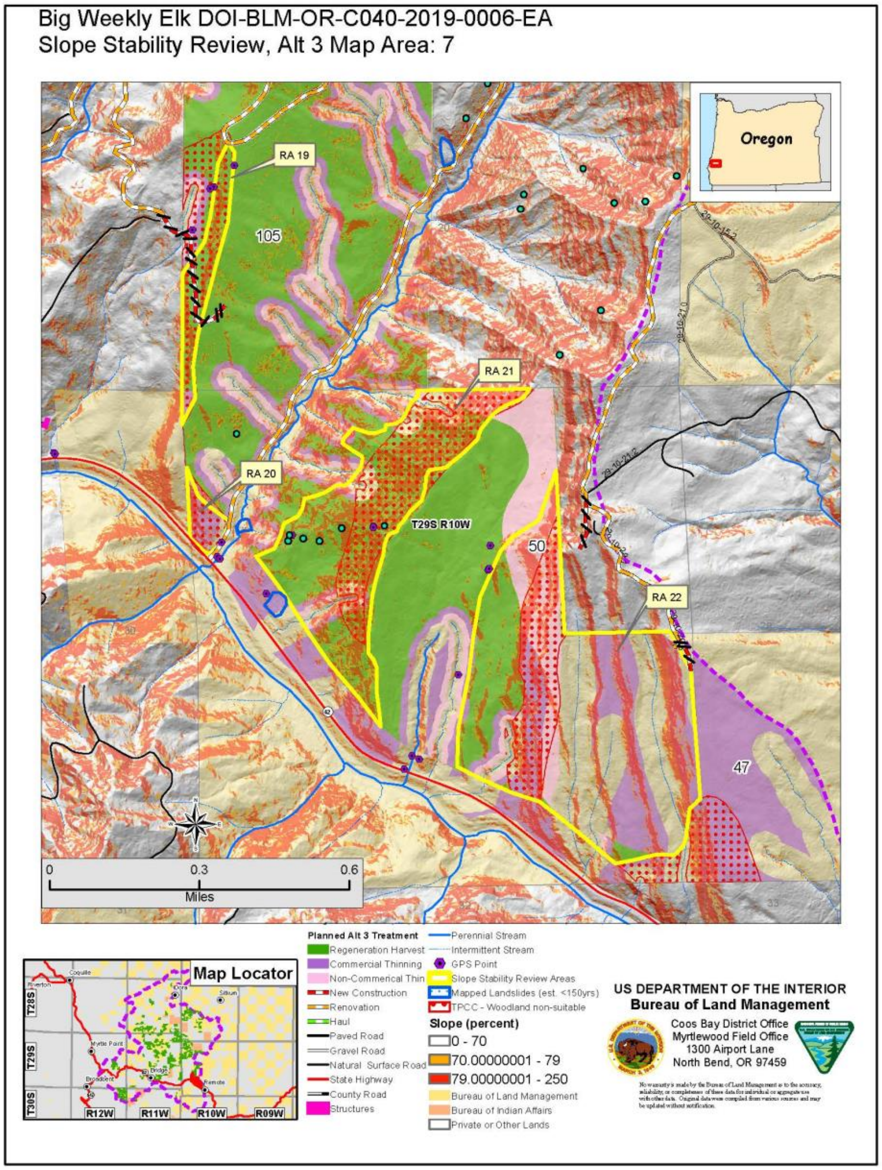
6	18	104 RR Outer Zone	Headwall >70%	Residence	No commercial treatments in outer riparian reserve or unstable headwalls where slopes are > 70%

<table>
<tr><th>Map Area</th><th>Review Area ID</th><th>EA Unit/ Land Use Allocation</th><th>Slope Class</th><th>Downslope Risk</th><th>Recommendations/ Project Design Features</th></tr>
<tr><td colspan="6">



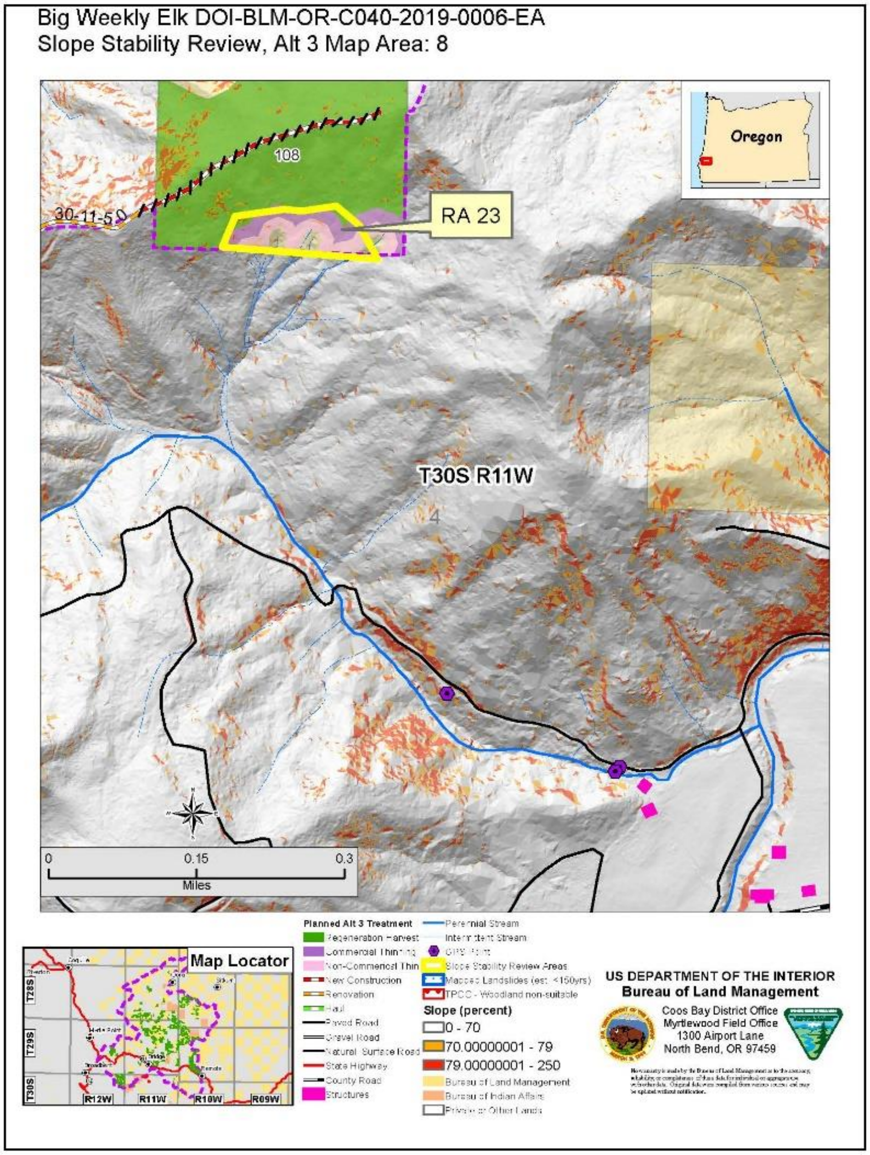
</td></tr>
<tr><td>7</td><td>19</td><td>105 TPCC</td><td>Headwall >70%</td><td>Highway</td><td>No Harvest in TPCC withdrawn area, reduced TPCC boundary</td></tr>
<tr><td>7</td><td>20</td><td>105 TPCC</td><td>Open Slope >80%</td><td>Highway</td><td>No Harvest in TPCC withdrawn area</td></tr>
<tr><td>7</td><td>21</td><td>105 TPCC</td><td>Headwall >70%</td><td>Highway</td><td>No Harvest in TPCC withdrawn, increased TPCC boundary</td></tr>
<tr><td>7</td><td>22</td><td>47 LSR and TPCC</td><td>Headwall >70%</td><td>Highway</td><td>No Harvest in TPCC withdrawn, increased TPCC boundary</td></tr>
</table>

Map Area	Review Area ID	EA Unit/ Land Use Allocation	Slope Class	Downslope Risk	Recommendations/ Project Design Features



8	23	108 RR Outer Zone	< Slope Thresholds	Residence	No commercial treatments in outer riparian reserve if unstable slopes are observed during layout

Map Area	Review Area ID	EA Unit/ Land Use Allocation	Slope Class	Downslope Risk	Recommendations/ Project Design Features



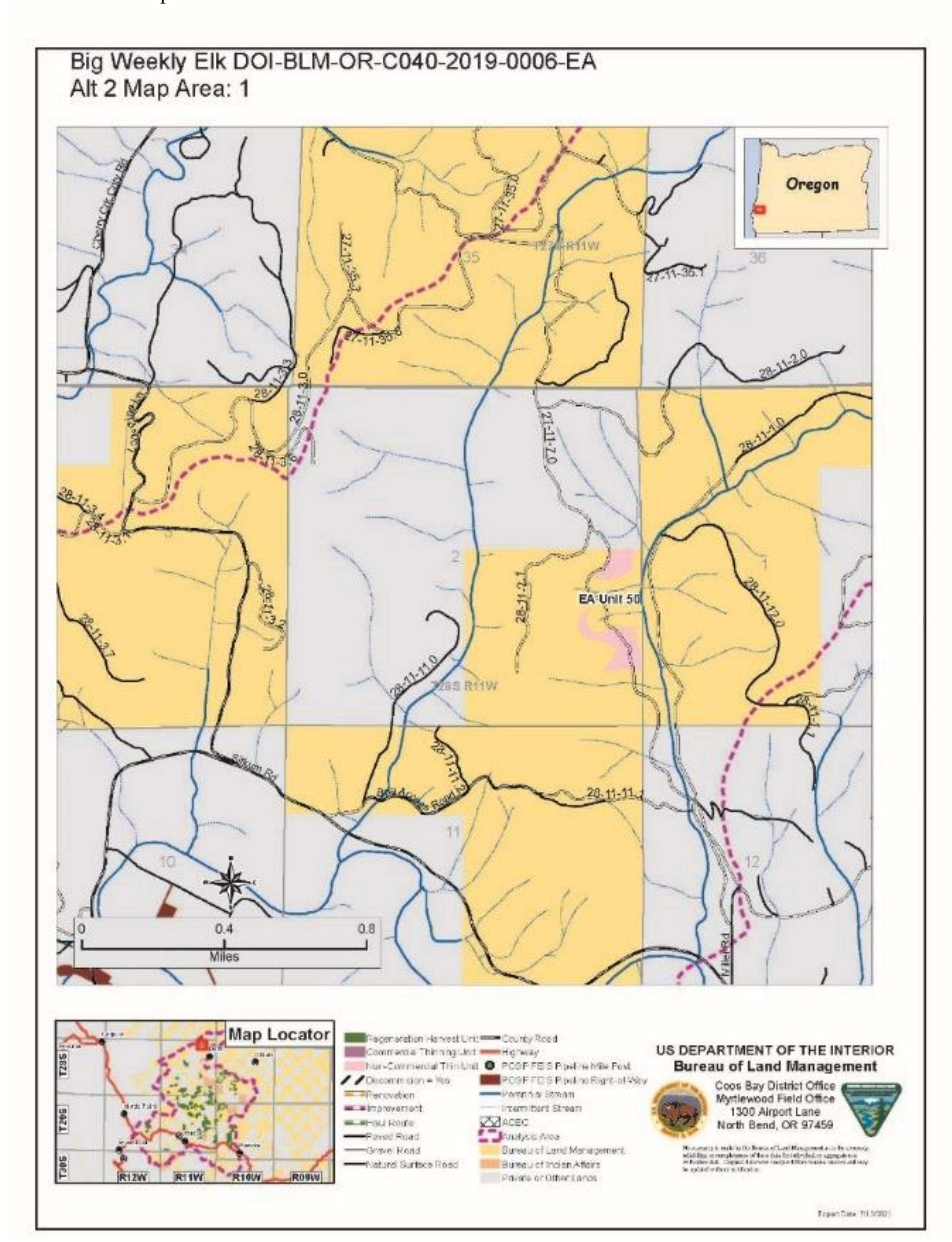
Sample Tree Falling

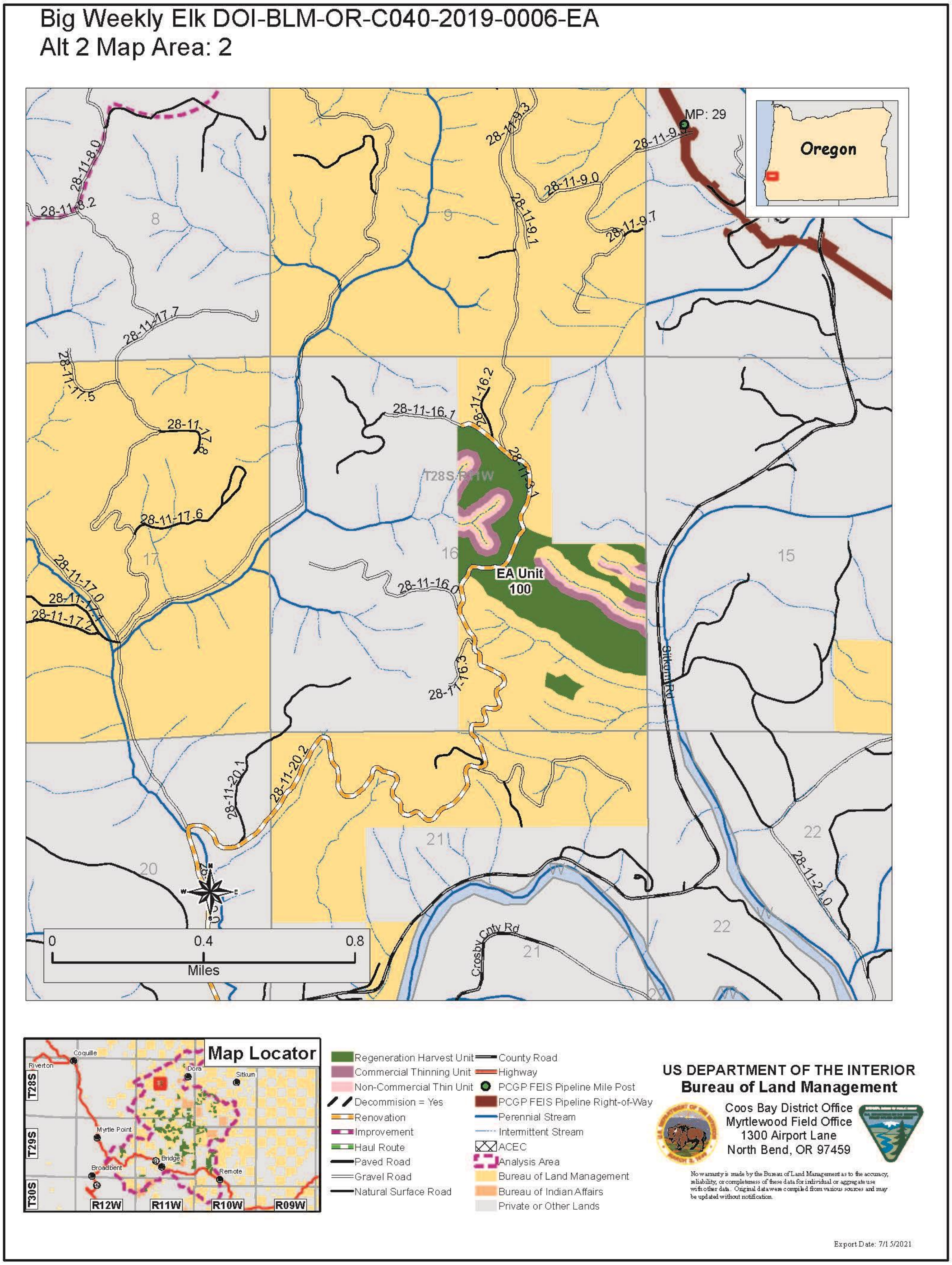
73. Timber cruising would employ methods that would include the felling of sample trees to formulate local volume tables. Felled sample trees would be a subset of those already designated for removal.
74. Selected sample trees would be limited to no more than one tree per 2.5 acres.
75. In RR, sample tree selection would not include those larger than 24 inches diameter at breast height.
76. Sample tree felling would not occur within ½-site-potential tree height of stream channels.
77. Sample tree felling would avoid existing snags.
78. All seasonal and daily timing restrictions for threatened and endangered species would apply to sample tree falling, where necessary.
79. Sampled trees would remain on site to provide down woody material if no timber sale occurs.

Appendix C: Maps (Harvest/Restoration Units, Road Work, Haul)

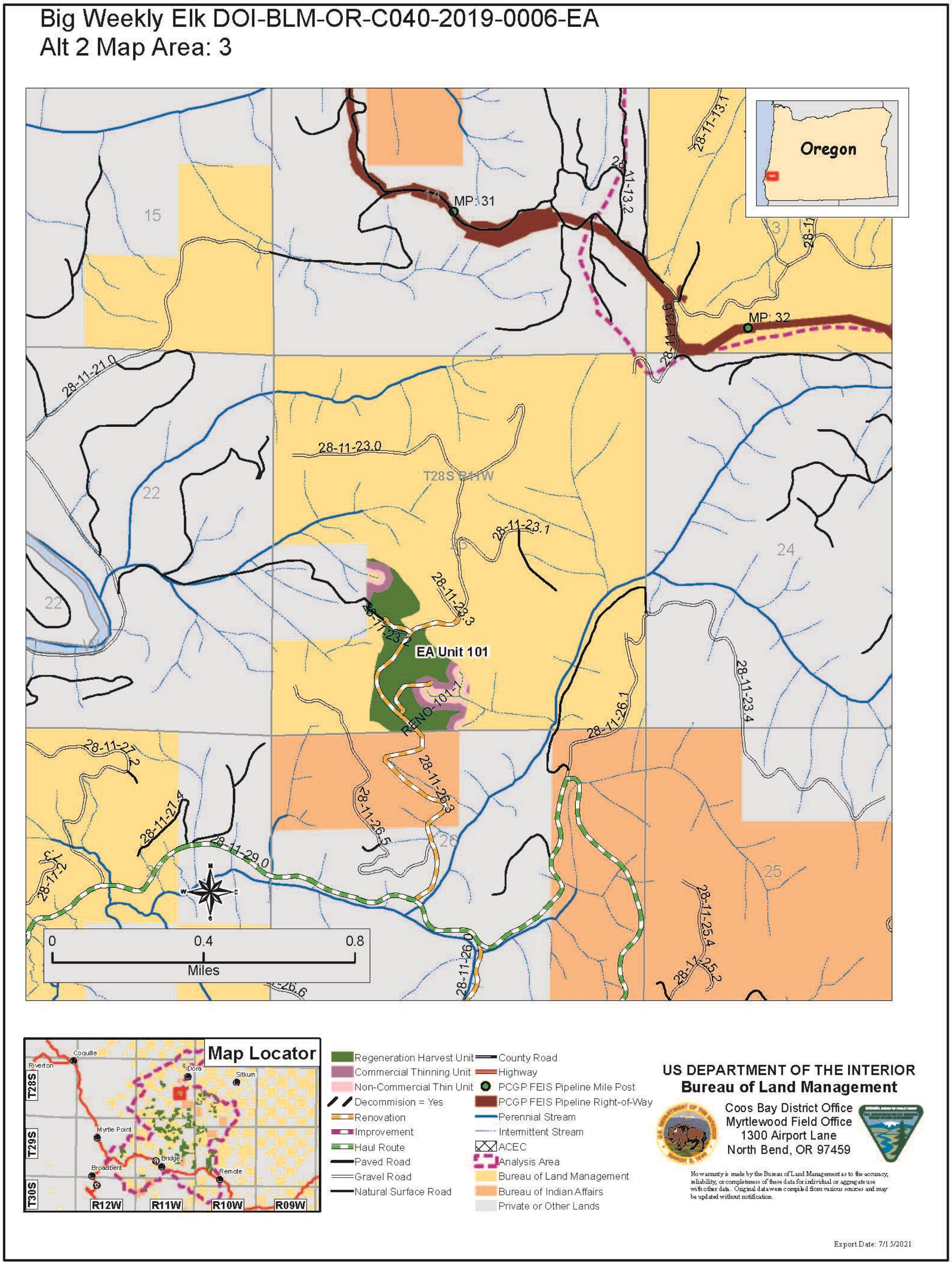
Big Weekly Elk Project Area

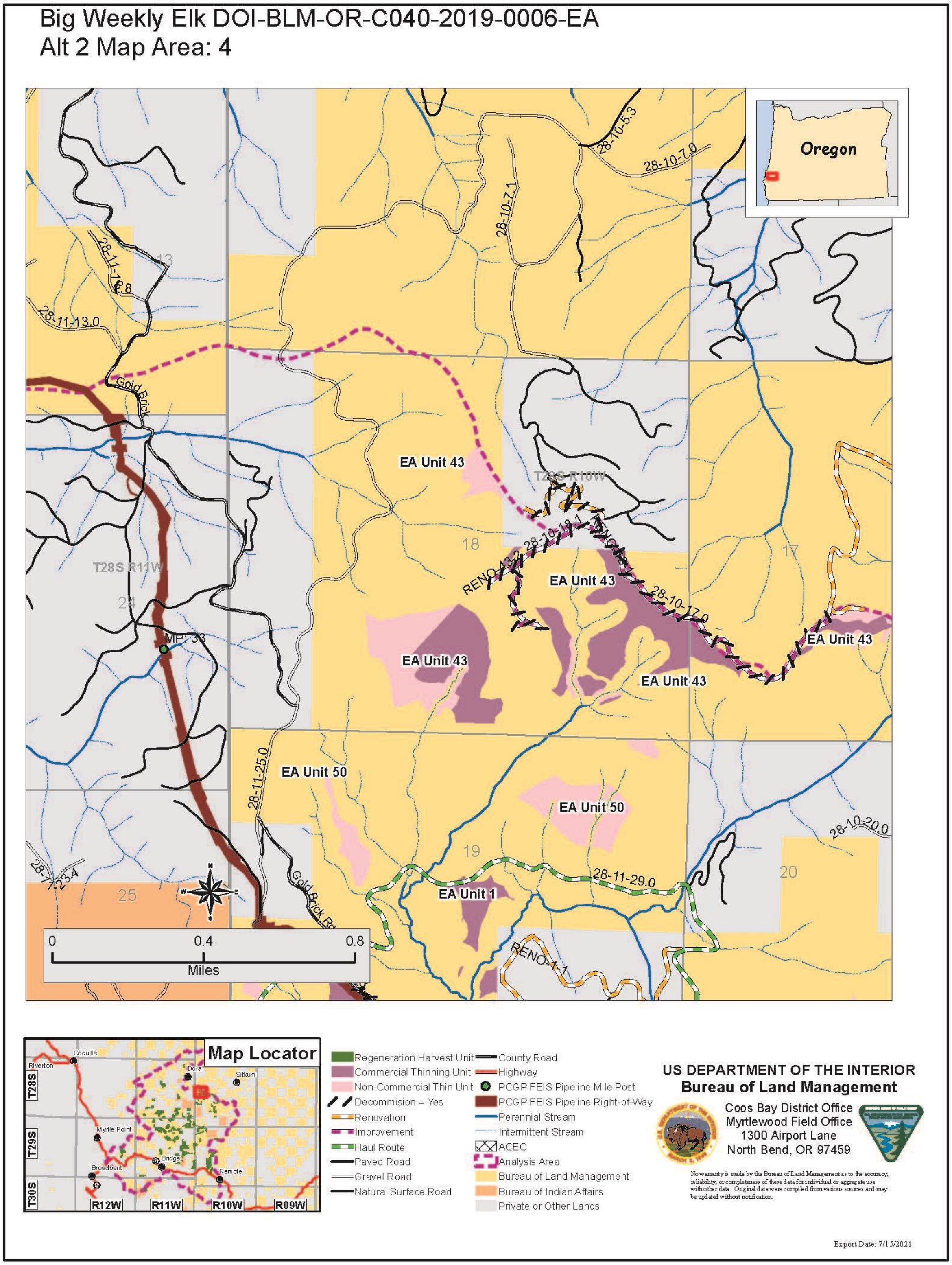
Alternative 2 Maps:

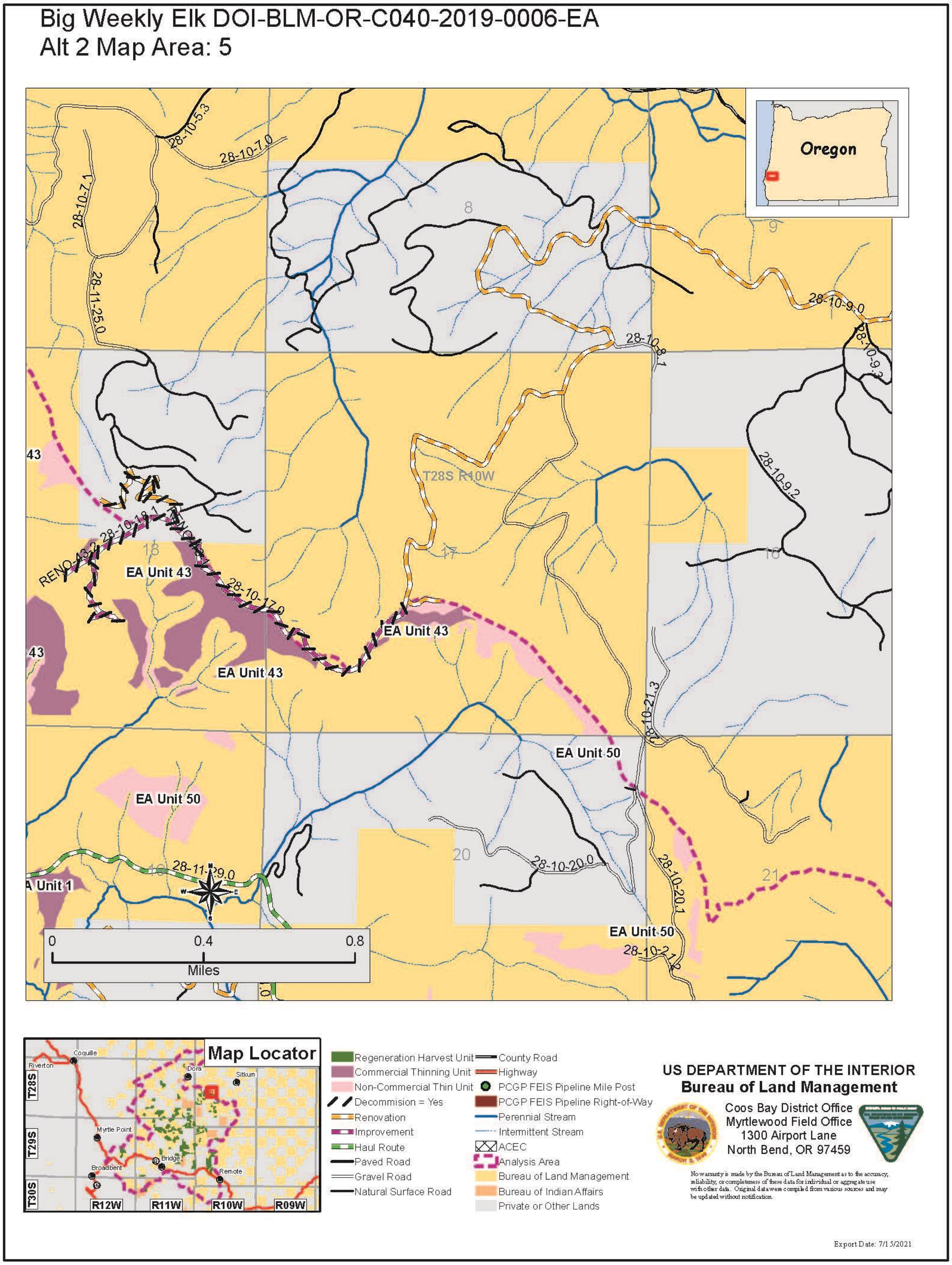




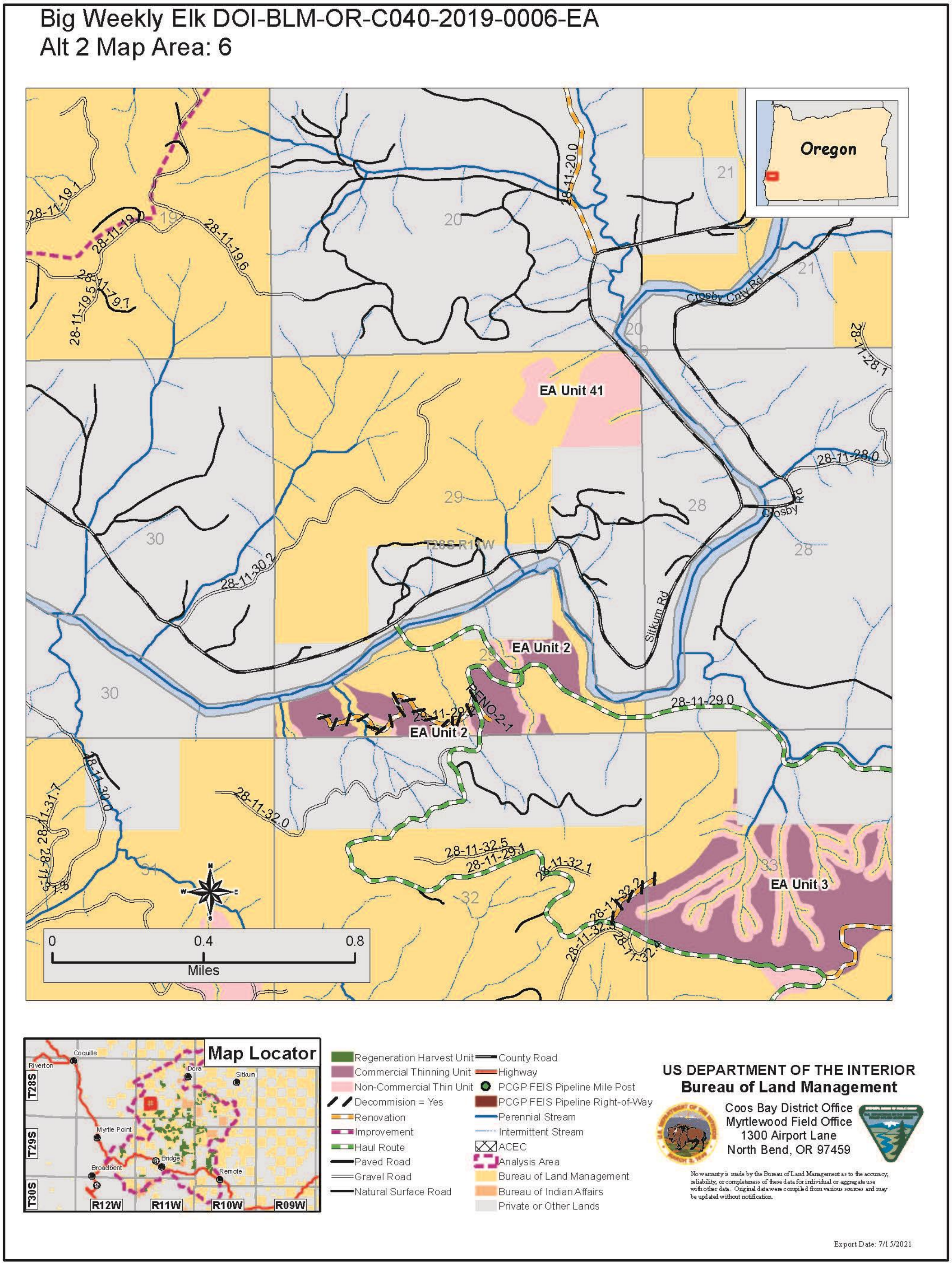
Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 2
Oregon
MP: 29
EA Unit 100
T28S R11W
Sitkum Rd
Crosby Cnty Rd
Miles
Map Locator
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commercial Thin Unit
Decommision = Yes
Renovation
Improvement
Haul Route
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.
Export Date: 7/15/2021


Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 3
Oregon
MP: 31
MP: 32
15
22
24
25
T28S R11W
EA Unit 101
28-11-21.0
28-11-23.0
28-11-23.1
28-11-23.3
28-11-23.4
28-11-26.1
28-11-26.3
28-11-26.5
28-11-29.0
28-11-27.4
28-11-25.4
28-11-13.1
28-11-13.2
RENO-101-1
0
0.4
0.8
Miles
Map Locator
Coquille
Riverton
Dora
Sitkum
Myrtle Point
Bridge
Broadbent
Remote
T28S
T29S
T30S
R12W
R11W
R10W
R09W
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commercial Thin Unit
Decommission = Yes
Renovation
Improvement
Haul Route
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.
Export Date: 7/15/2021


Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 4
Oregon
28-10-5.3
28-10-7.0
28-10-7.1
28-11-13.0
Gold Brick
EA Unit 43
T28S R10W
T28S R11W
18
17
24
MP 33
28-10-18.1
RENO-43-1
28-10-17.0
EA Unit 50
28-11-25.0
19
20
28-10-20.0
28-11-29.0
EA Unit 1
RENO-1-1
25
Gold Brick Rd
0
0.4
0.8
Miles
Map Locator
Coquille
Riverton
Dora
Sitkum
Myrtle Point
Bridge
Broadbent
Remote
T28S
T29S
T30S
R12W
R11W
R10W
R09W
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commercial Thin Unit
Decommission = Yes
Renovation
Improvement
Haul Route
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.
Export Date: 7/15/2021

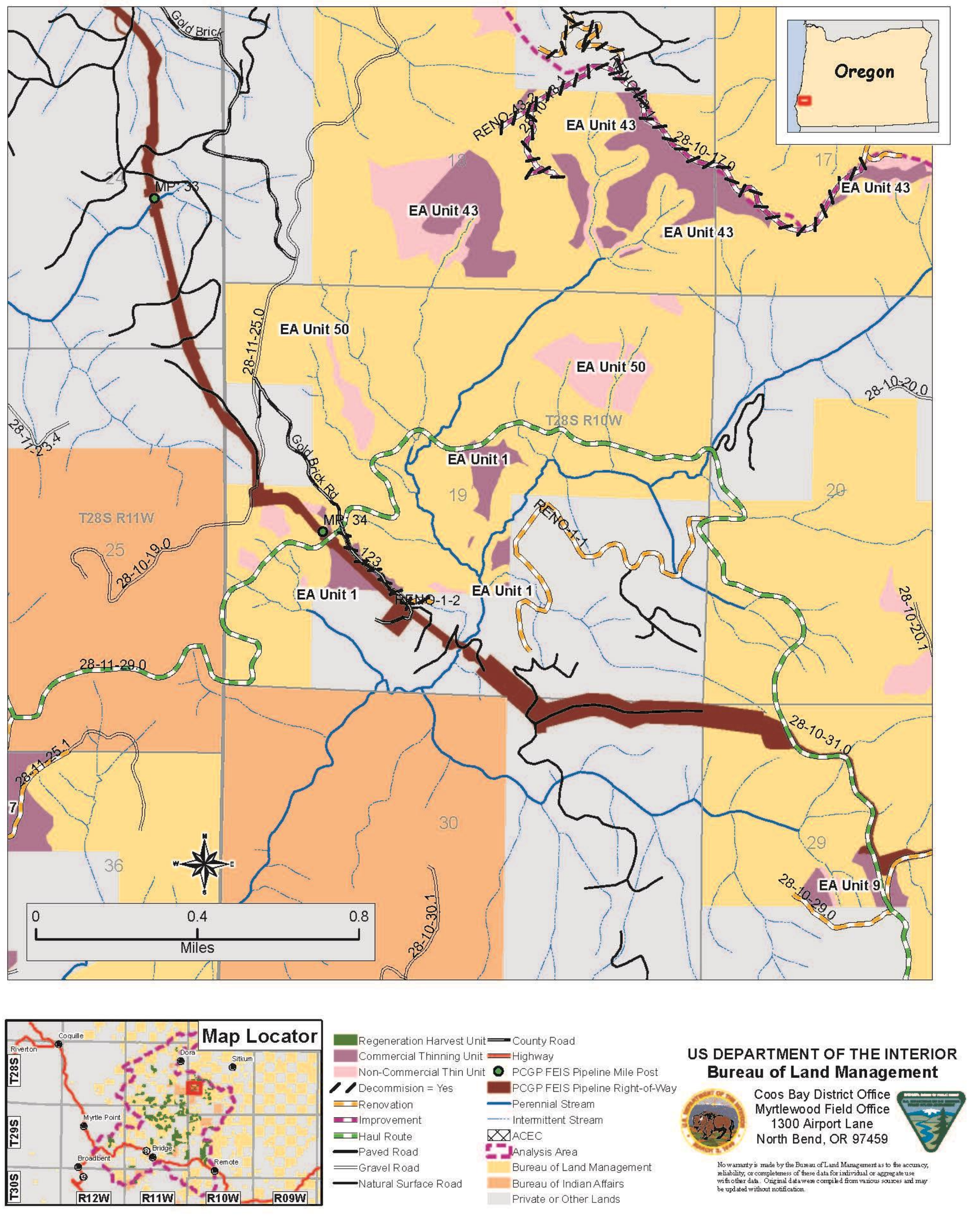


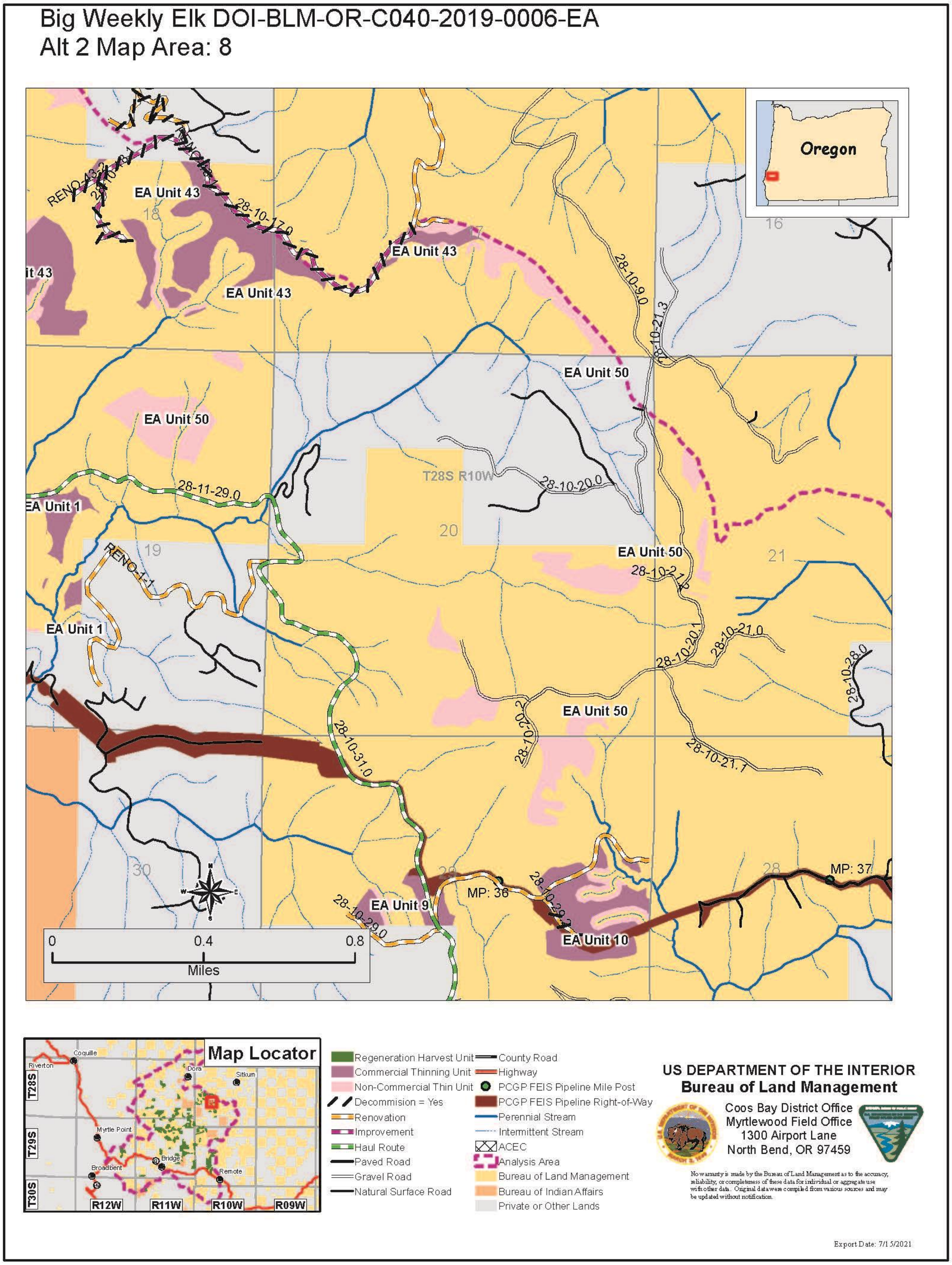
Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 5
Oregon
EA Unit 43
EA Unit 50
T28S R10W
28-10-7.0
28-10-5.3
28-10-7.1
28-11-25.0
28-10-9.0
28-10-8.1
28-10-9.2
28-10-17.0
28-10-21.3
28-10-20.0
28-10-20.1
28-11-29.0
Miles
Map Locator
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commercial Thin Unit
Decommission = Yes
Renovation
Improvement
Haul Route
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
Export Date: 7/15/2021

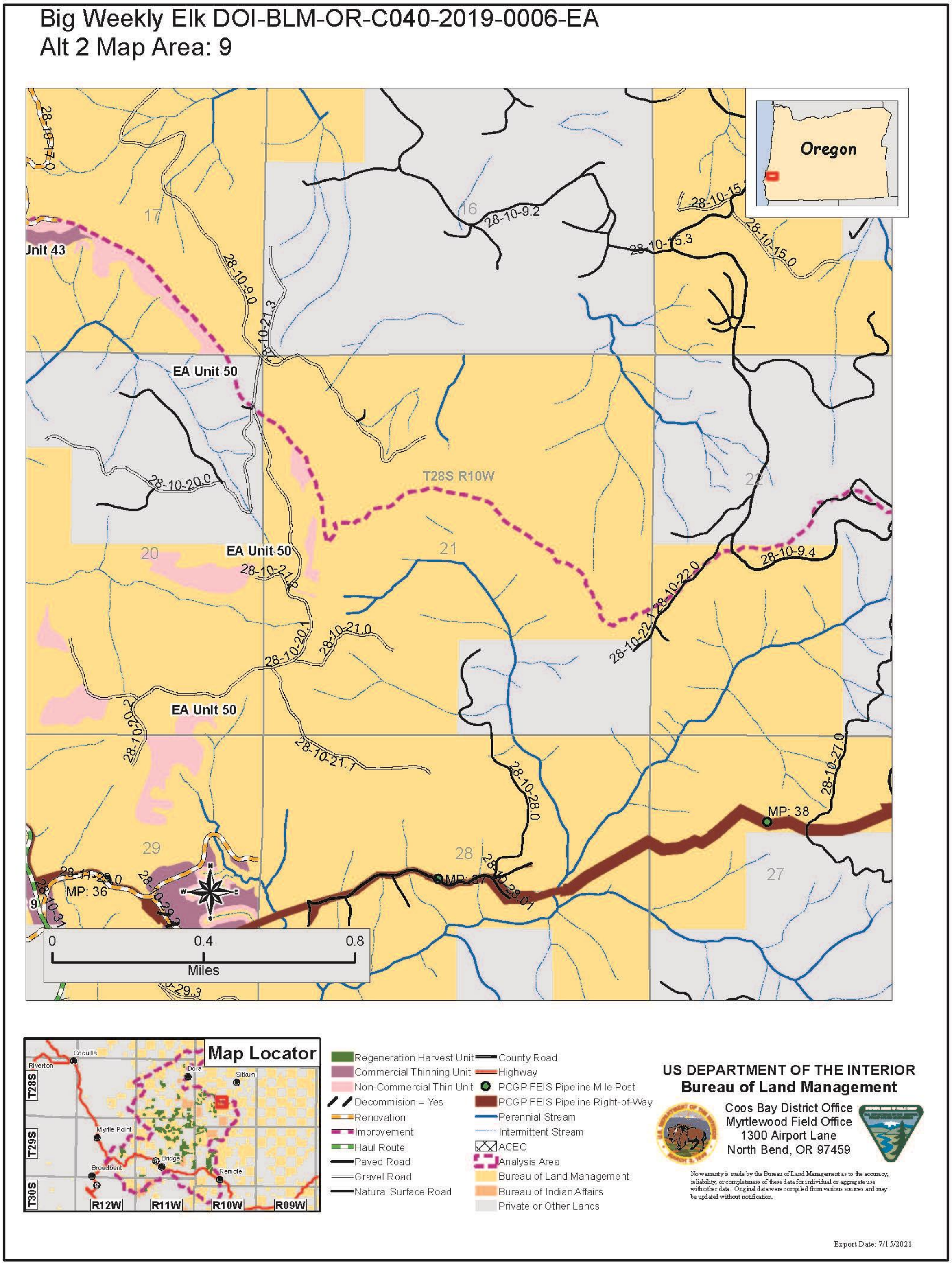


Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 6
Oregon
EA Unit 41
EA Unit 2
EA Unit 3
Crosby Cnty Rd
Crosby Rd
Sitkum Rd
0
0.4
0.8
Miles
Map Locator
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commercial Thin Unit
Decommission = Yes
Renovation
Improvement
Haul Route
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
Export Date: 7/15/2021

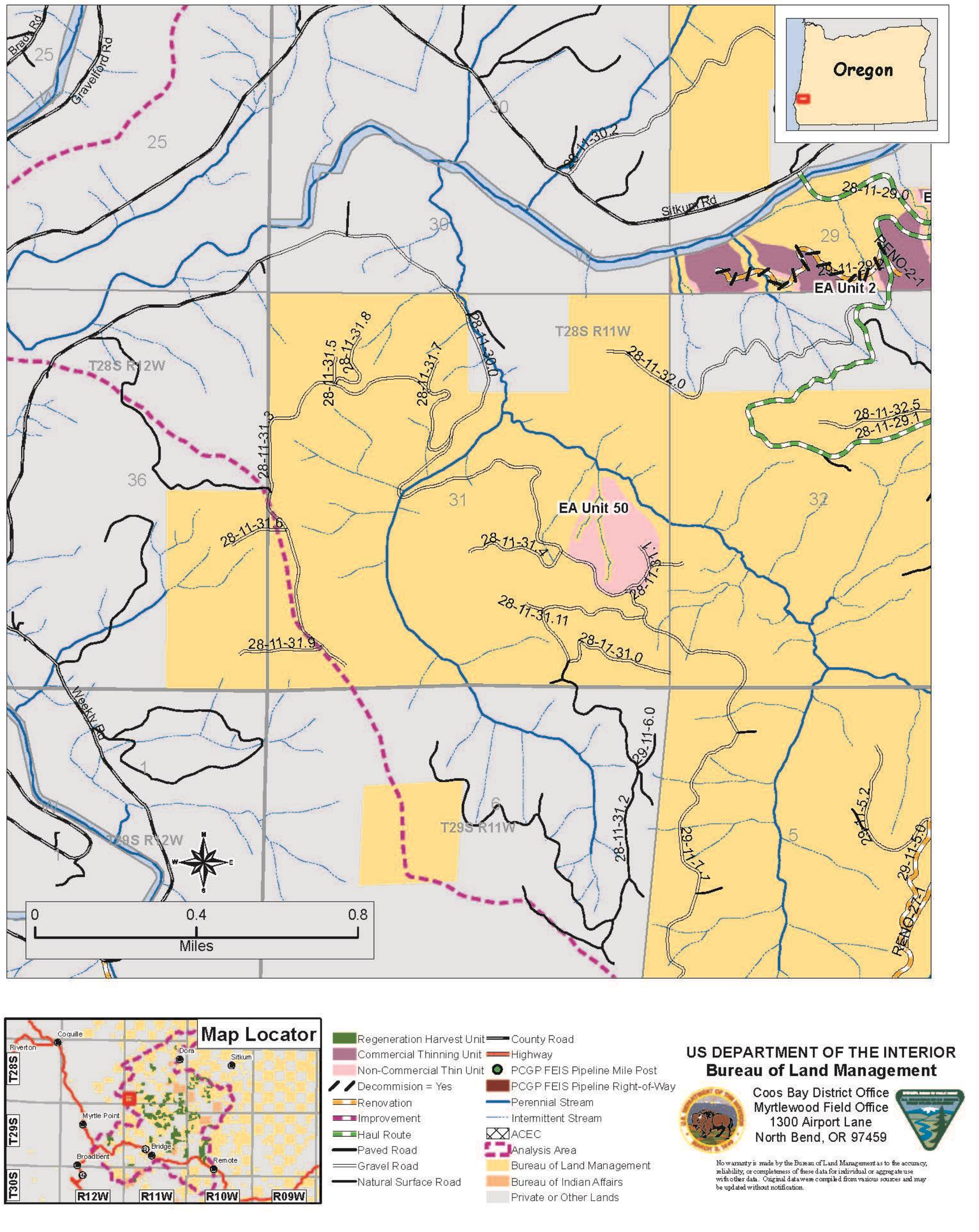
Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 7

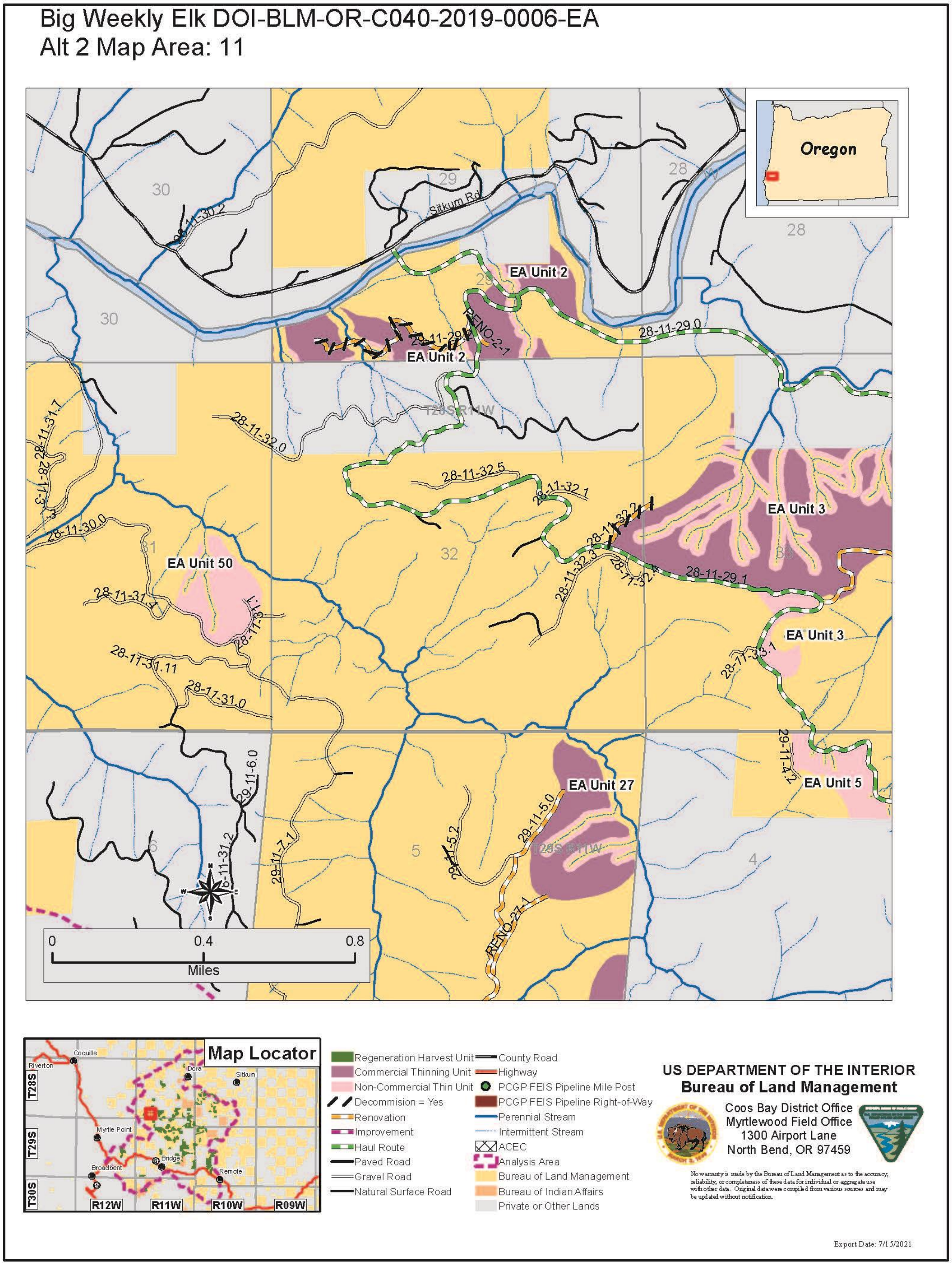



Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 8
Oregon
EA Unit 43
EA Unit 50
EA Unit 1
EA Unit 9
EA Unit 10
T28S R10W
28-11-29.0
28-10-17.0
28-10-9.0
28-10-21.3
28-10-20.0
28-10-21.2
28-10-21.0
28-10-20.1
28-10-28.0
28-10-20.2
28-10-21.1
28-10-31.0
28-10-29.0
28-10-29.2
RENO-43
RENO-1-1
MP: 36
MP: 37
0
0.4
0.8
Miles
Map Locator
Coquille
Riverton
Dora
Sitkum
Myrtle Point
Bridge
Broadbent
Remote
T28S
T29S
T30S
R12W
R11W
R10W
R09W
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commercial Thin Unit
Decommission = Yes
Renovation
Improvement
Haul Route
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.
Export Date: 7/15/2021

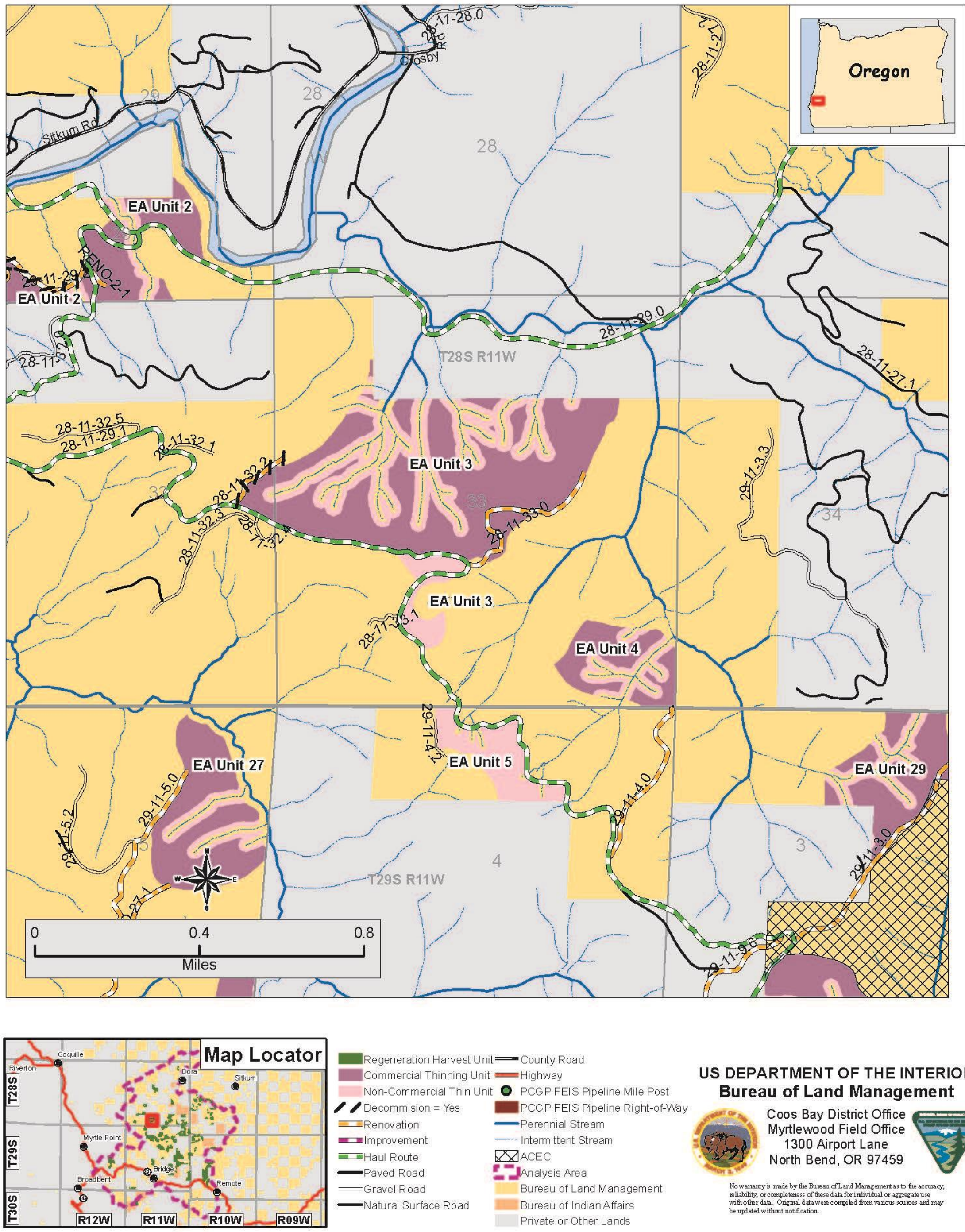

Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 9
Oregon
Unit 43
EA Unit 50
EA Unit 50
EA Unit 50
T28S R10W
16
17
20
21
22
27
28
29
28-10-17.0
28-10-9.0
28-10-21.3
28-10-9.2
28-10-15.3
28-10-15.0
28-10-20.0
28-10-21.1
28-10-20.1
28-10-21.0
28-10-22.0
28-10-22.1
28-10-9.4
28-10-20.2
28-10-21.7
28-10-28.0
28-10-28.01
28-10-27.0
28-11-25.0
28-10-29.2
MP: 36
MP: 37
MP: 38
0
0.4
0.8
Miles
Map Locator
Coquille
Riverton
Dora
Sitkum
Myrtle Point
Bridge
Broadbent
Remote
T28S
T29S
T30S
R12W
R11W
R10W
R09W
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commercial Thin Unit
Decommission = Yes
Renovation
Improvement
Haul Route
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.
Export Date: 7/15/2021

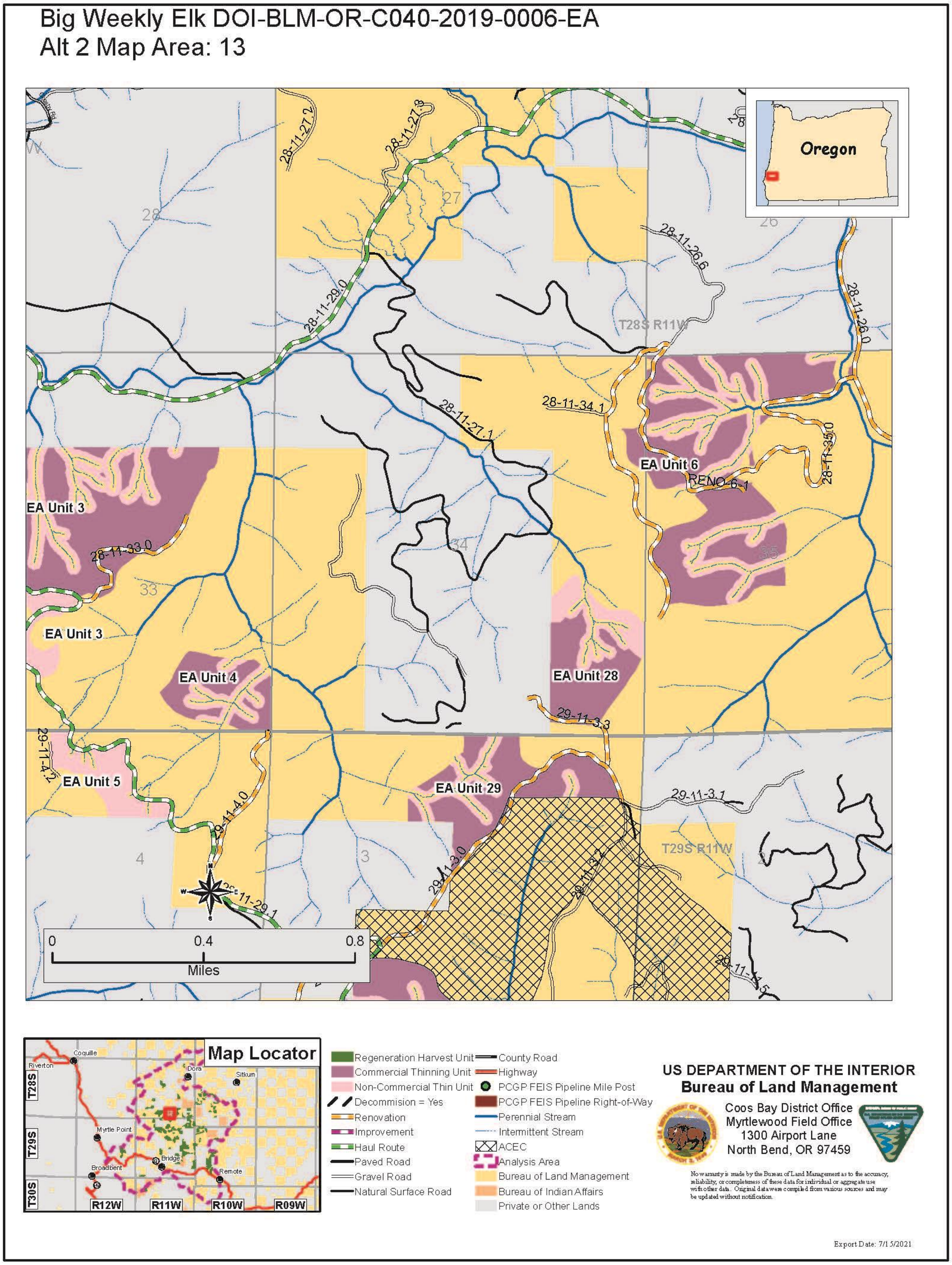
Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 10



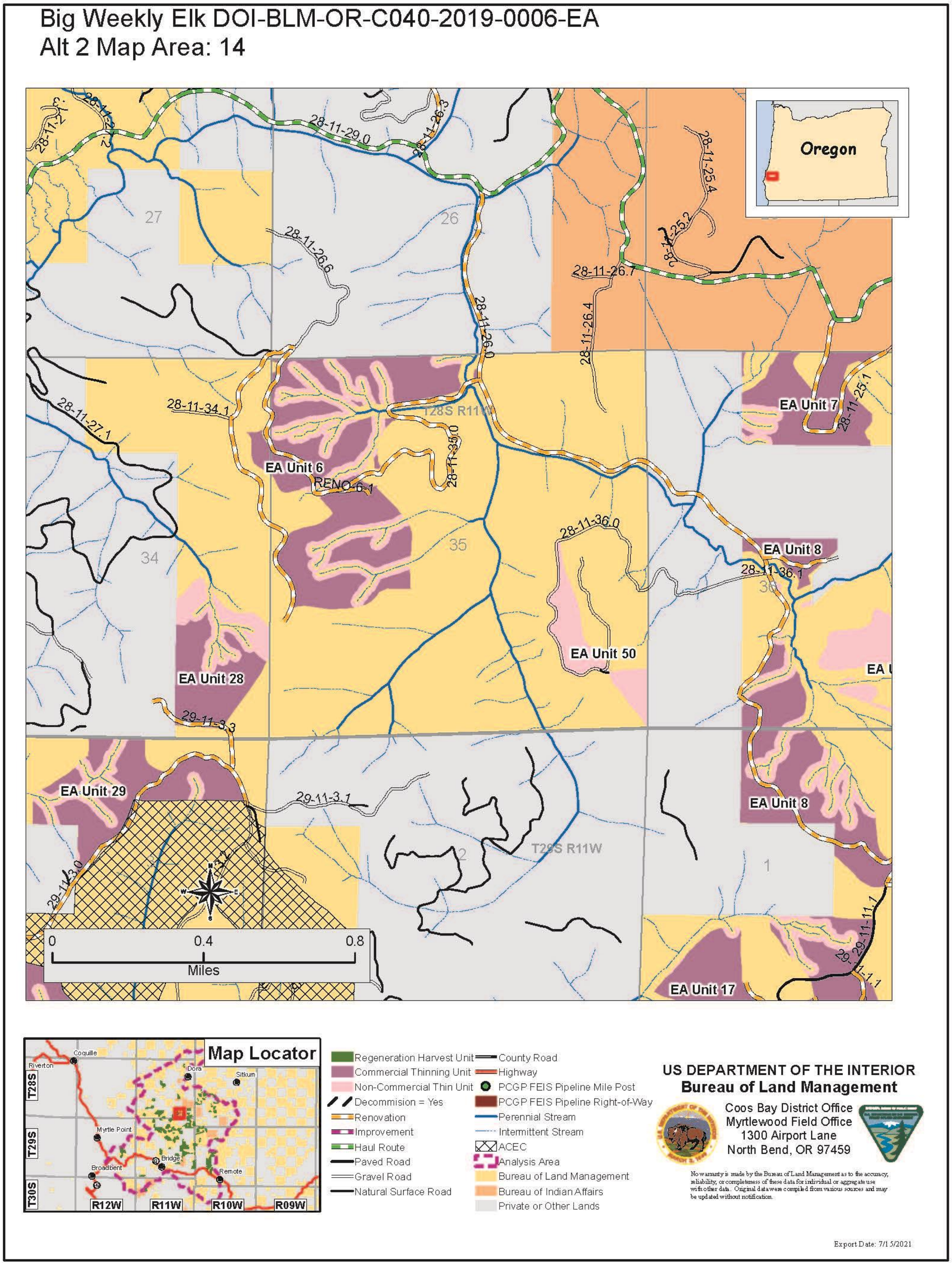

Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 11
Oregon
Sitkum Rd
EA Unit 2
EA Unit 3
EA Unit 50
EA Unit 27
EA Unit 5
28-11-29.0
28-11-32.0
28-11-32.5
28-11-32.1
28-11-29.1
28-11-30.0
28-11-31.4
28-11-31.11
28-11-31.0
29-11-6.0
29-11-7.1
29-11-5.0
29-11-4.2
28-11-33.1
RENO-2-1
RENO-27-1
T28S-R11W
0
0.4
0.8
Miles
Map Locator
Coquille
Riverton
Dora
Sitkum
Myrtle Point
Bridge
Broadbent
Remote
T28S
T29S
T30S
R12W
R11W
R10W
R09W
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commercial Thin Unit
Decommision = Yes
Renovation
Improvement
Haul Route
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
Export Date: 7/15/2021

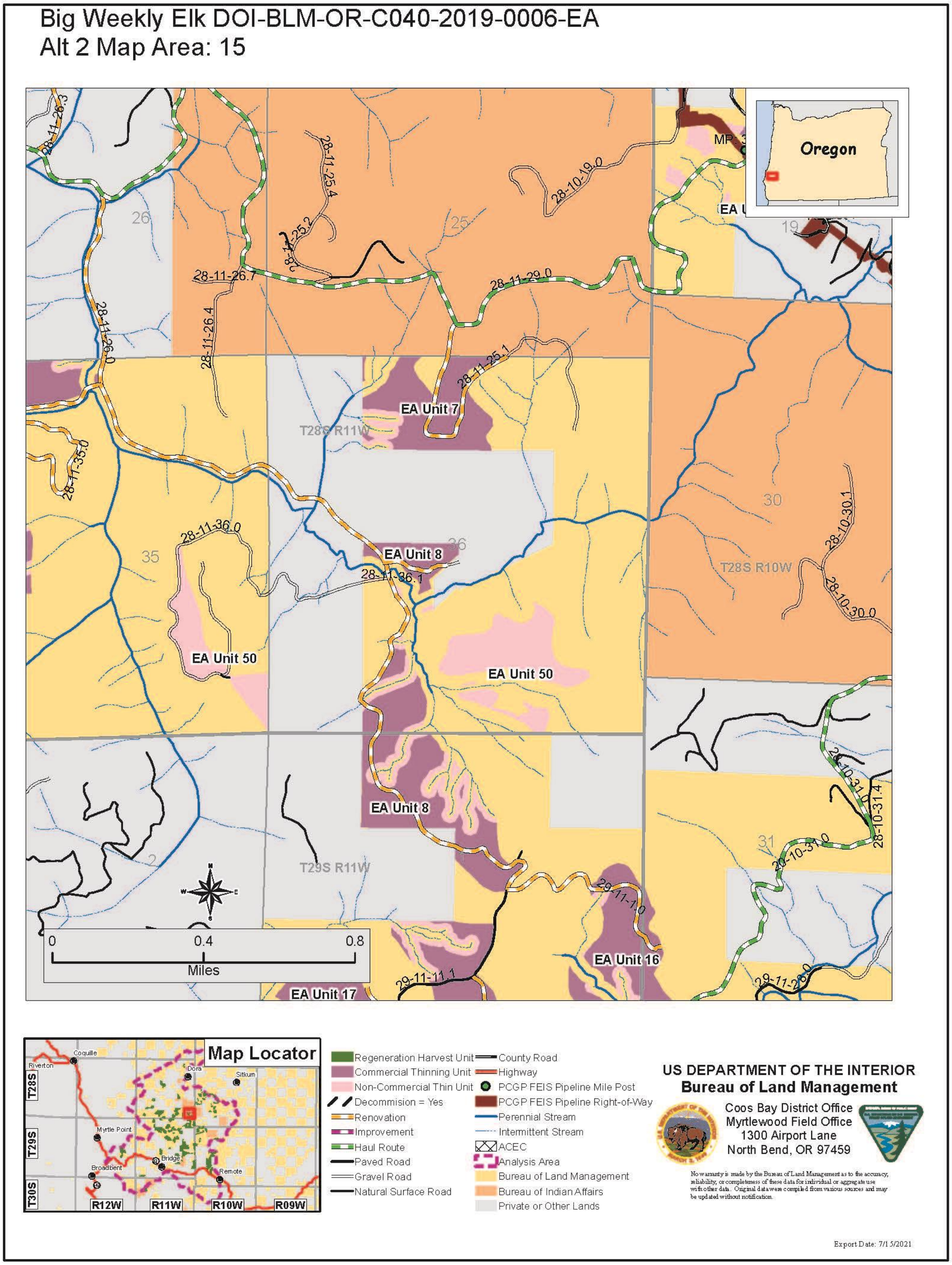
Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 12

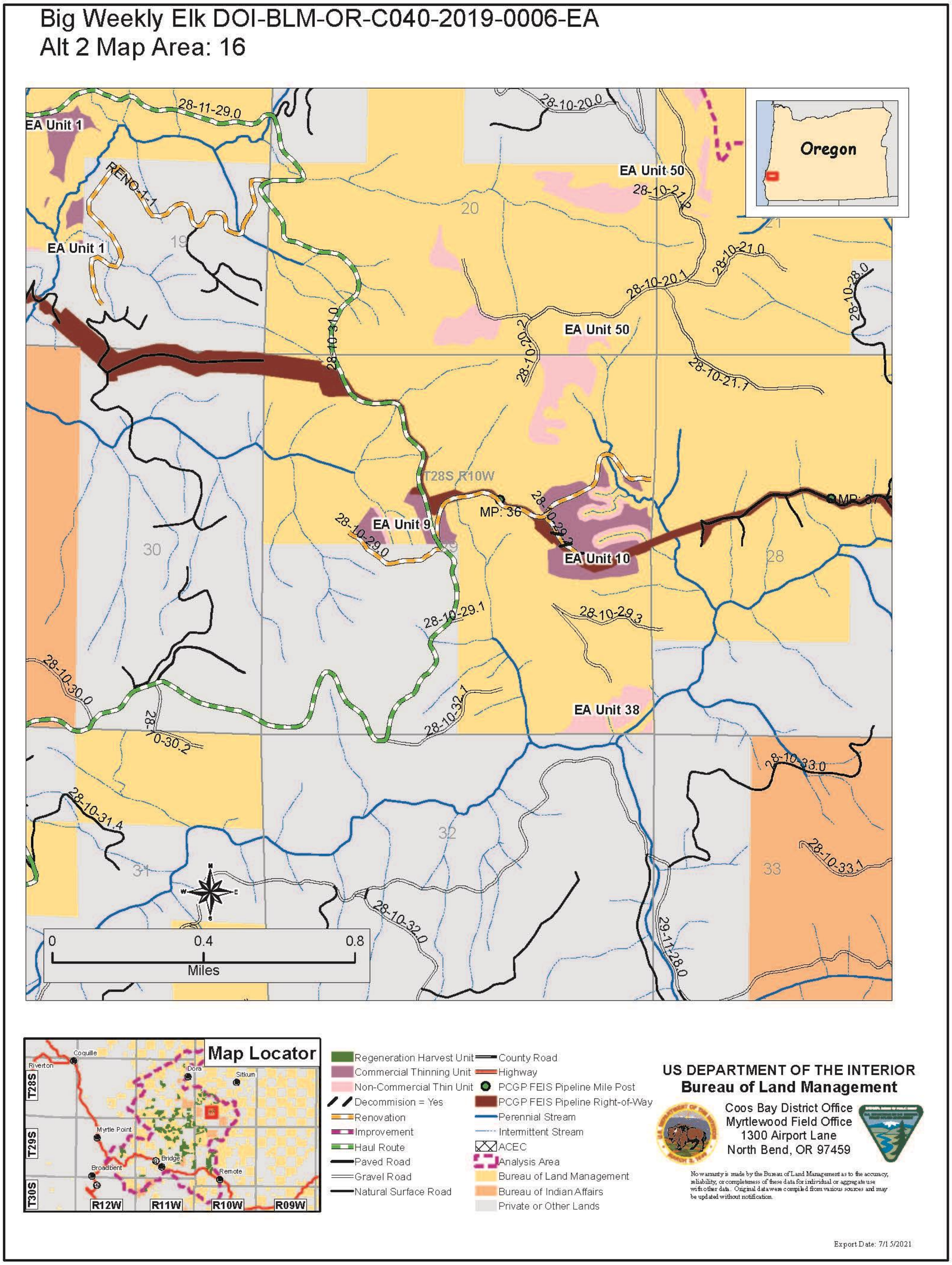




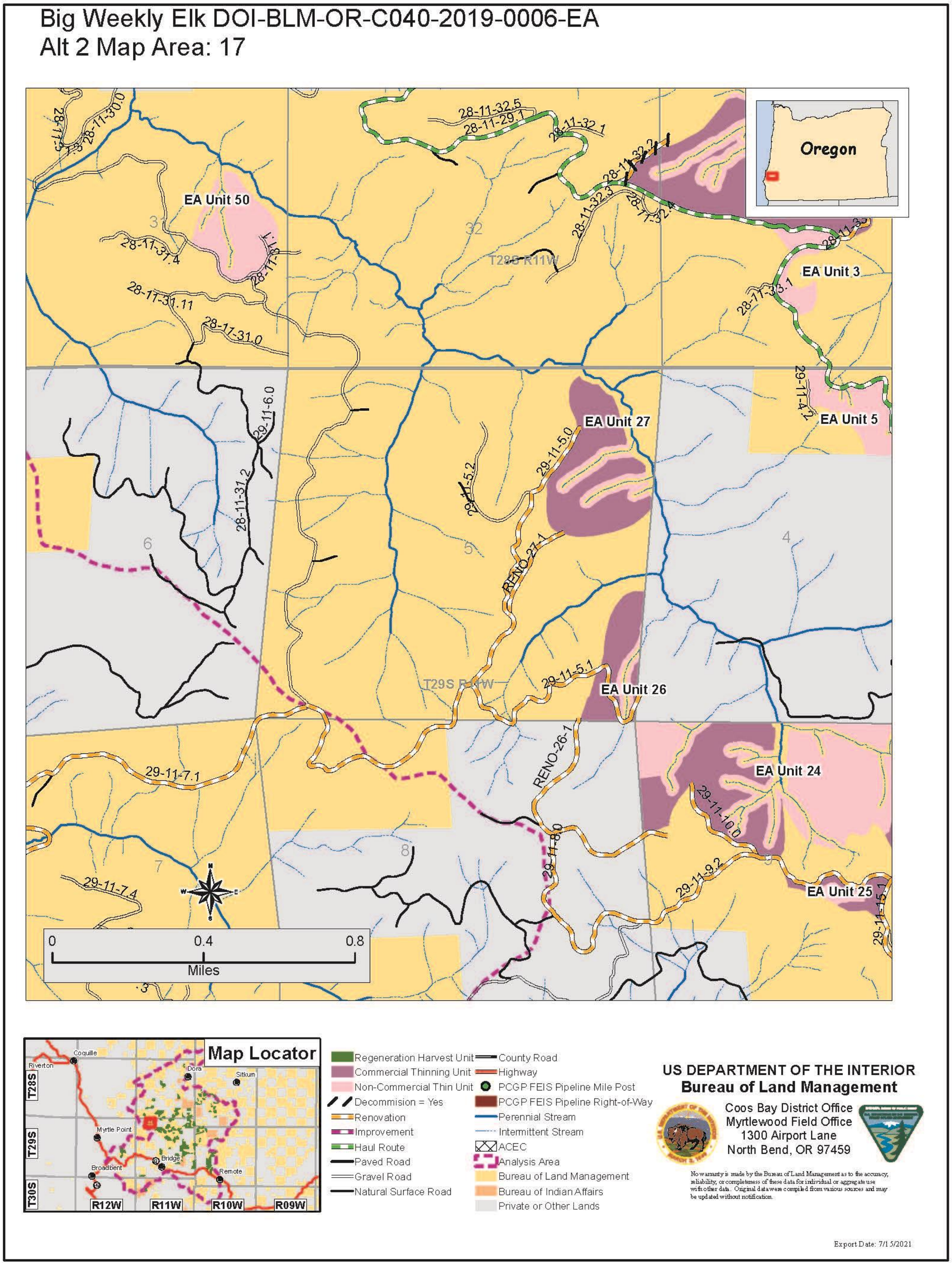
Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 13
Oregon
28-11-27.2
28-11-27.3
28-11-29.0
28-11-26.6
28-11-26.0
T28S R11W
28-11-34.1
28-11-27.1
28-11-35.0
EA Unit 6
RENO-6-1
EA Unit 3
28-11-33.0
EA Unit 3
EA Unit 4
EA Unit 28
29-11-3.3
29-11-4.2
EA Unit 5
EA Unit 29
29-11-3.1
29-11-4.0
T29S R11W
29-11-3.0
29-11-3.2
29-11-29.1
29-11-11.5
0
0.4
0.8
Miles
Map Locator
Coquille
Riverton
Dora
Sitkum
Myrtle Point
Bridge
Broadbent
Remote
T28S
T29S
T30S
R12W
R11W
R10W
R09W
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commercial Thin Unit
Decommission = Yes
Renovation
Improvement
Haul Route
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
Export Date: 7/15/2021


Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 14
Oregon
EA Unit 6
EA Unit 7
EA Unit 8
EA Unit 17
EA Unit 28
EA Unit 29
EA Unit 50
T28S R11W
0 0.4 0.8
Miles
Map Locator
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commercial Thin Unit
Decommission = Yes
Renovation
Improvement
Haul Route
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
Export Date: 7/15/2021

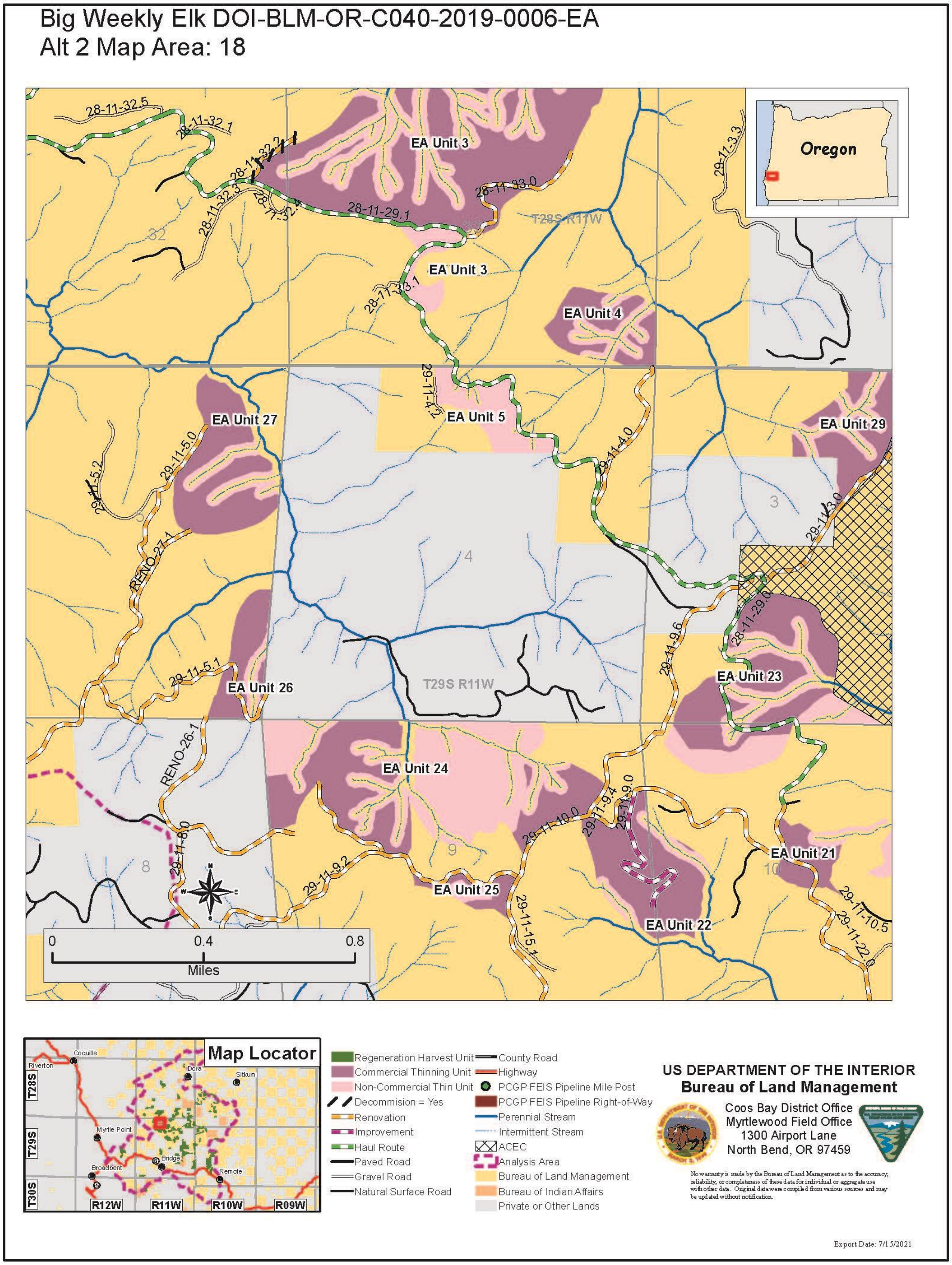

Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 15
Oregon
EA Unit 7
EA Unit 8
EA Unit 50
EA Unit 16
EA Unit 17
T28S R11W
T28S R10W
T29S R11W
28-11-26.3
28-11-25.4
28-11-25.2
28-11-26.7
28-11-26.4
28-11-26.0
28-11-29.0
28-10-19.0
28-11-25.1
28-11-35.0
28-11-36.0
28-11-36.1
28-10-30.1
28-10-30.0
28-10-31.0
28-10-31.4
29-11-1.0
29-11-11.1
29-11-28.0
0
0.4
0.8
Miles
Map Locator
Coquille
Riverton
Dora
Sitkum
Myrtle Point
Bridge
Broadbent
Remote
T28S
T29S
T30S
R12W
R11W
R10W
R09W
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commercial Thin Unit
Decommission = Yes
Renovation
Improvement
Haul Route
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.
Export Date: 7/15/2021

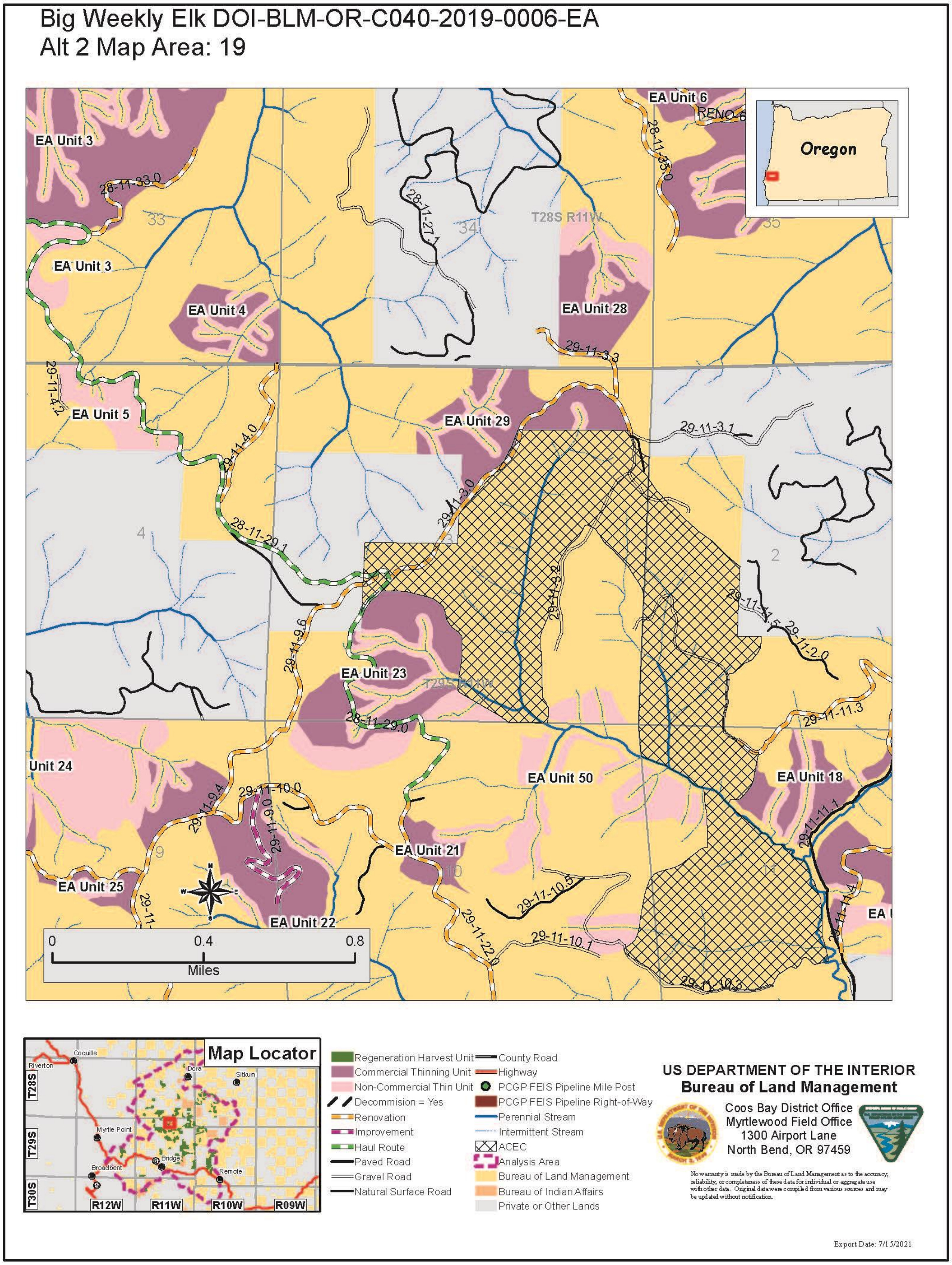


Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 16
Oregon
EA Unit 1
EA Unit 50
EA Unit 9
EA Unit 10
EA Unit 38
T28S R10W
MP: 36
MP: 37
28-11-29.0
28-10-20.0
28-10-21.0
28-10-20.1
28-10-28.0
28-10-20.2
28-10-21.7
28-10-31.0
28-10-29.0
28-10-29.1
28-10-29.3
28-10-30.0
28-10-30.2
28-10-32.1
28-10-33.0
28-10-33.1
28-10-31.4
28-10-32.0
29-11-28.0
RENO-1-1
0
0.4
0.8
Miles
Map Locator
Coquille
Riverton
Dora
Sitkum
Myrtle Point
Bridge
Broadbent
Remote
T28S
T29S
T30S
R12W
R11W
R10W
R09W
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commercial Thin Unit
Decommission = Yes
Renovation
Improvement
Haul Route
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.
Export Date: 7/15/2021

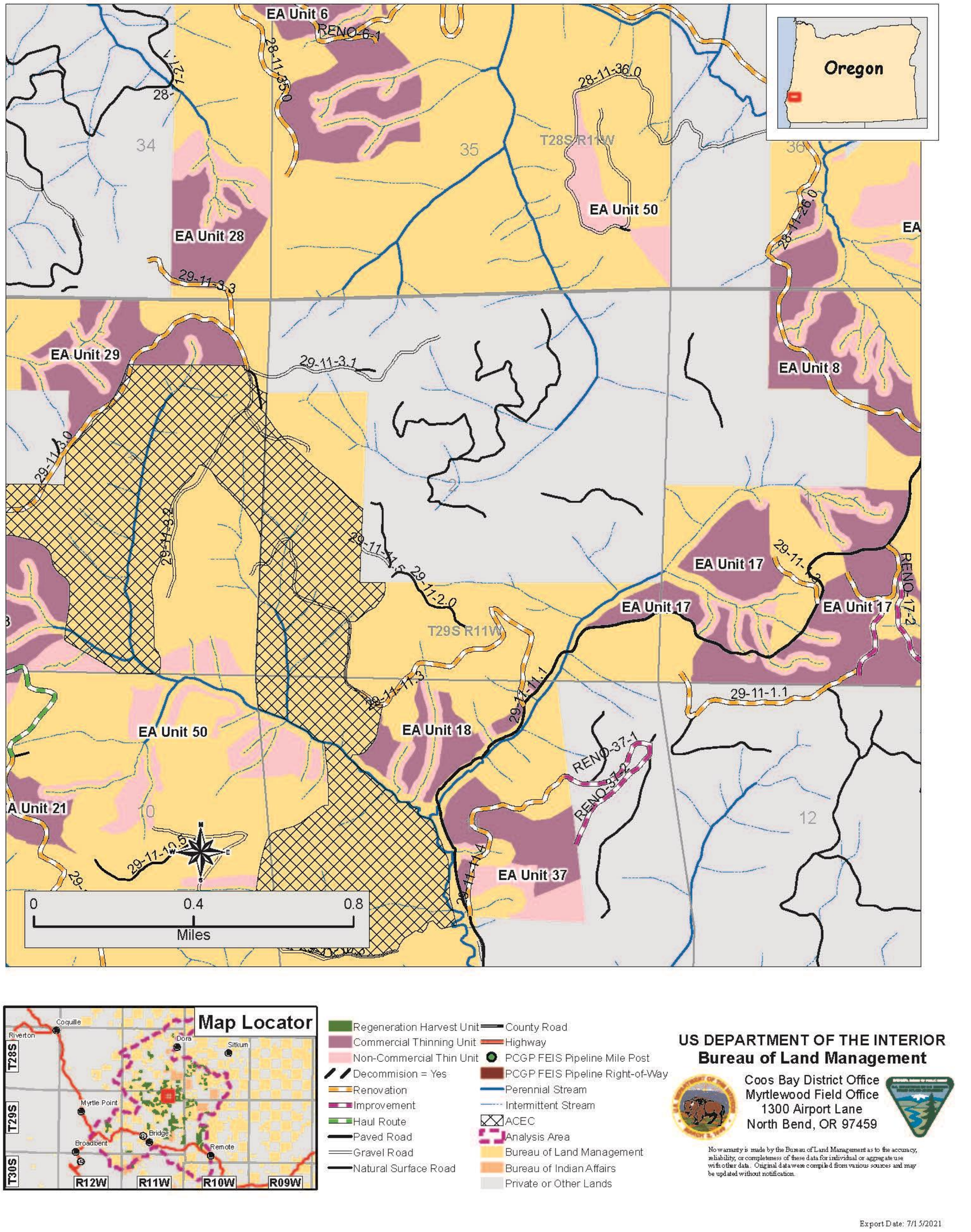


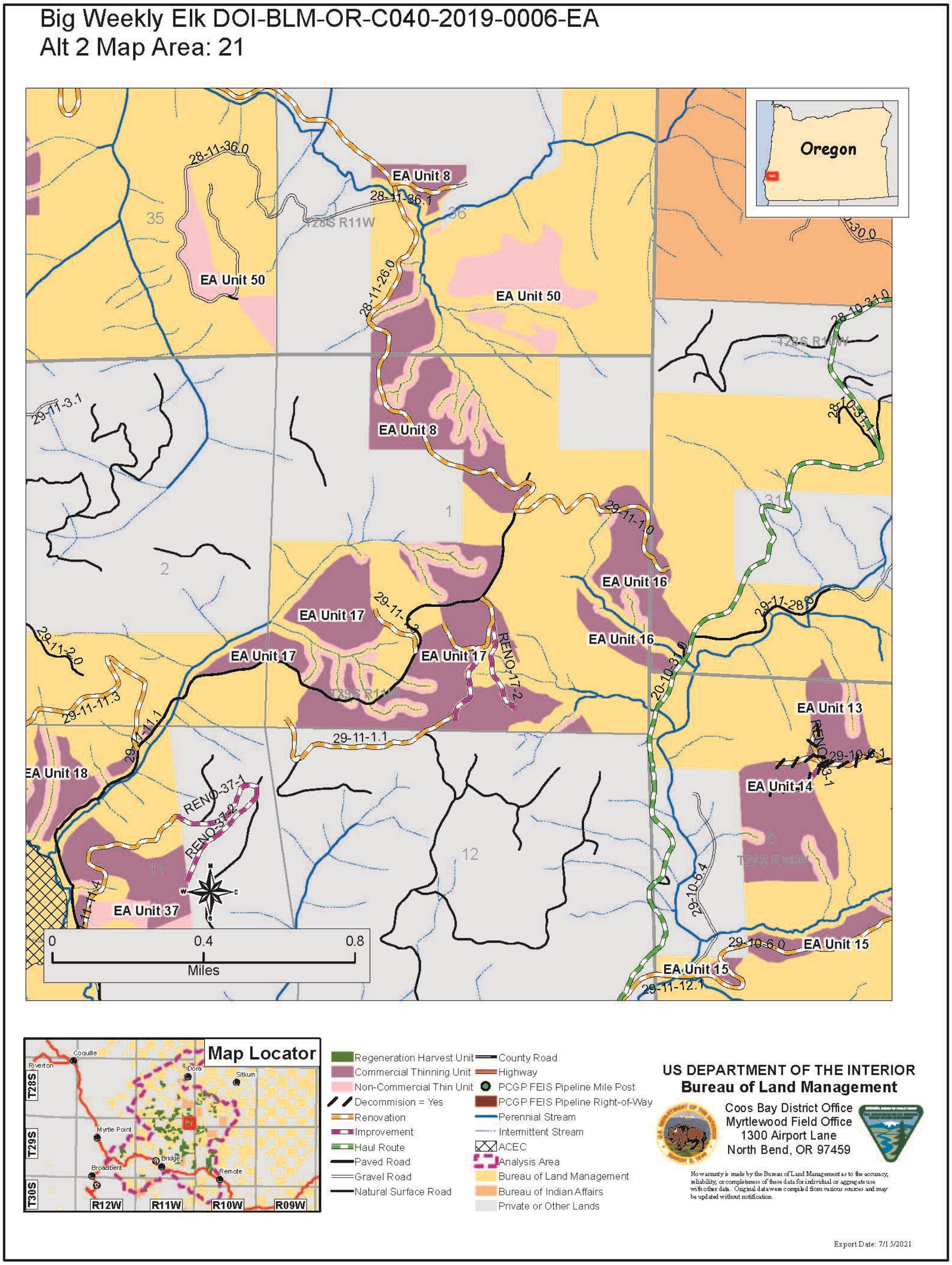
Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 17
Oregon
EA Unit 50
EA Unit 3
EA Unit 5
EA Unit 27
EA Unit 26
EA Unit 24
EA Unit 25
T29S R11W
28-11-32.5
28-11-29.1
28-11-32.1
28-11-32.2
28-11-32.3
28-11-32.4
28-11-30.0
28-11-31.4
28-11-31.11
28-11-31.0
28-11-31.2
29-11-6.0
29-11-5.0
29-11-5.2
29-11-5.1
29-11-4.2
RENO-27-1
RENO-26-1
29-11-7.1
29-11-7.4
29-11-8.0
29-11-9.2
29-11-10.0
29-11-15.1
0
0.4
0.8
Miles
Map Locator
Coquille
Riverton
Dora
Sitkum
Myrtle Point
Bridge
Broadbent
Remote
T28S
T29S
T30S
R12W
R11W
R10W
R09W
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commercial Thin Unit
Decommission = Yes
Renovation
Improvement
Haul Route
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
Export Date: 7/15/2021


Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 18
Oregon
EA Unit 3
EA Unit 3
EA Unit 4
EA Unit 5
EA Unit 27
EA Unit 29
EA Unit 26
EA Unit 23
EA Unit 24
EA Unit 21
EA Unit 25
EA Unit 22
T28S R11W
T29S R11W
28-11-32.5
28-11-32.1
28-11-32.2
28-11-32.3
28-11-33.0
28-11-29.1
28-11-33.1
29-11-3.3
29-11-4.2
29-11-4.0
29-11-5.0
29-11-5.2
RENO-27-1
29-11-3.0
28-11-29.0
29-11-9.6
29-11-5.1
RENO-26-1
29-11-8.0
29-11-9.2
29-11-10.0
29-11-9.4
29-11-9.0
29-11-15.1
29-11-10.5
29-11-22.0
32
3
4
8
9
10
0
0.4
0.8
Miles
Map Locator
Coquille
Riverton
Dora
Sitkum
Myrtle Point
Bridge
Broadbent
Remote
T28S
T29S
T30S
R12W
R11W
R10W
R09W
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commercial Thin Unit
Decommission = Yes
Renovation
Improvement
Haul Route
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.
Export Date: 7/15/2021

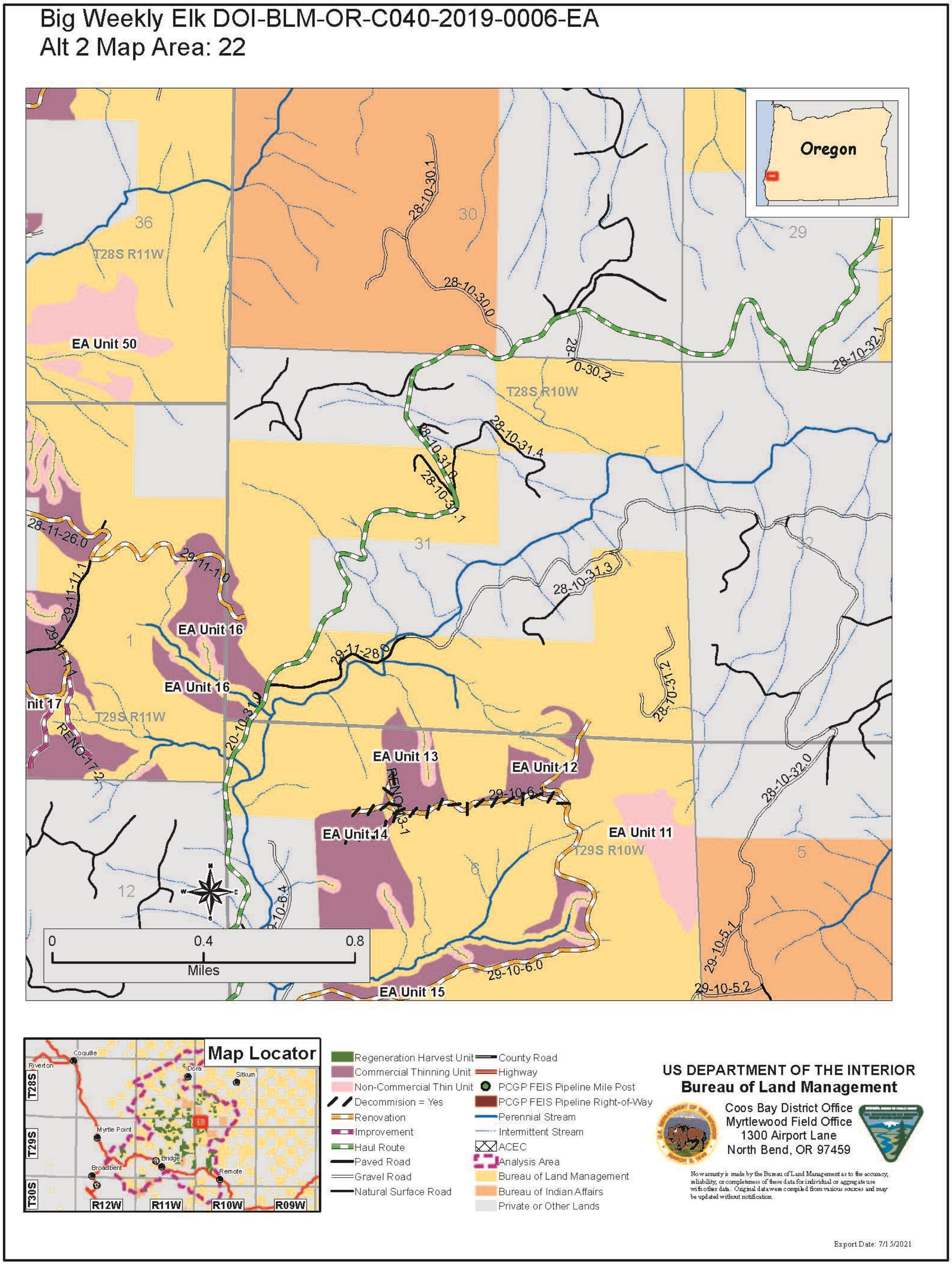

Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 19
Oregon
EA Unit 3
EA Unit 4
EA Unit 5
EA Unit 6
EA Unit 18
EA Unit 21
EA Unit 22
EA Unit 23
EA Unit 25
EA Unit 28
EA Unit 29
EA Unit 50
Unit 24
T28S R11W
0
0.4
0.8
Miles
Map Locator
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commercial Thin Unit
Decommission = Yes
Renovation
Improvement
Haul Route
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.
Export Date: 7/15/2021

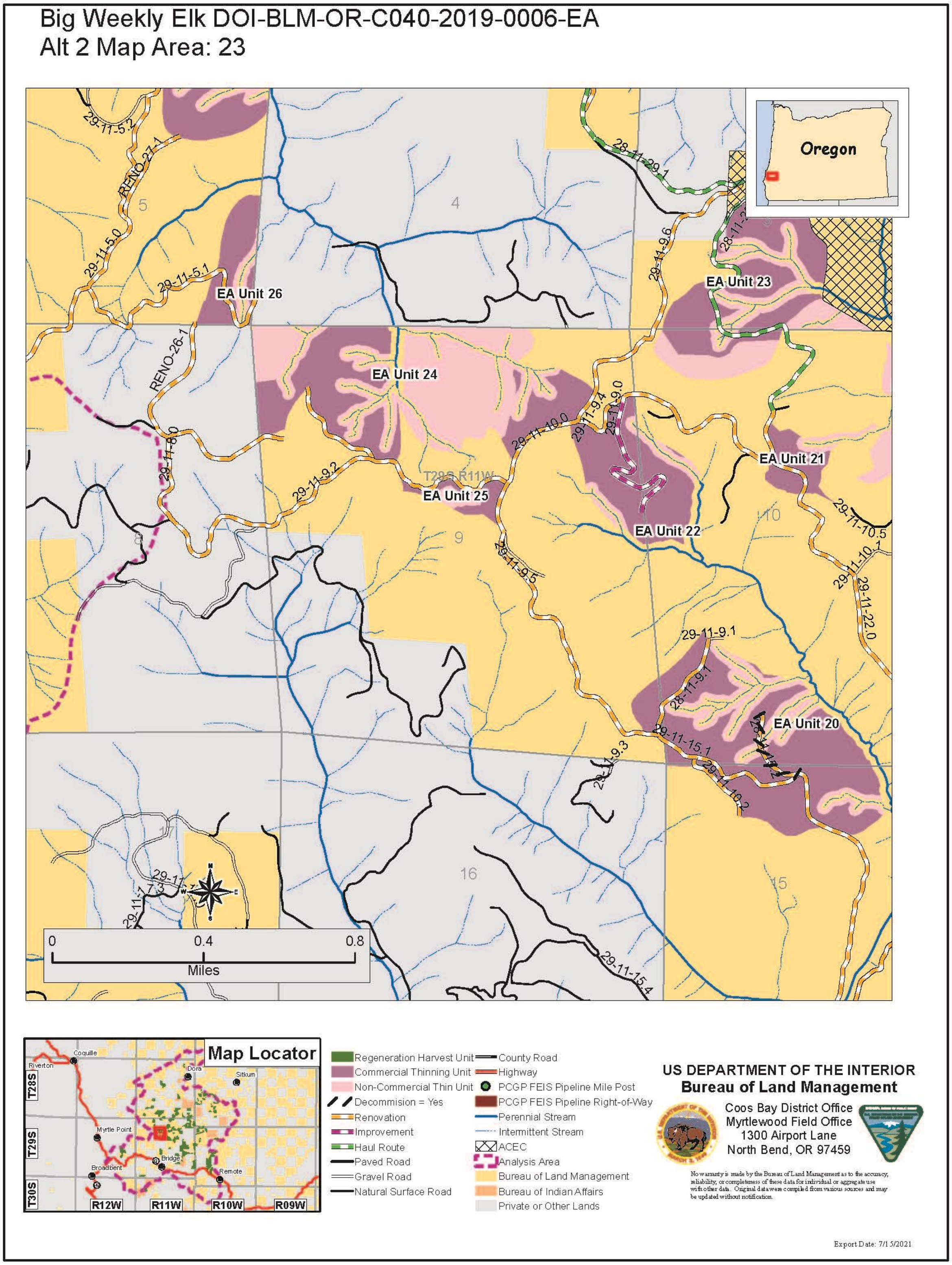
Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 20

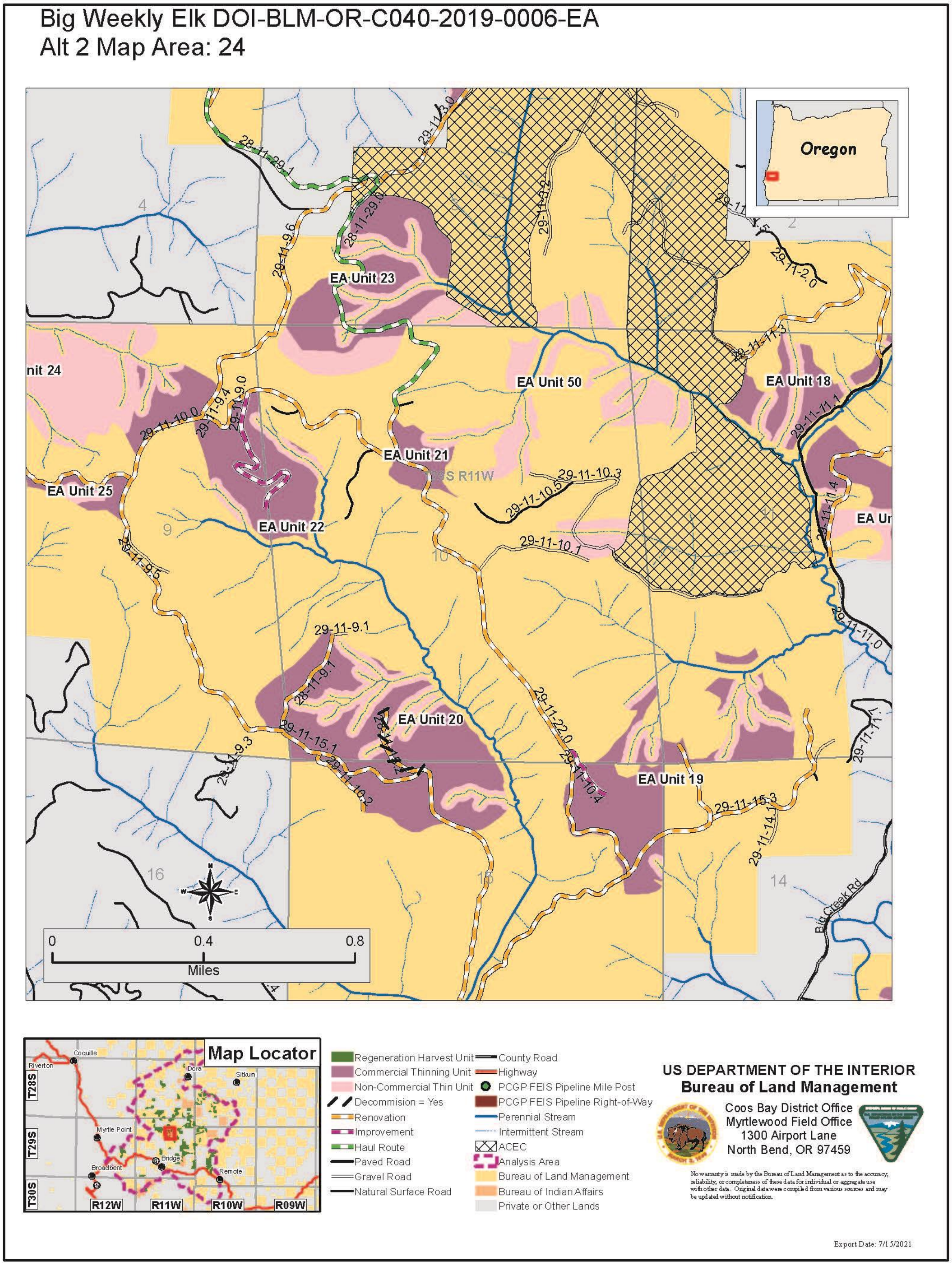


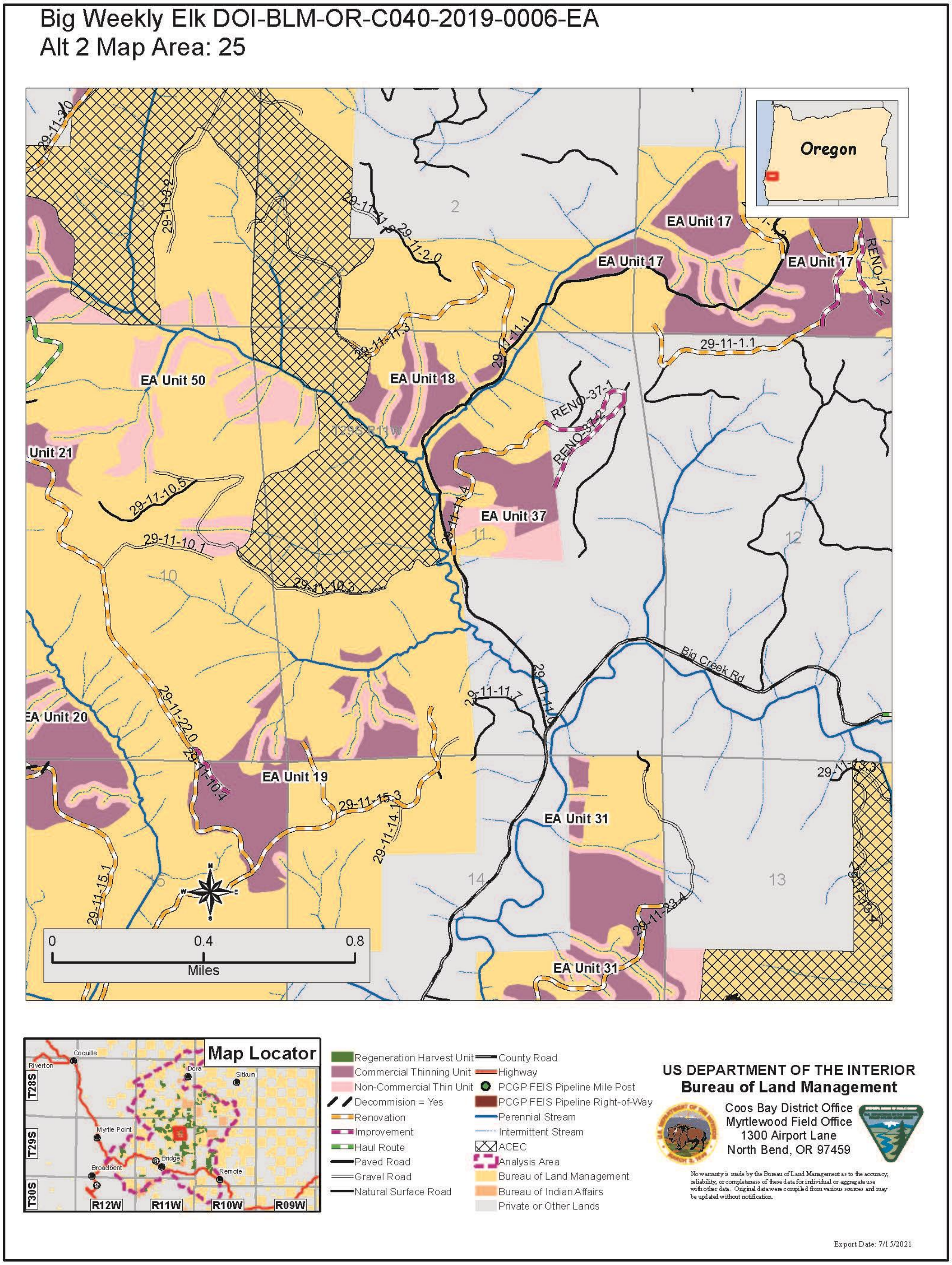

Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 21
Oregon
EA Unit 8
EA Unit 50
EA Unit 17
EA Unit 16
EA Unit 18
EA Unit 37
EA Unit 13
EA Unit 14
EA Unit 15
28-11-36.0
28-11-36.1
28-11-26.0
28-10-31.0
28-10-31.1
29-11-3.1
29-11-1.0
29-11-28.0
29-11-2.0
29-11-11.3
29-11-11.1
29-11-1.1
29-10-31.0
29-10-6.1
29-10-6.4
29-10-6.0
29-11-12.1
RENO-17-2
RENO-37-1
RENO-37-2
T28S R11W
T29S R11W
0
0.4
0.8
Miles
Map Locator
Coquille
Riverton
Dora
Sitkum
Myrtle Point
Bridge
Broadbent
Remote
T28S
T29S
T30S
R12W
R11W
R10W
R09W
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commercial Thin Unit
Decommission = Yes
Renovation
Improvement
Haul Route
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.
Export Date: 7/15/2021

Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 22

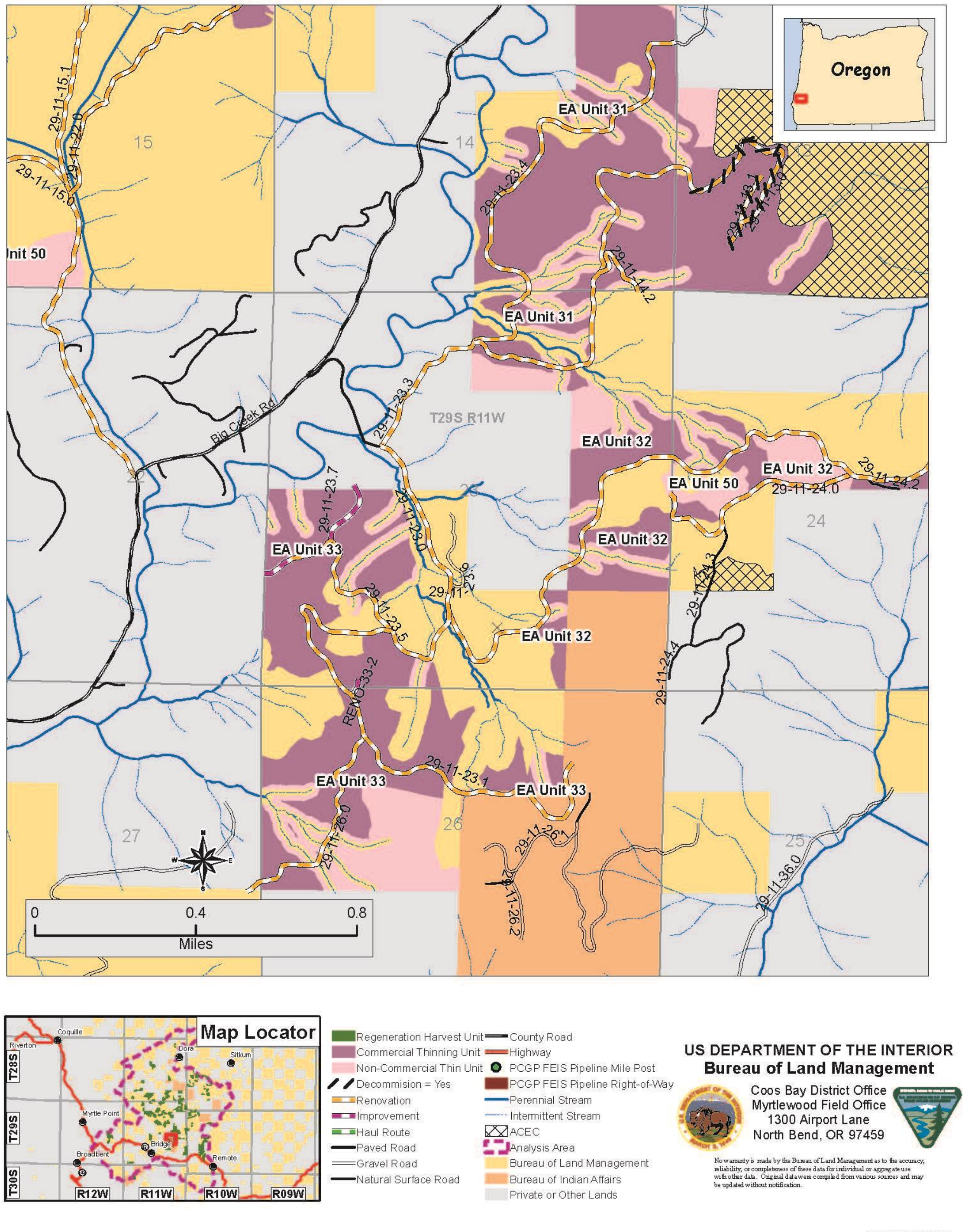


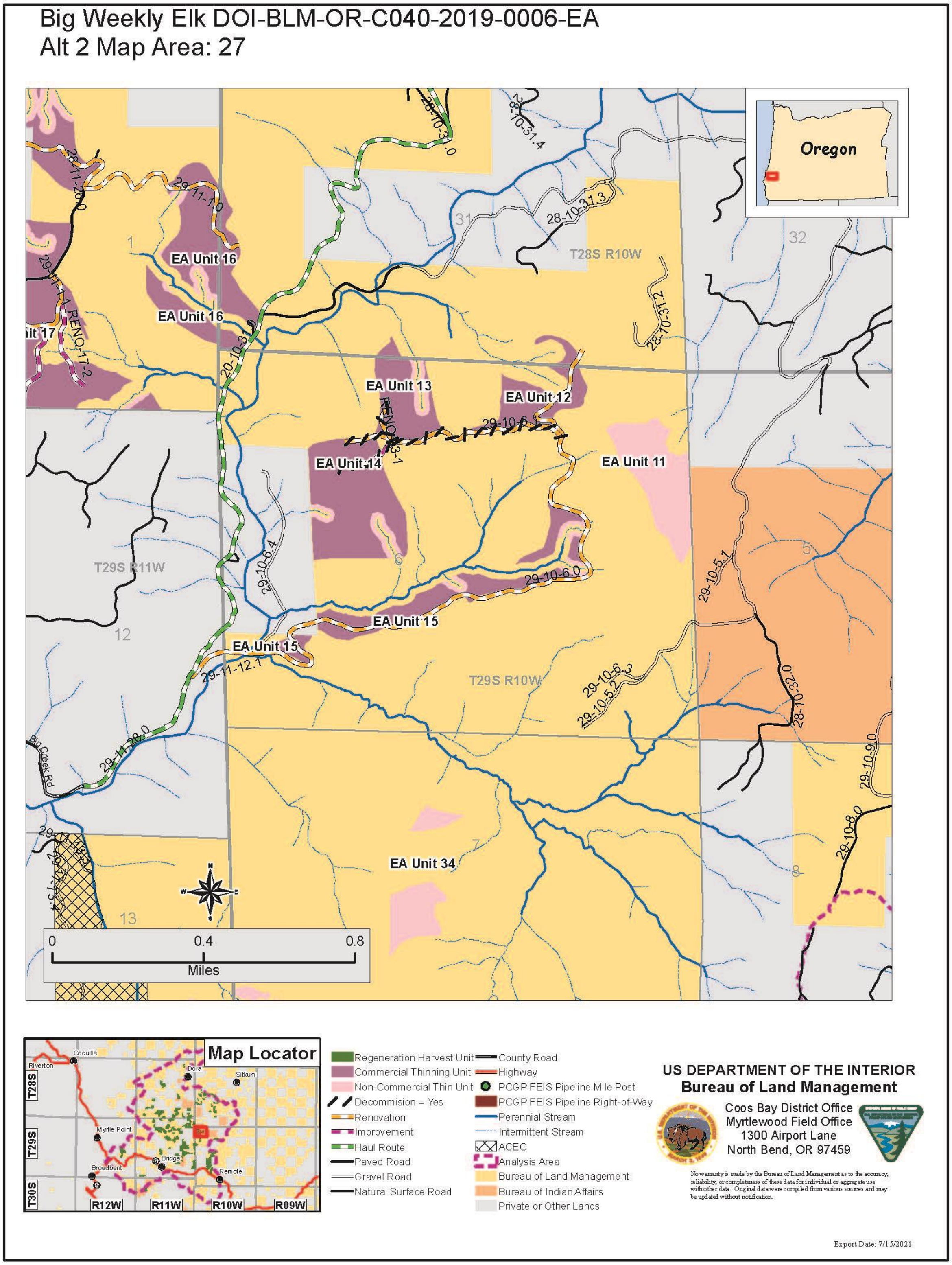

Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 23
Oregon
EA Unit 20
EA Unit 21
EA Unit 22
EA Unit 23
EA Unit 24
EA Unit 25
EA Unit 26
T29S R11W
Miles
Map Locator
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commercial Thin Unit
Decommission = Yes
Renovation
Improvement
Haul Route
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
Export Date: 7/15/2021

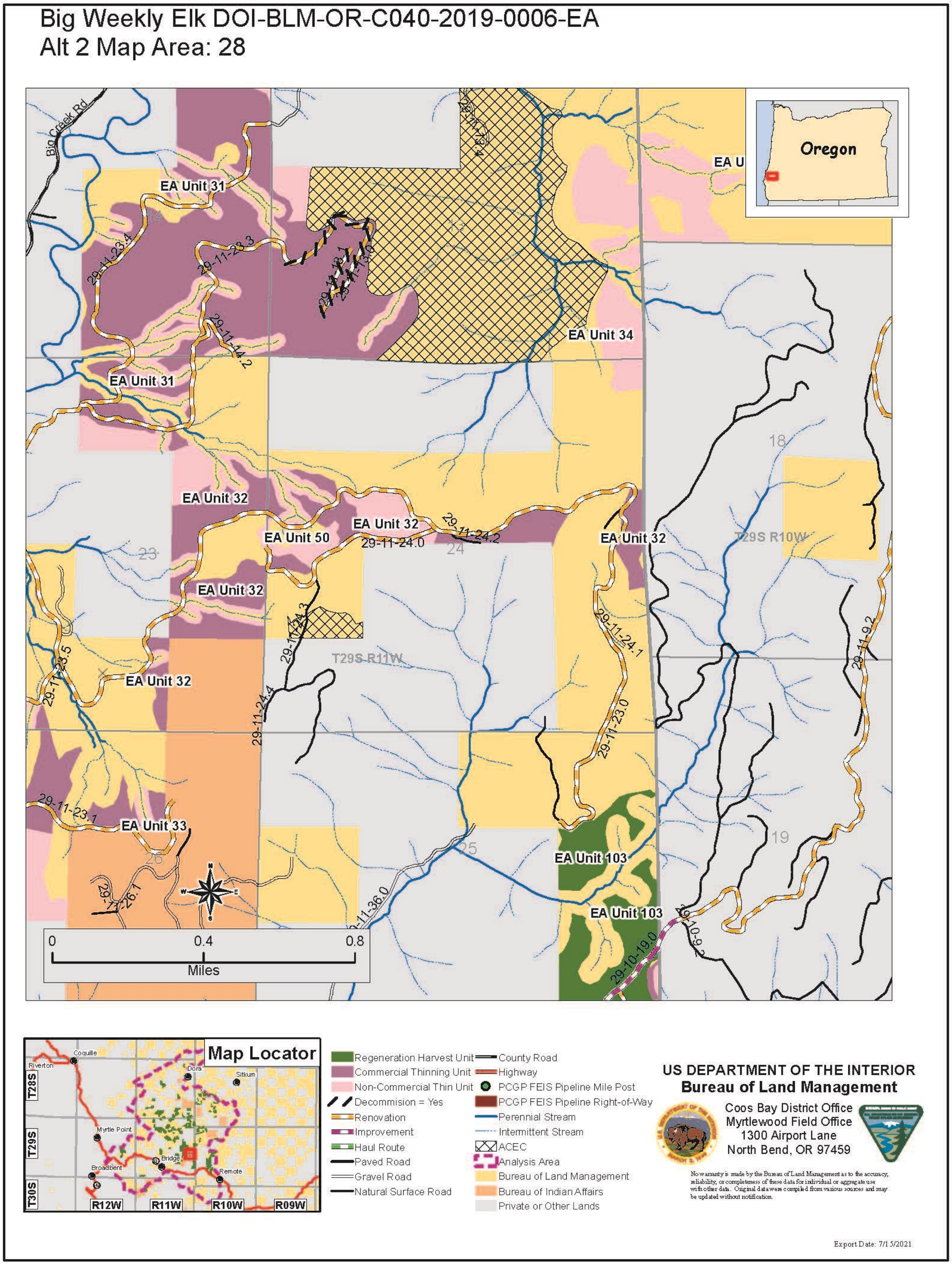

Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 24
Oregon
EA Unit 23
EA Unit 50
EA Unit 18
EA Unit 24
EA Unit 21
EA Unit 25
EA Unit 22
EA Unit 20
EA Unit 19
29S R11W
28-11-29.1
28-11-29.0
29-11-9.6
29-11-10.0
29-11-9.4
29-11-9.0
29-11-9.5
29-11-10.3
29-11-10.1
29-11-9.1
28-11-9.1
29-11-15.1
29-11-9.3
29-11-10.2
29-11-22.0
29-11-10.4
29-11-15.3
29-11-14.1
29-11-11.0
29-11-11.4
29-11-11.1
29-11-11.3
29-11-2.0
29-11-3.2
Big Creek Rd
0
0.4
0.8
Miles
Map Locator
Coquille
Riverton
Dora
Sitkum
Myrtle Point
Bridge
Broadbent
Remote
T28S
T29S
T30S
R12W
R11W
R10W
R09W
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commercial Thin Unit
Decommission = Yes
Renovation
Improvement
Haul Route
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.
Export Date: 7/15/2021


Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 25
Oregon
EA Unit 17
EA Unit 17
EA Unit 17
EA Unit 50
EA Unit 18
Unit 21
EA Unit 37
EA Unit 20
EA Unit 19
EA Unit 31
EA Unit 31
Big Creek Rd
29-11-1.1
29-11-2.0
29-11-11.3
29-11-10.1
29-11-10.3
29-17-10.5
29-11-22.0
29-11-10.4
29-11-15.3
29-11-15.1
29-11-23.4
RENO-37-1
RENO-37-2
RENO-17-2
0
0.4
0.8
Miles
Map Locator
T28S
T29S
T30S
R12W
R11W
R10W
R09W
Coquille
Riverton
Dora
Sitkum
Myrtle Point
Bridge
Broadbent
Remote
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commercial Thin Unit
Decommission = Yes
Renovation
Improvement
Haul Route
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.
Export Date: 7/15/2021

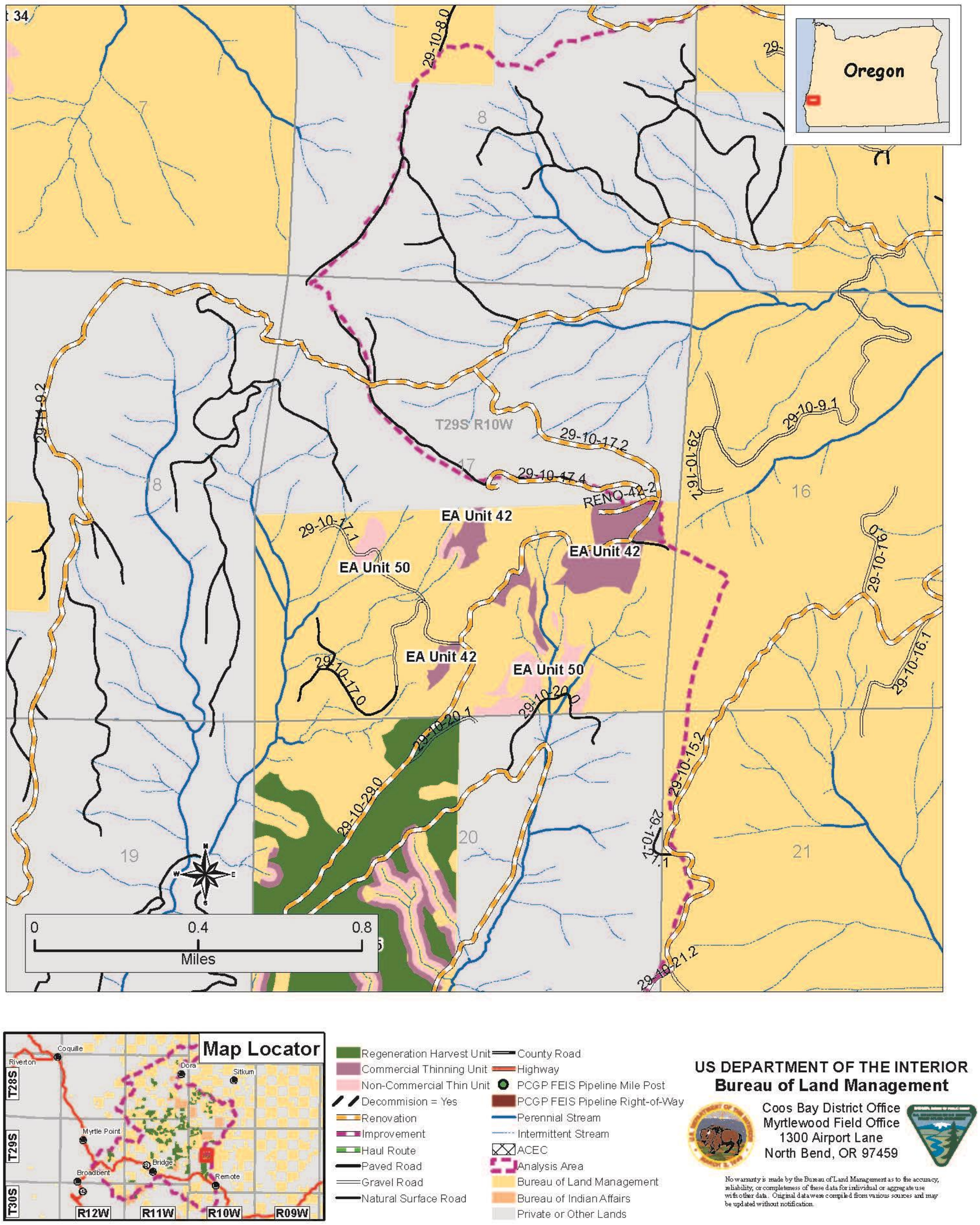
Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 26

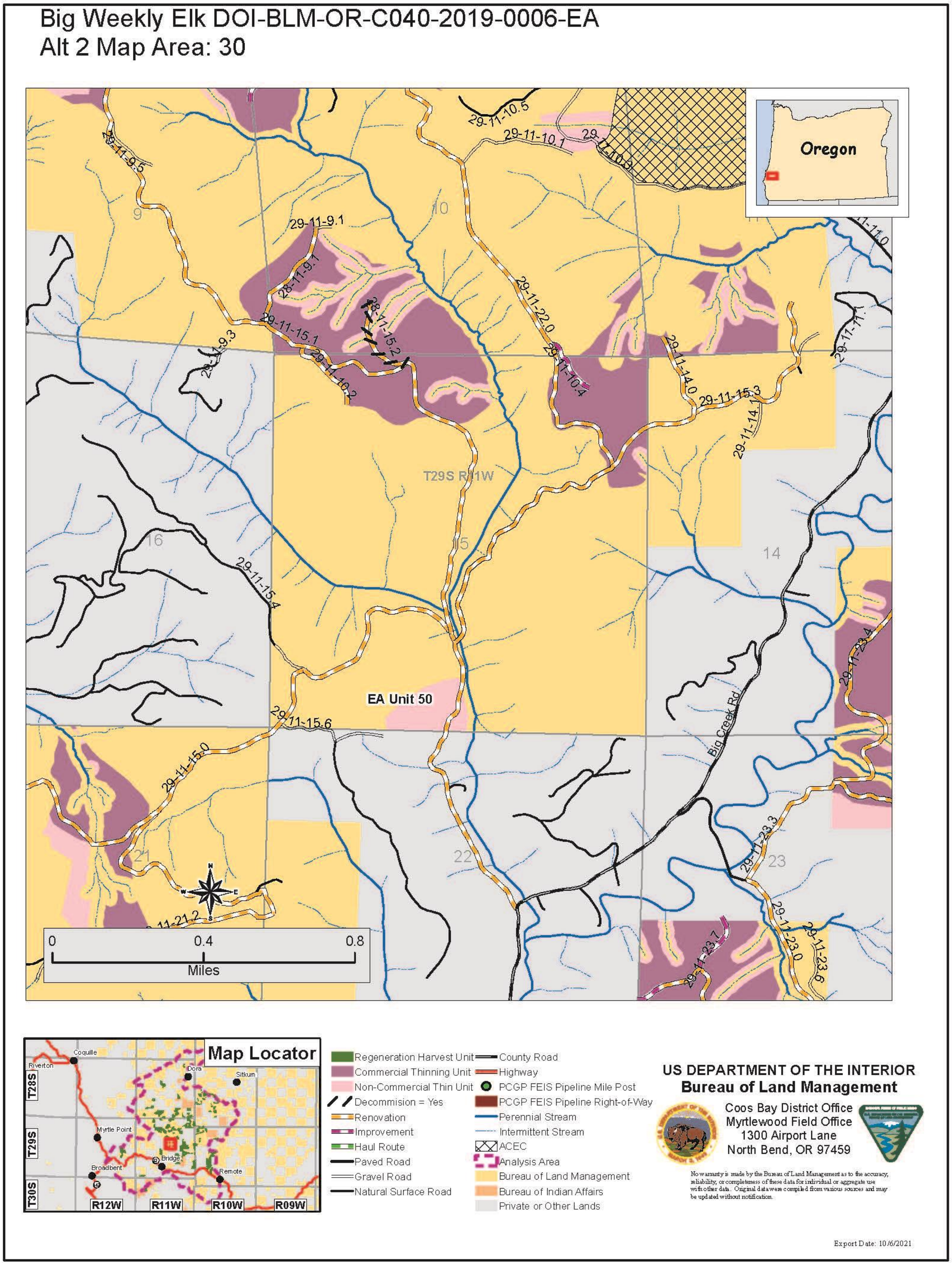



Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 27
Oregon
EA Unit 16
EA Unit 16
EA Unit 17
EA Unit 13
EA Unit 12
EA Unit 14
EA Unit 11
EA Unit 15
EA Unit 15
EA Unit 34
T28S R10W
T29S R11W
T29S R10W
28-10-31.3
28-10-31.4
28-10-31.2
29-11-1.0
29-10-6.1
29-10-6.0
29-10-6.4
29-10-5.1
29-10-6.3
29-10-5.2
28-10-32.0
29-10-9.0
29-10-8.0
29-11-12.1
29-11-28.0
Big Creek Rd
0
0.4
0.8
Miles
Map Locator
Coquille
Riverton
Dora
Sitkum
Myrtle Point
Bridge
Broadbent
Remote
T28S
T29S
T30S
R12W
R11W
R10W
R09W
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commercial Thin Unit
Decommission = Yes
Renovation
Improvement
Haul Route
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.
Export Date: 7/15/2021

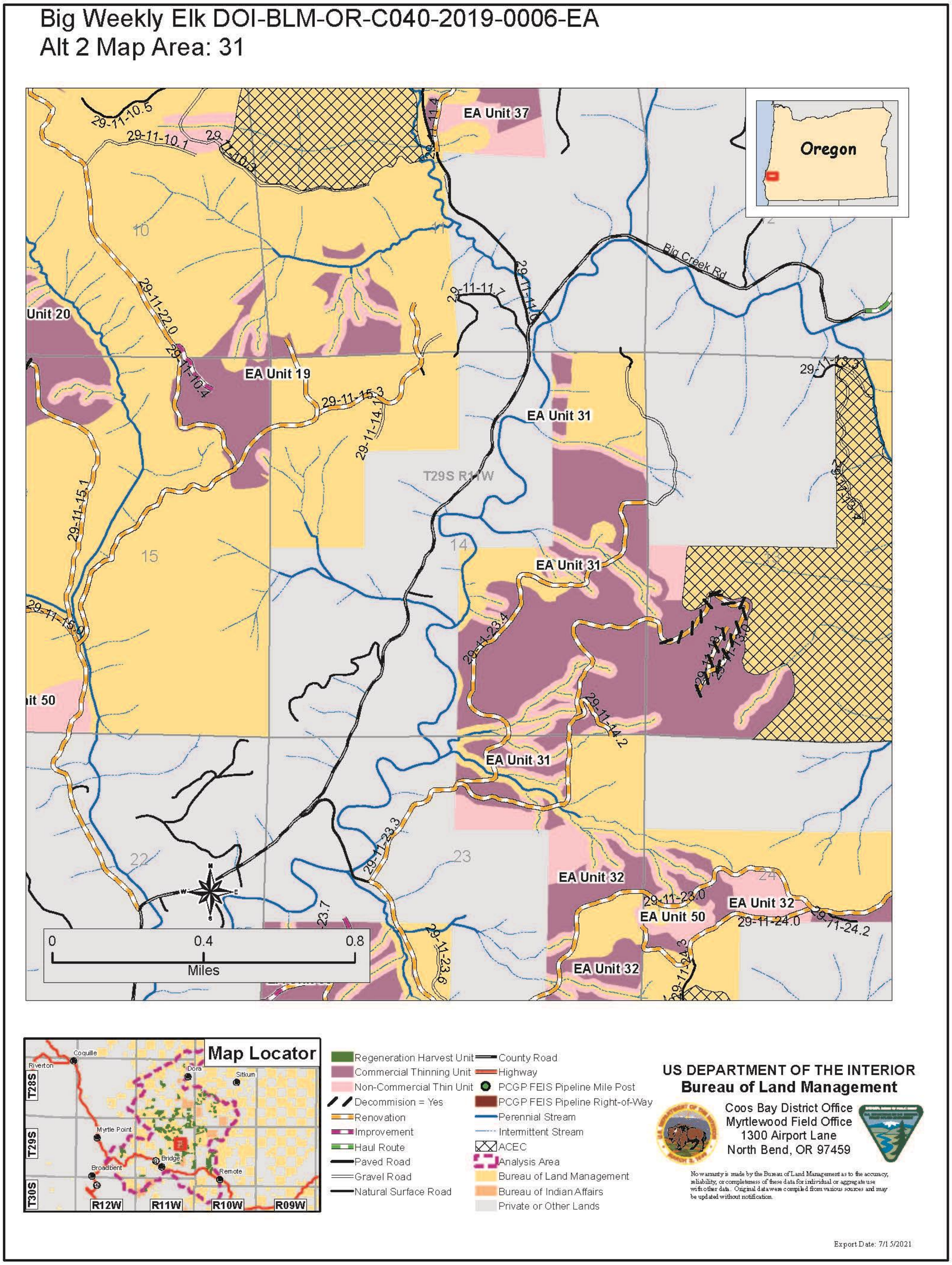

Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 28
Oregon
EA Unit 31
EA Unit 32
EA Unit 33
EA Unit 34
EA Unit 50
EA Unit 103
T29S R10W
T29S R11W
Big Creek Rd
29-11-23.4
29-11-28.3
29-11-14.2
29-11-24.0
29-11-24.2
29-11-24.1
29-11-23.0
29-11-24.3
29-11-24.4
29-11-23.5
29-11-23.1
29-11-26.1
29-11-36.0
29-11-9.2
29-10-19.0
29-10-9.2
0
0.4
0.8
Miles
Map Locator
Coquille
Riverton
Dora
Sitkum
Myrtle Point
Bridge
Broadbent
Remote
T28S
T29S
T30S
R12W
R11W
R10W
R09W
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commercial Thin Unit
Decommision = Yes
Renovation
Improvement
Haul Route
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
Export Date: 7/15/2021

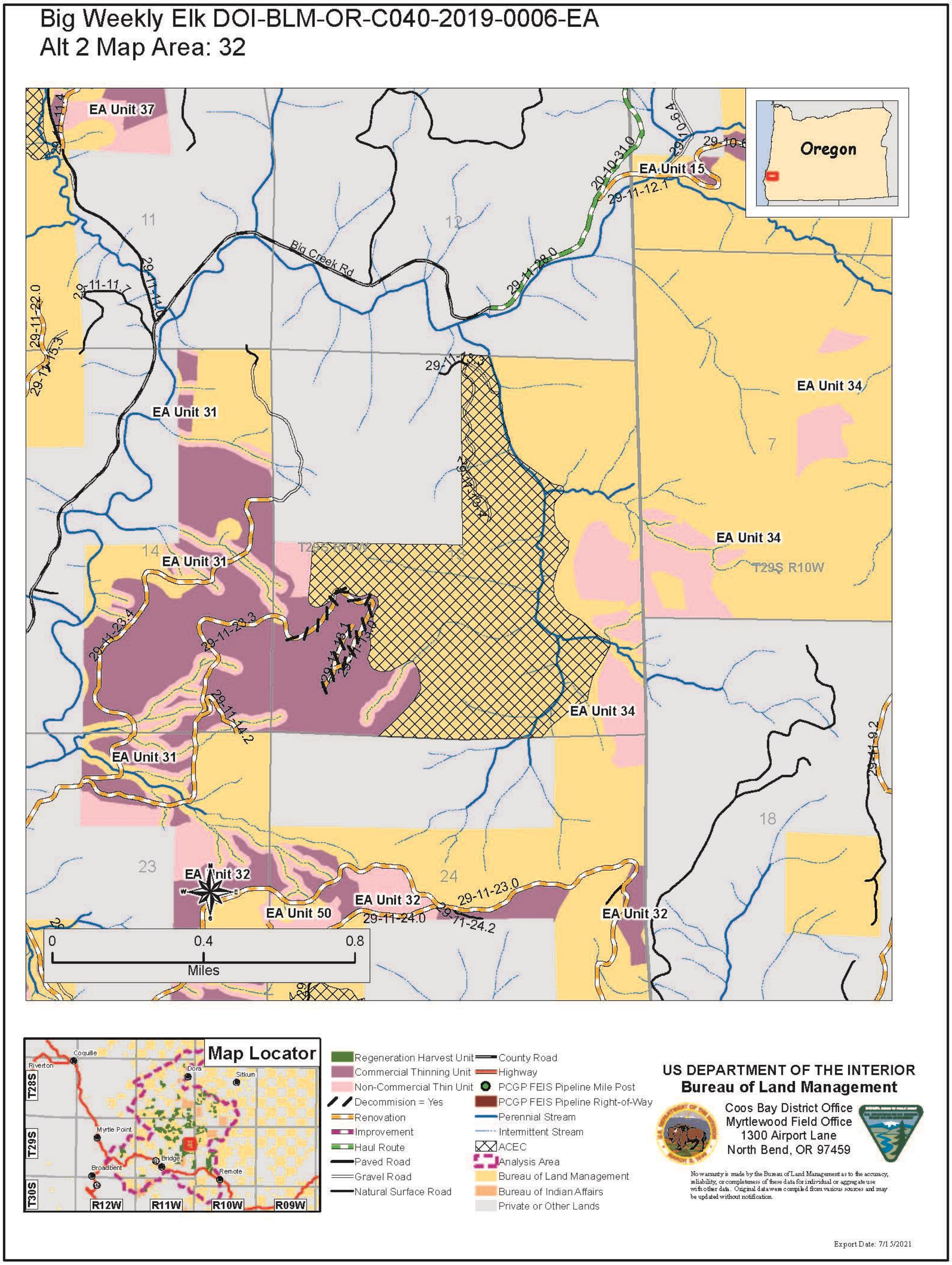
Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 29



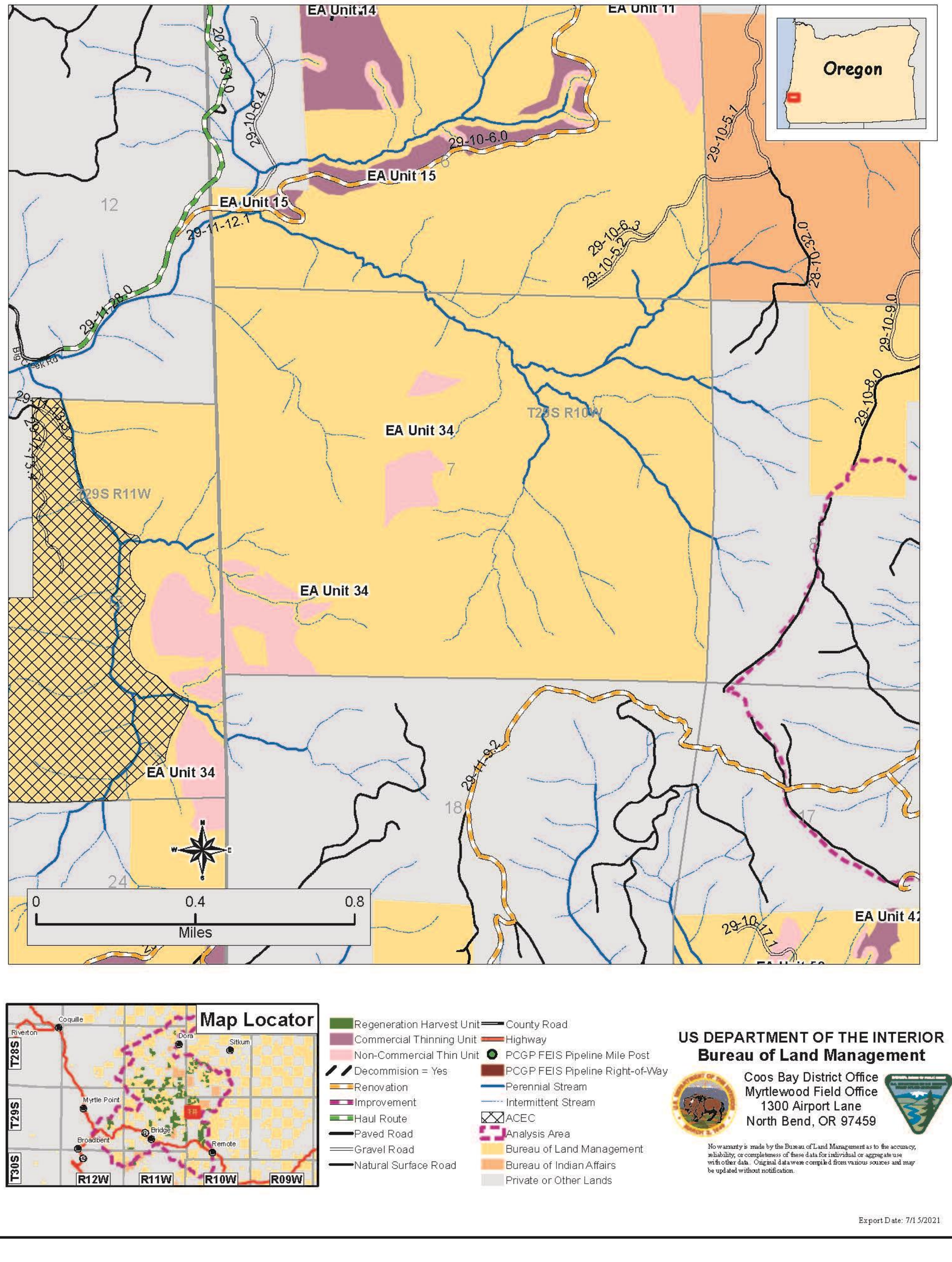

Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 30
Oregon
T29S R11W
EA Unit 50
Big Creek Rd
0
0.4
0.8
Miles
Map Locator
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commercial Thin Unit
Decommision = Yes
Renovation
Improvement
Haul Route
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
Export Date: 10/6/2021

Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 31

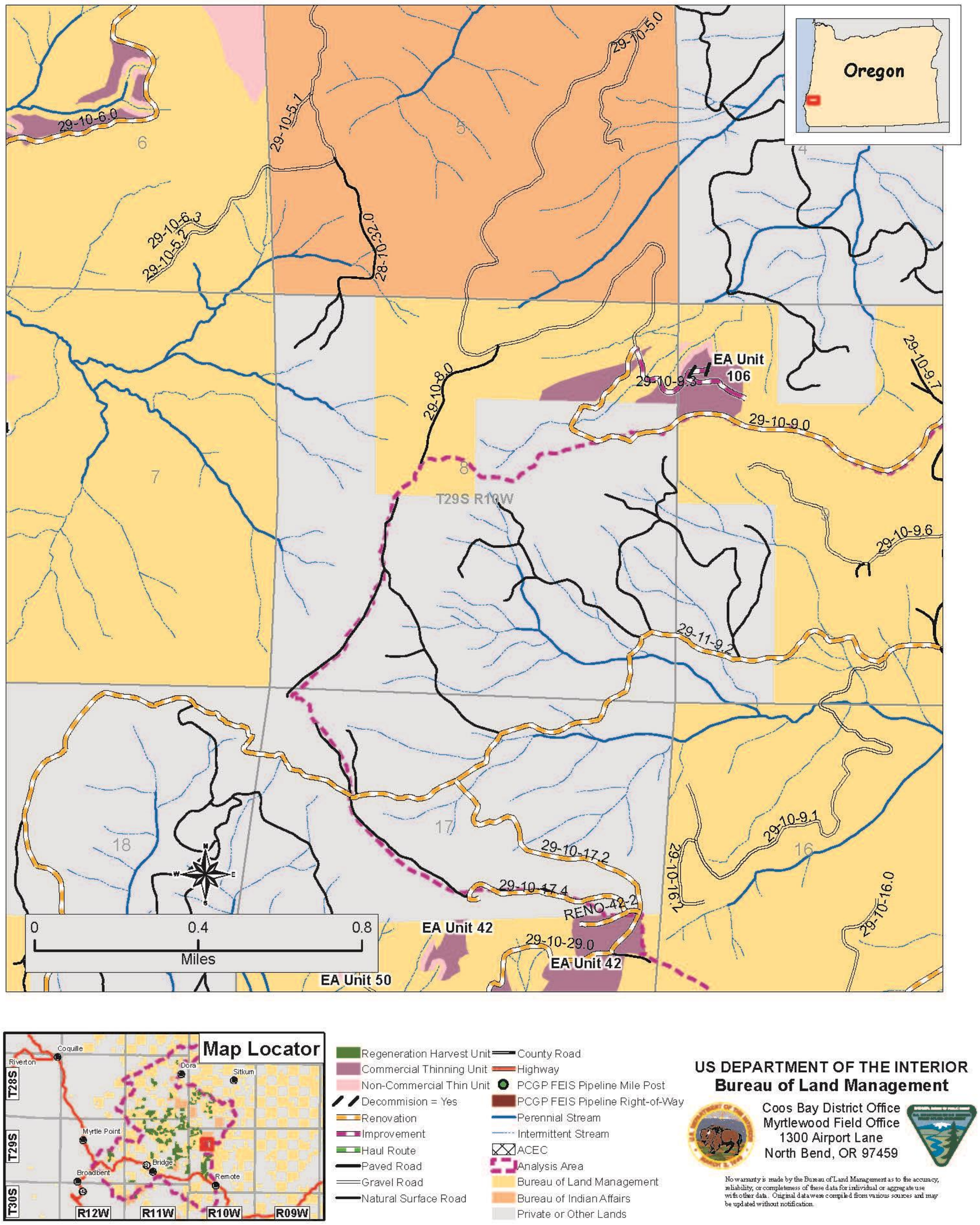


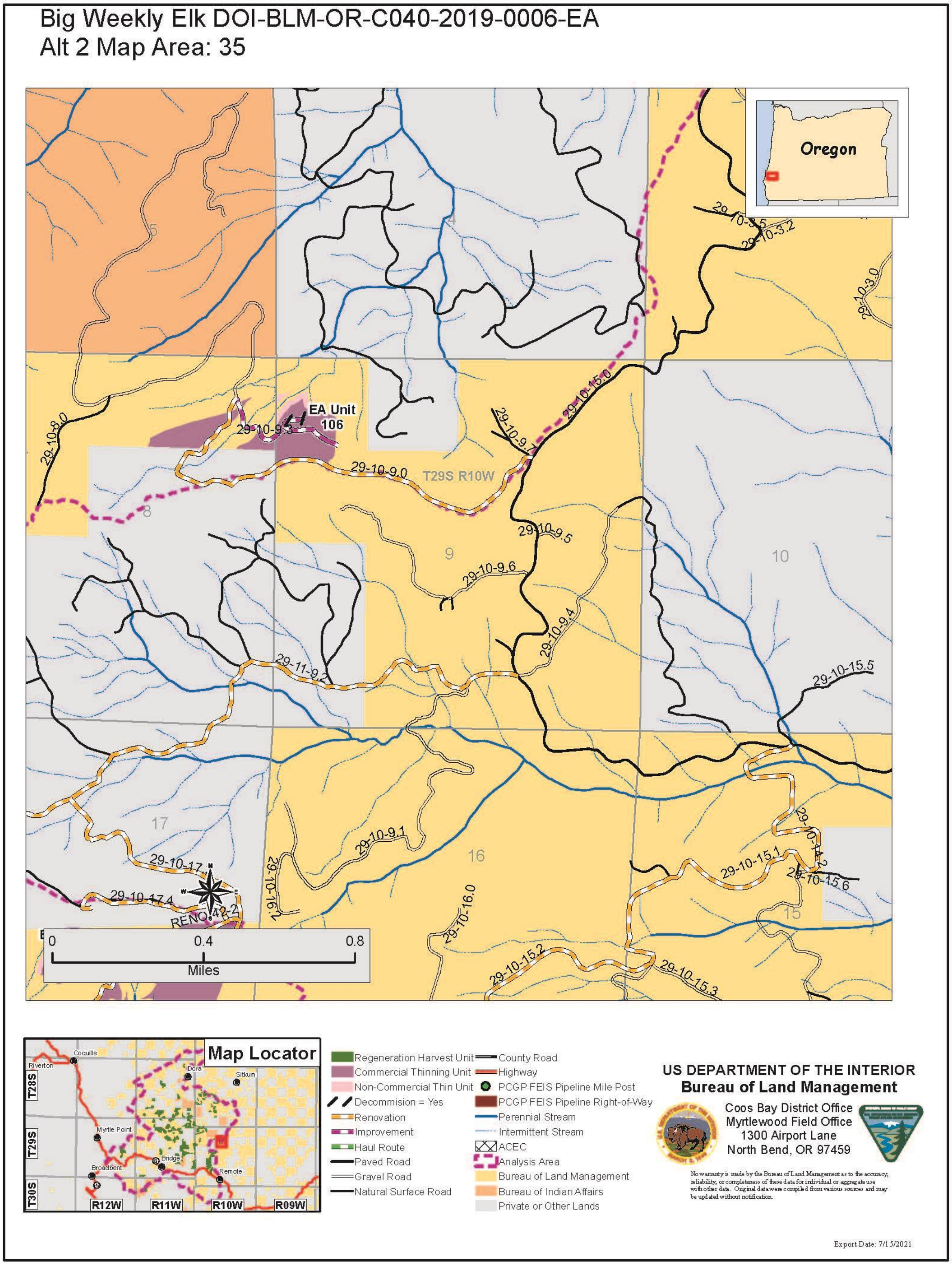

Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 32
EA Unit 37
EA Unit 15
EA Unit 31
EA Unit 34
EA Unit 32
EA Unit 50
Big Creek Rd
Oregon
T29S R10W
0
0.4
0.8
Miles
Map Locator
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commercial Thin Unit
Decommission = Yes
Renovation
Improvement
Haul Route
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.
Export Date: 7/15/2021

Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 33



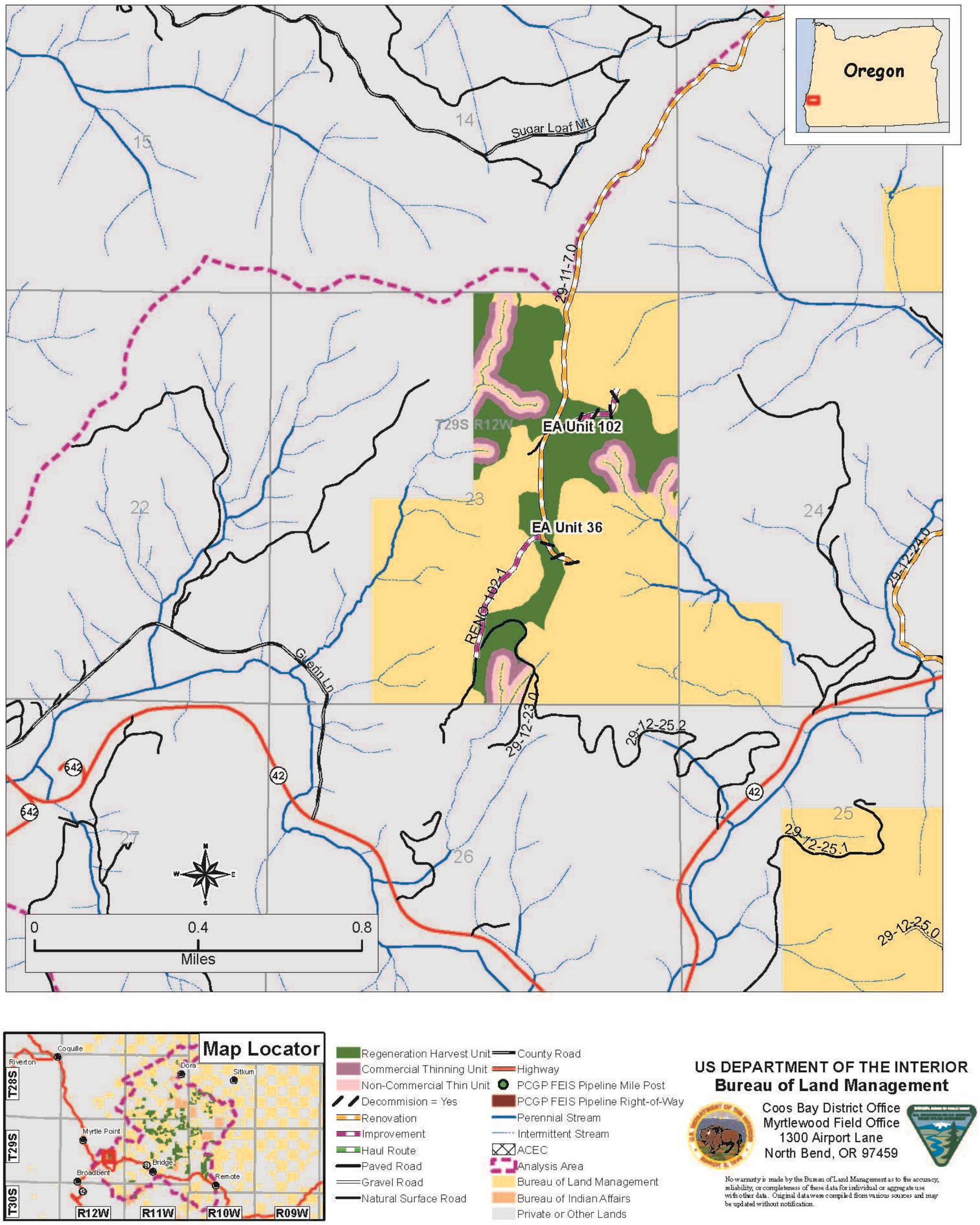
Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 34

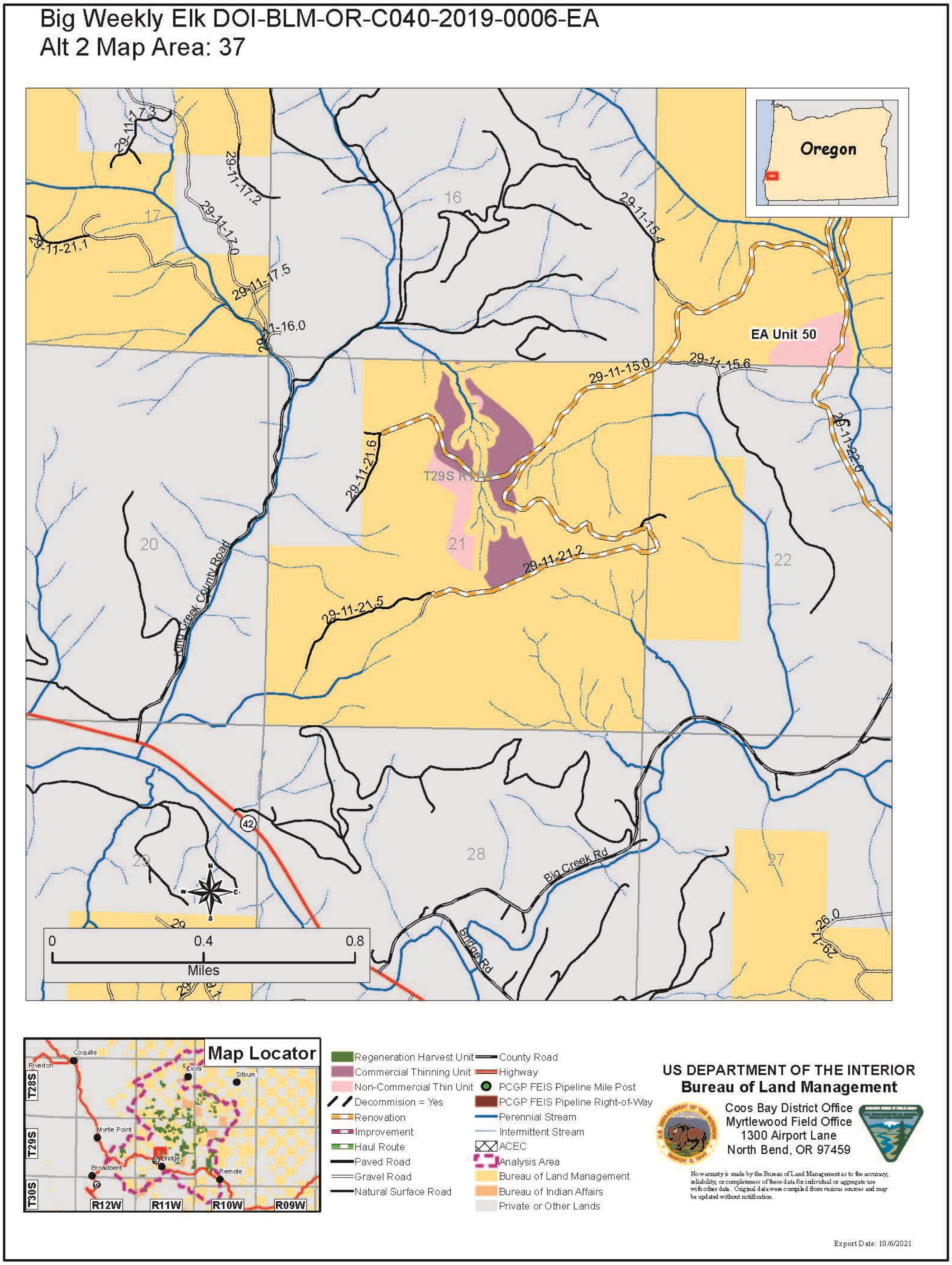


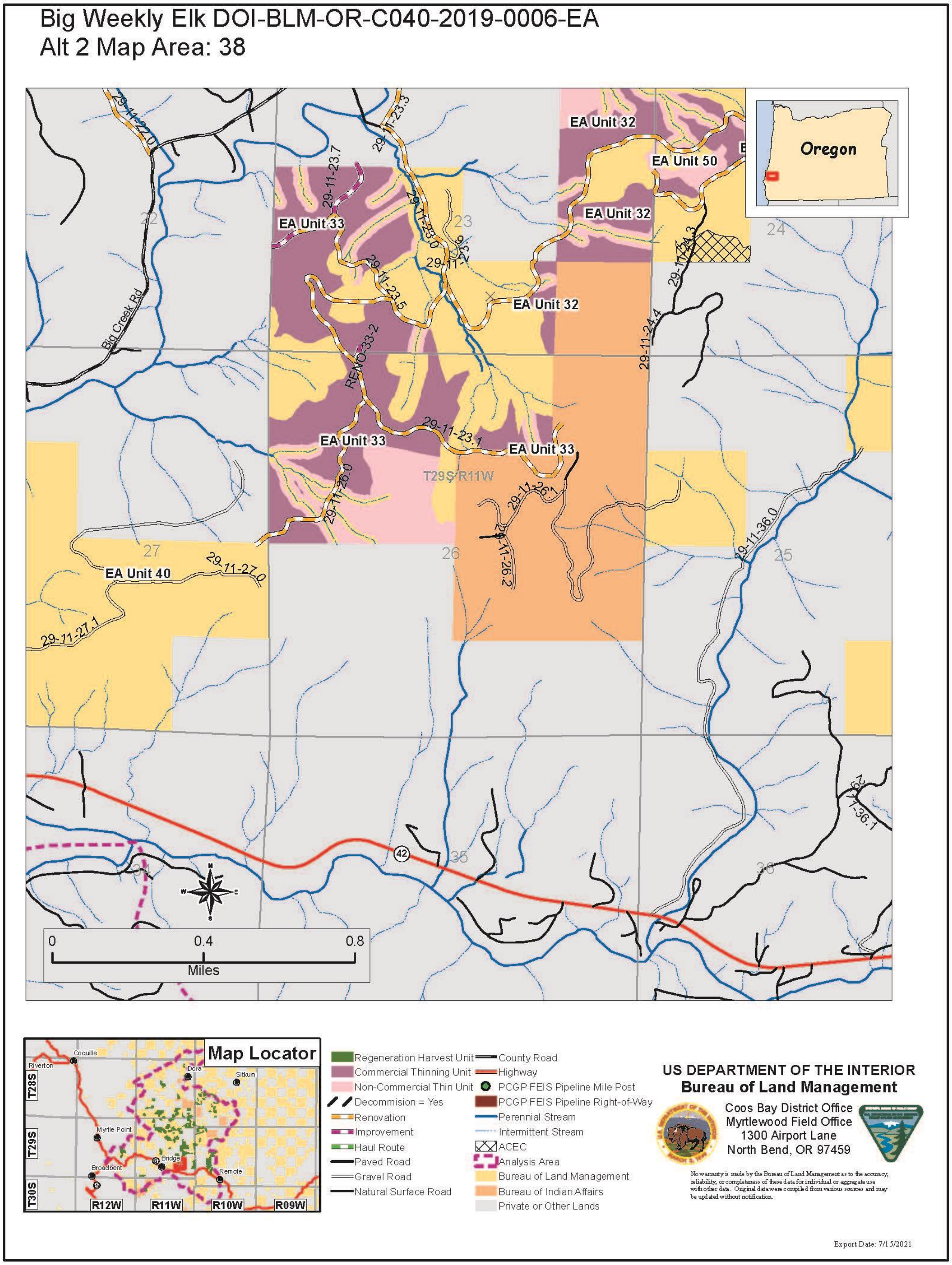


Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 35
Oregon
EA Unit 106
29-10-9.3
29-10-9.0
T29S R10W
29-10-9.7
29-10-15.0
29-10-8.0
29-10-3.5
29-10-3.2
29-10-3.0
29-10-9.5
29-10-9.6
29-10-9.4
29-11-9.2
29-10-15.5
29-10-9.1
29-10-17
29-10-17.4
29-10-16.1
29-10-16.0
29-10-15.2
29-10-15.3
29-10-15.1
29-10-14.2
29-10-15.6
0
0.4
0.8
Miles
Map Locator
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commercial Thin Unit
Decommission = Yes
Renovation
Improvement
Haul Route
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
Export Date: 7/15/2021

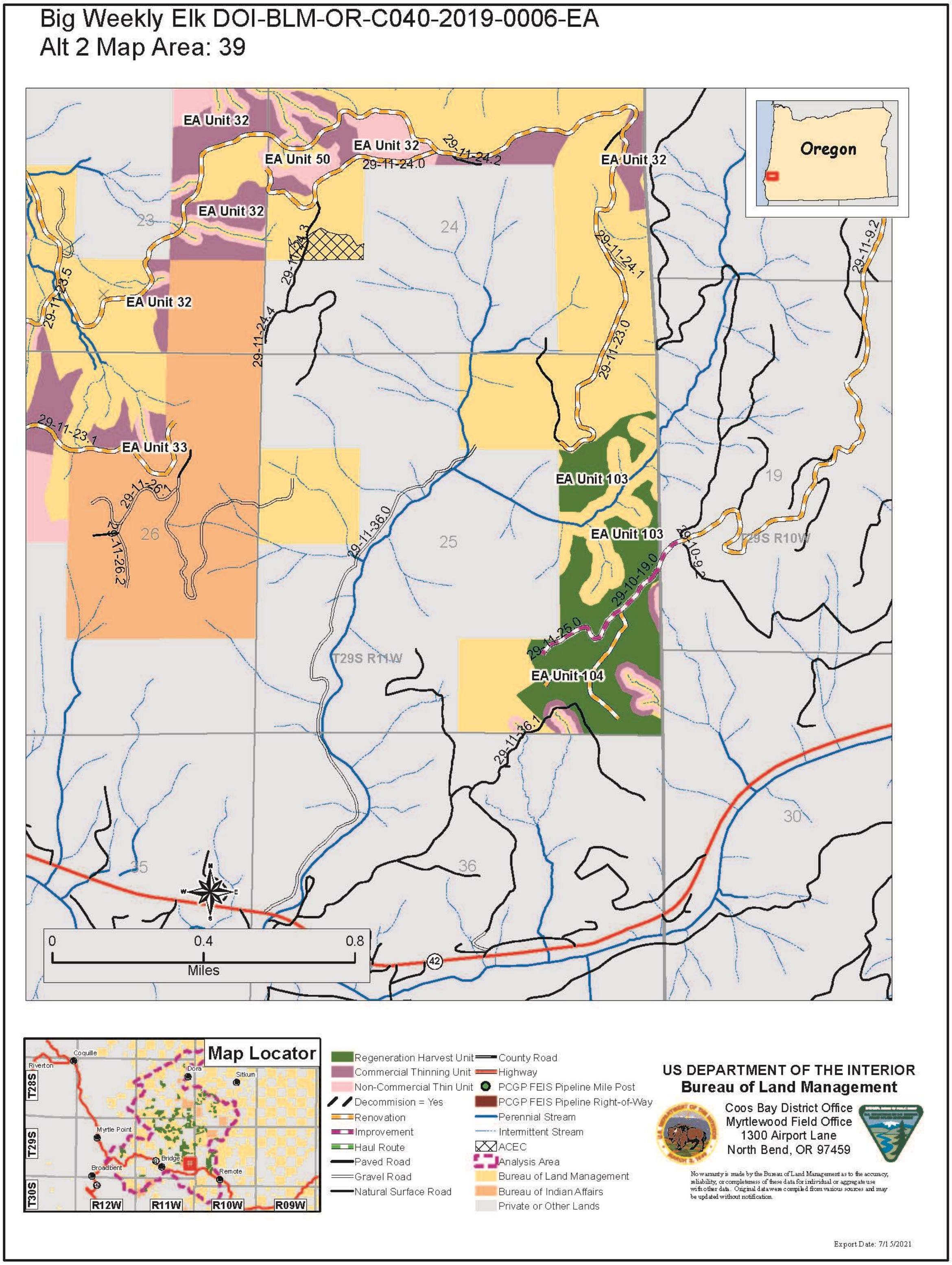
Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 36



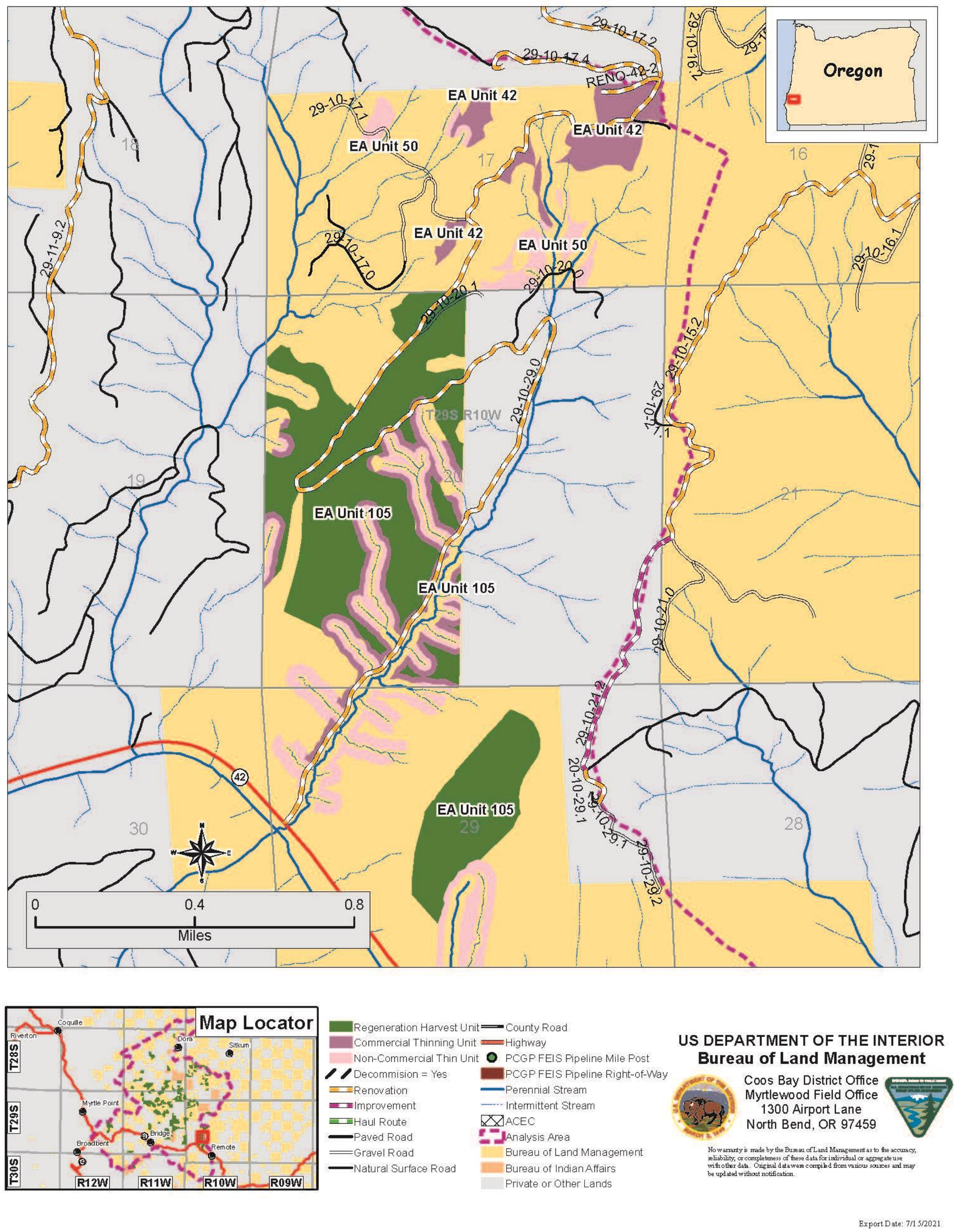

Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 37
Oregon
EA Unit 50
T29S R11W
16
17
20
21
22
27
28
29-11-17.3
29-11-17.2
29-11-17.0
29-11-17.5
29-11-21.1
29-11-16.0
29-11-15.4
29-11-15.0
29-11-15.6
29-11-22.0
29-11-21.6
29-11-21.2
29-11-21.5
29-11-26.0
Big Creek County Road
Big Creek Rd
Bridge Rd
42
0
0.4
0.8
Miles
Map Locator
Coquille
Riverton
Dora
Sitkum
Myrtle Point
Bridge
Broadbent
Remote
T28S
T29S
T30S
R12W
R11W
R10W
R09W
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commercial Thin Unit
Decommission = Yes
Renovation
Improvement
Haul Route
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.
Export Date: 10/6/2021



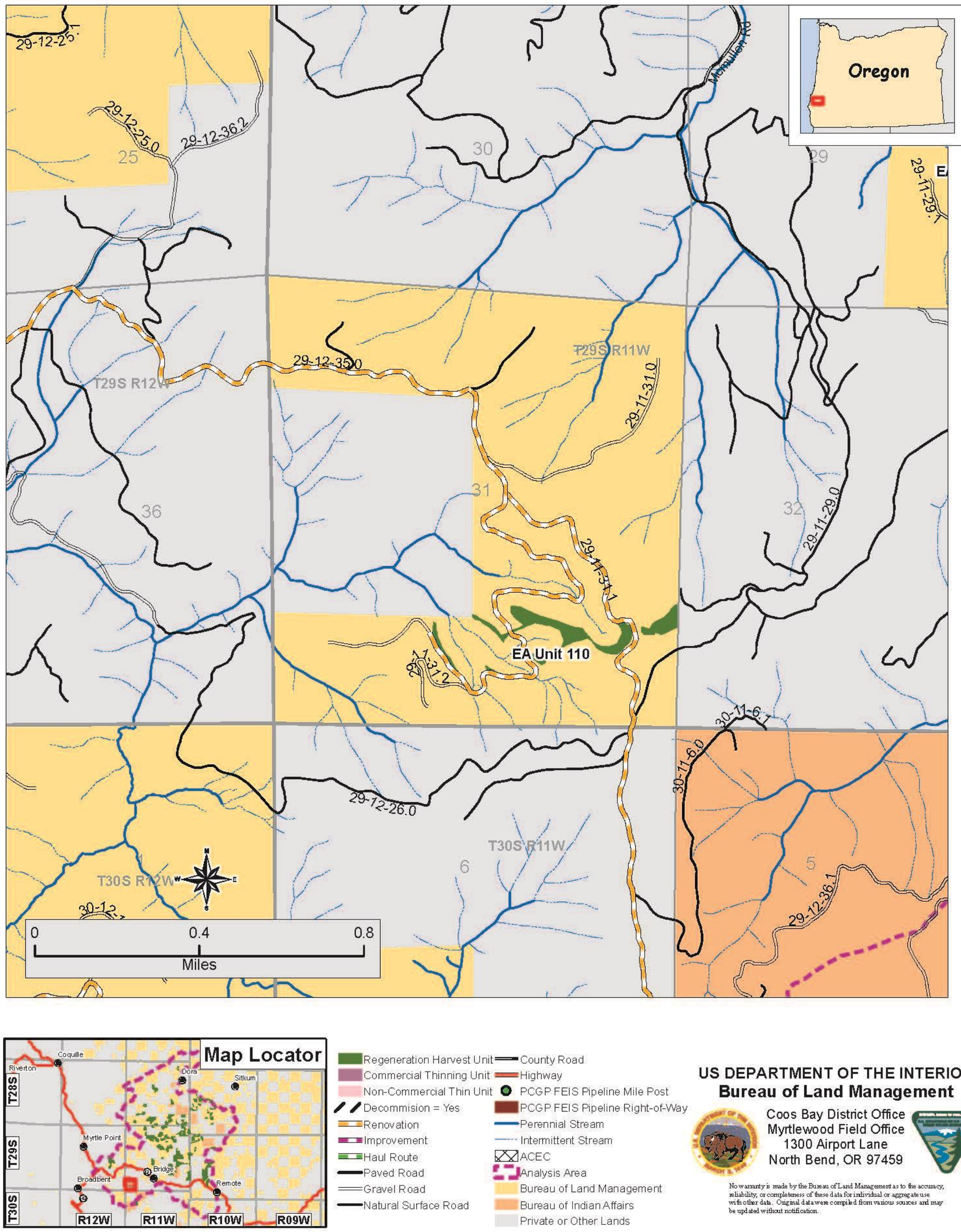
Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 38
EA Unit 32
EA Unit 50
EA Unit 33
EA Unit 40
Oregon
T29S R11W
Big Creek Rd
RENO-33-2
29-11-23.7
29-11-23.5
29-11-23.1
29-11-26.0
29-11-26.2
29-11-27.0
29-11-27.1
29-11-24.4
29-11-36.0
29-11-36.1
0
0.4
0.8
Miles
Map Locator
Coquille
Riverton
Dora
Sitkum
Myrtle Point
Bridge
Broadbent
Remote
T28S
T29S
T30S
R12W
R11W
R10W
R09W
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commercial Thin Unit
Decommission = Yes
Renovation
Improvement
Haul Route
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.
Export Date: 7/15/2021


Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 39
EA Unit 32
EA Unit 50
EA Unit 33
EA Unit 103
EA Unit 104
29-11-24.0
29-11-24.2
29-11-24.1
29-11-23.0
29-11-23.5
29-11-23.1
29-11-24.4
29-11-26.1
29-11-26.2
29-11-36.0
29-11-36.1
29-11-25.0
29-10-19.0
29-10-9.2
29-11-9.2
T29S R11W
T29S R10W
Oregon
0
0.4
0.8
Miles
42
Map Locator
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commercial Thin Unit
Decommision = Yes
Renovation
Improvement
Haul Route
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.
Export Date: 7/15/2021

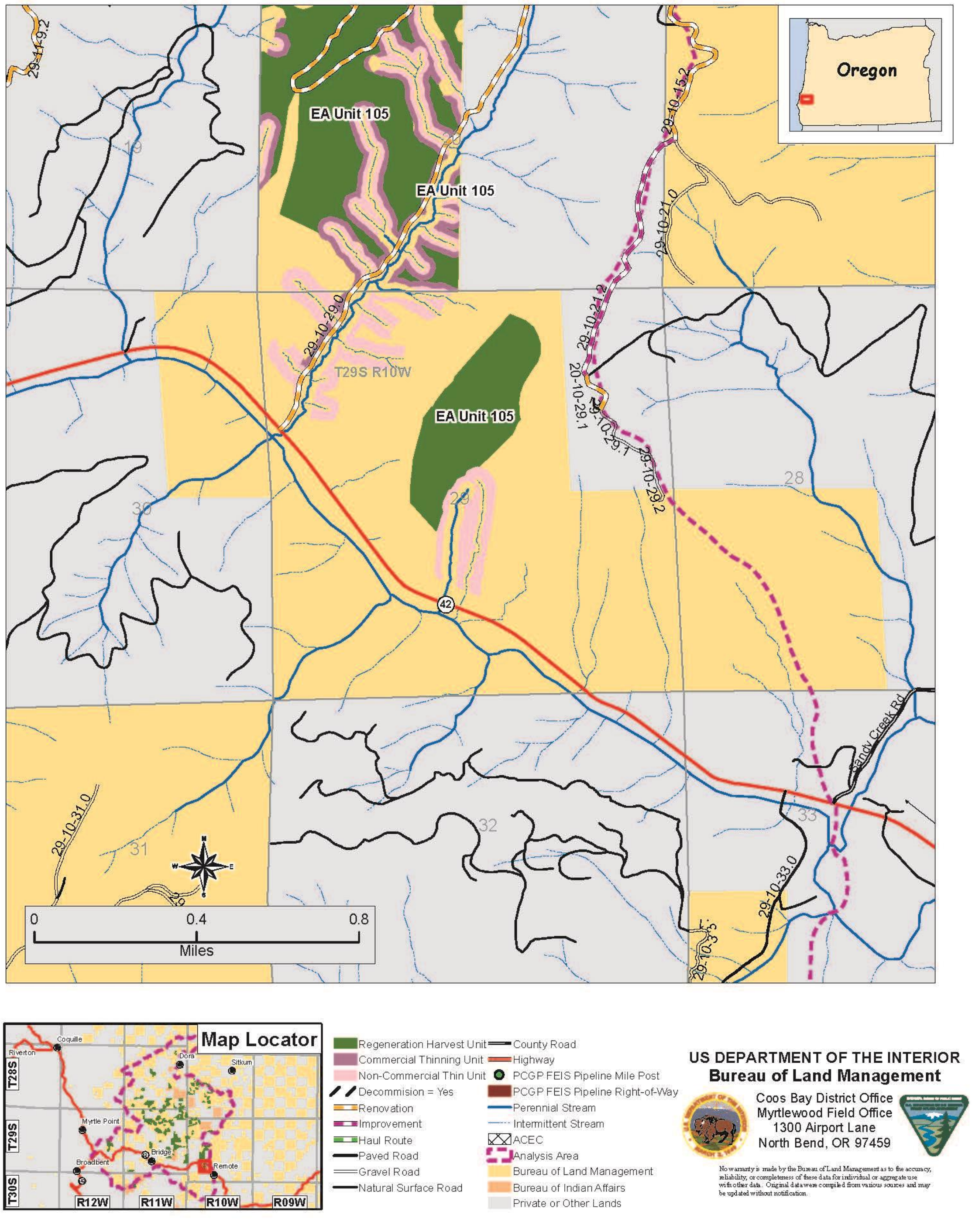
Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 40

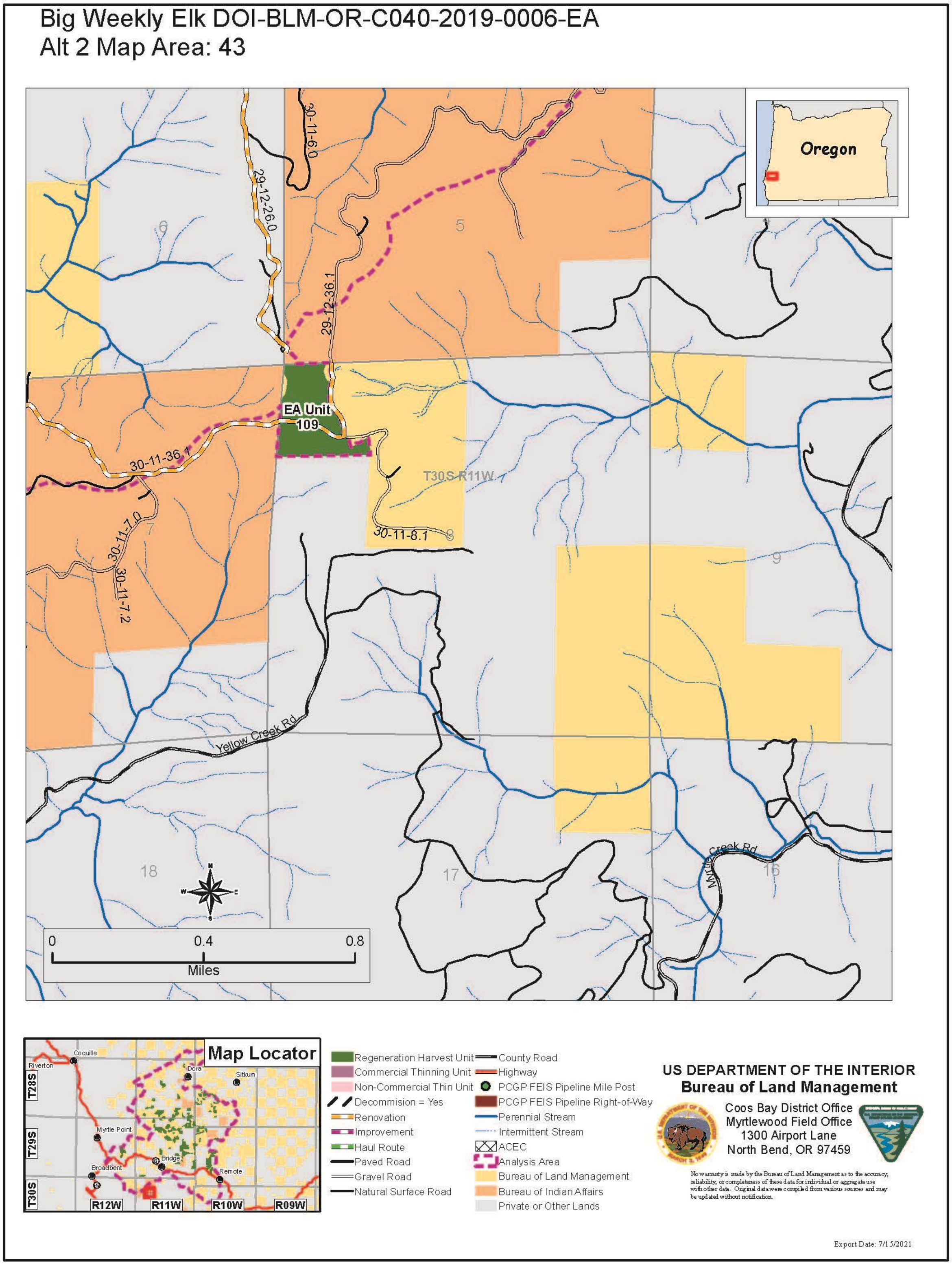


Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 41

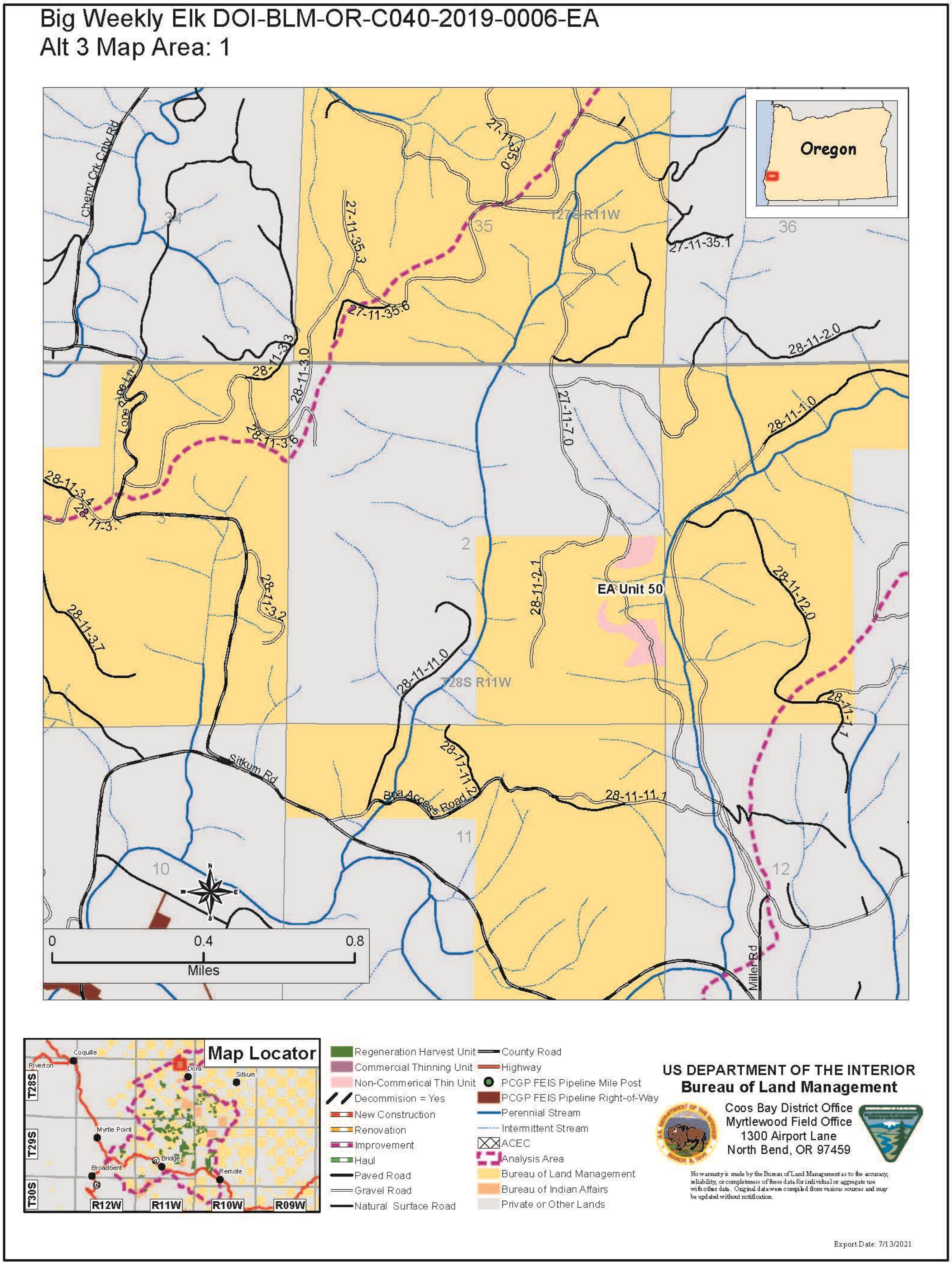


Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 42

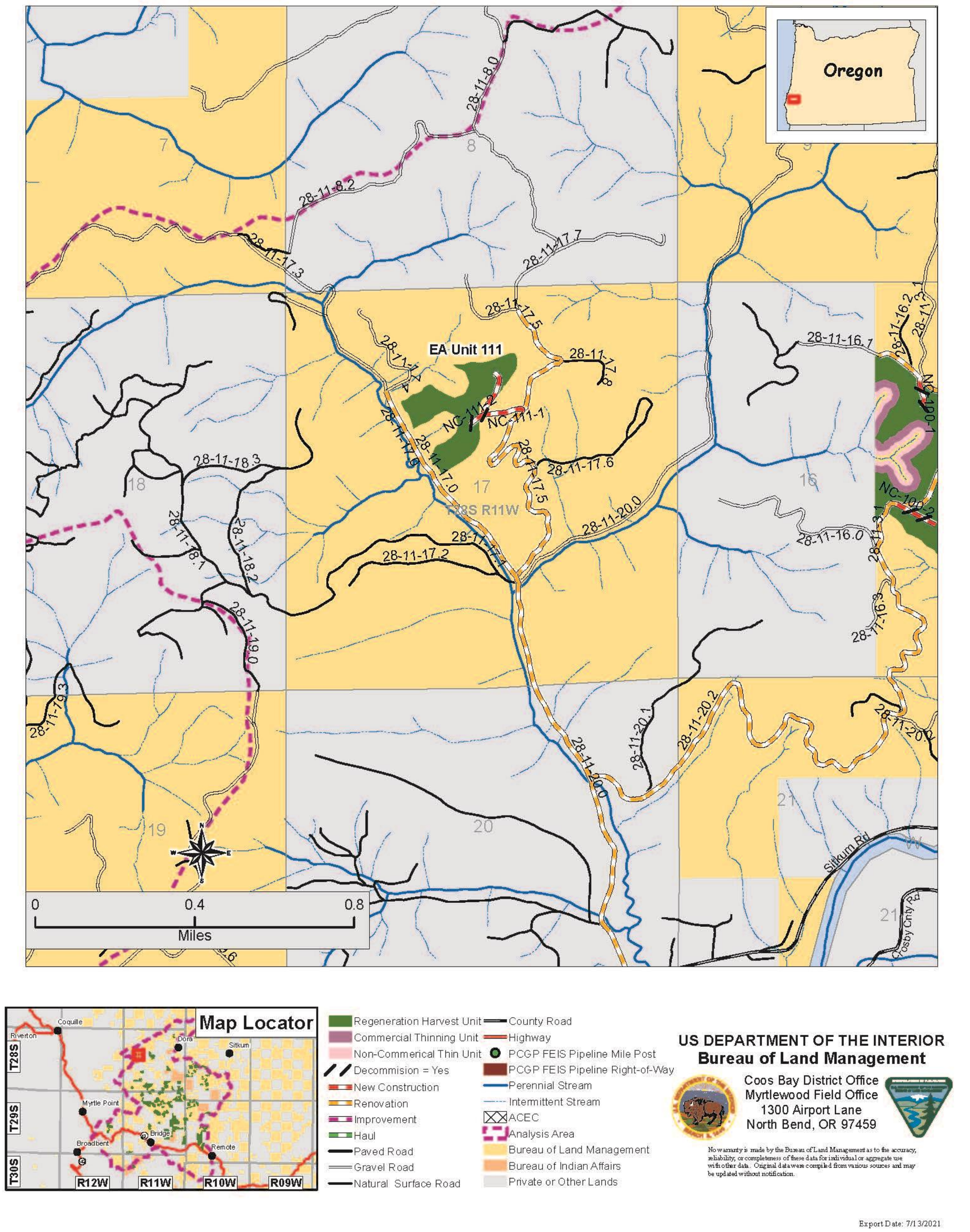



Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 2 Map Area: 43
Oregon
30-11-6.0
29-12-26.0
29-12-36.1
30-11-36.1
30-11-7.0
30-11-7.2
30-11-8.1
EA Unit
109
T30S R11W
6
5
8
9
18
17
16
Yellow Creek Rd
Myrtle Creek Rd
0
0.4
0.8
Miles
Map Locator
Coquille
Riverton
Dora
Sitkum
Myrtle Point
Bridge
Broadbent
Remote
T28S
T29S
T30S
R12W
R11W
R10W
R09W
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commercial Thin Unit
Decommision = Yes
Renovation
Improvement
Haul Route
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.
Export Date: 7/15/2021

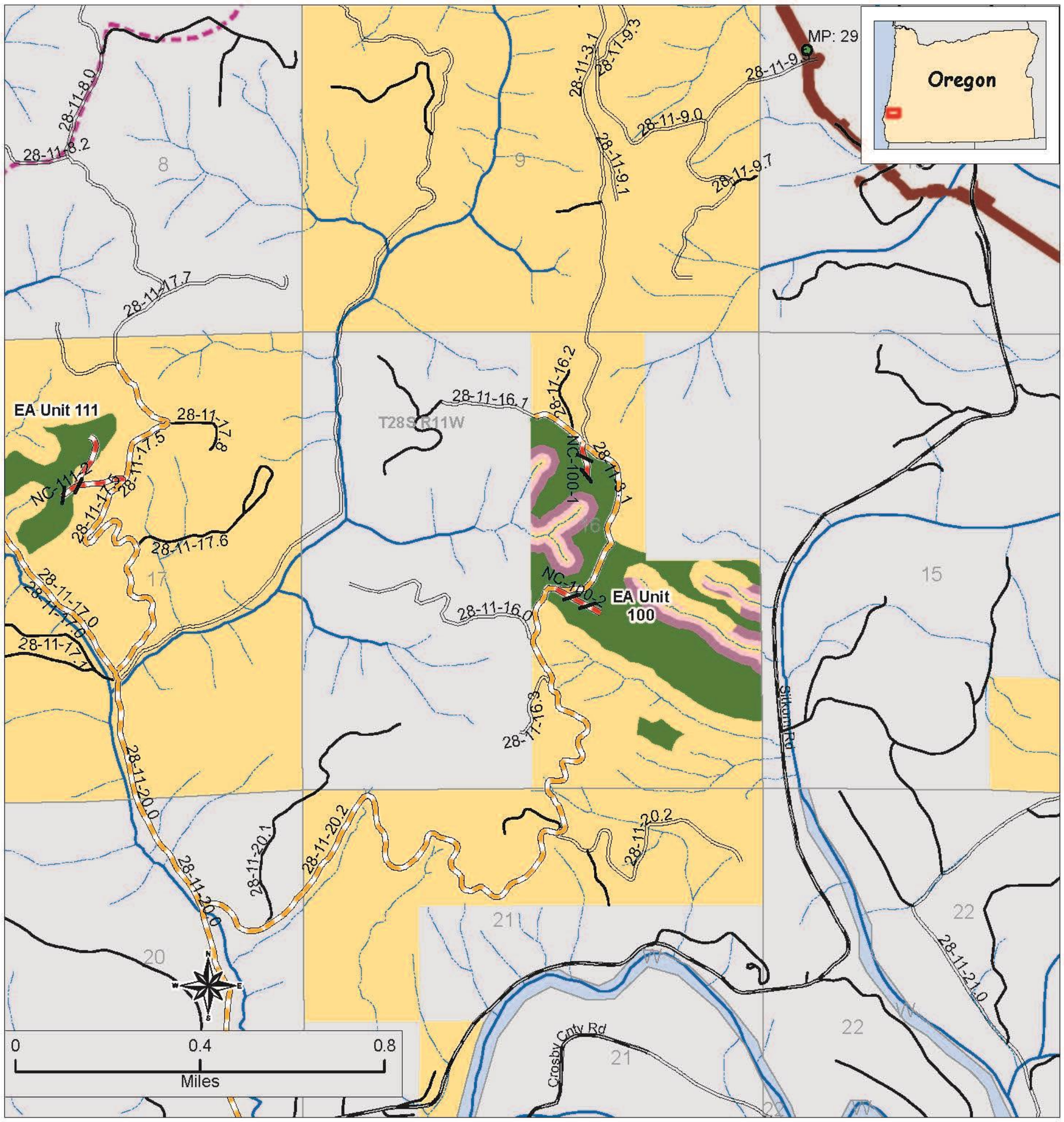
Alternative 3 Maps:



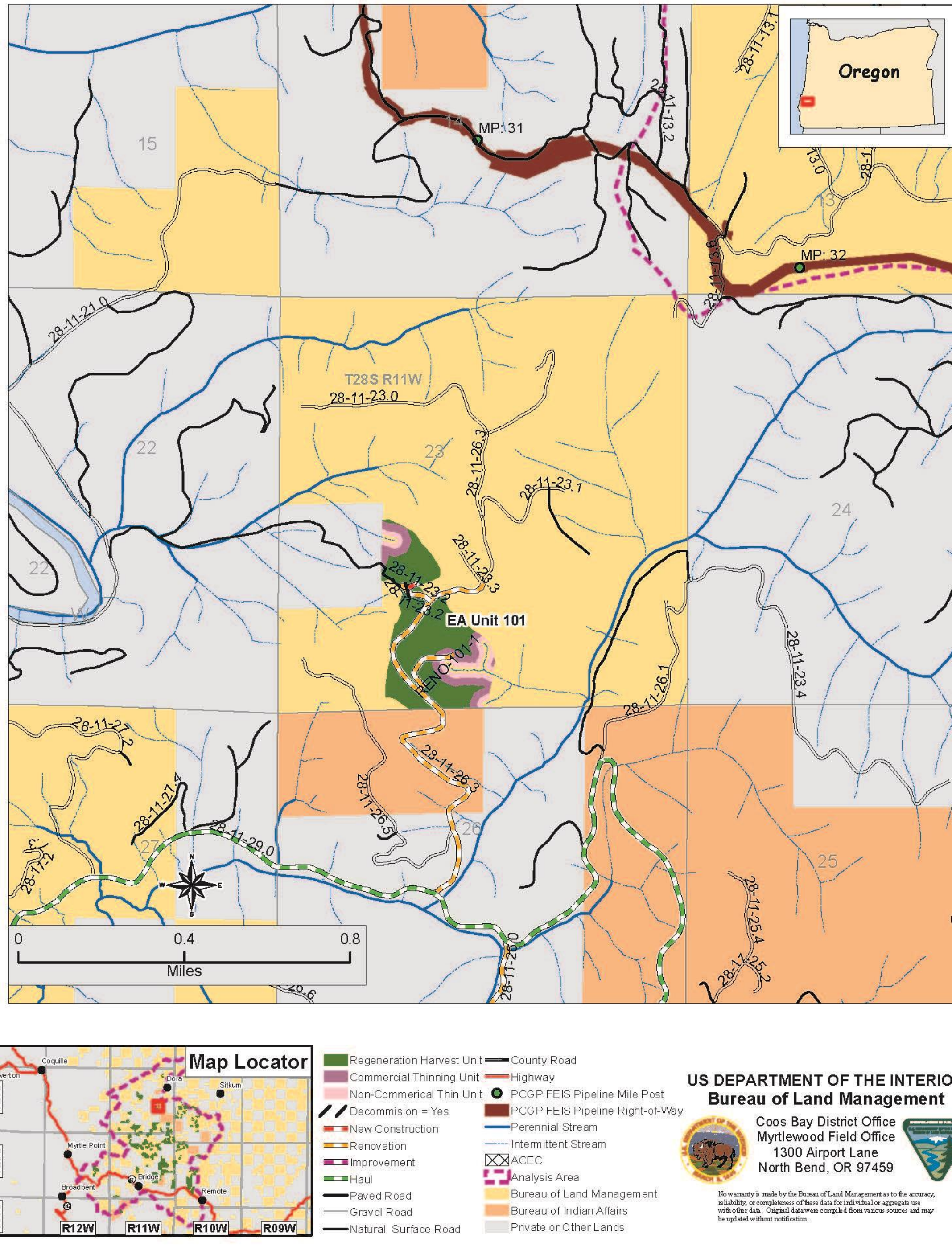
Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 2



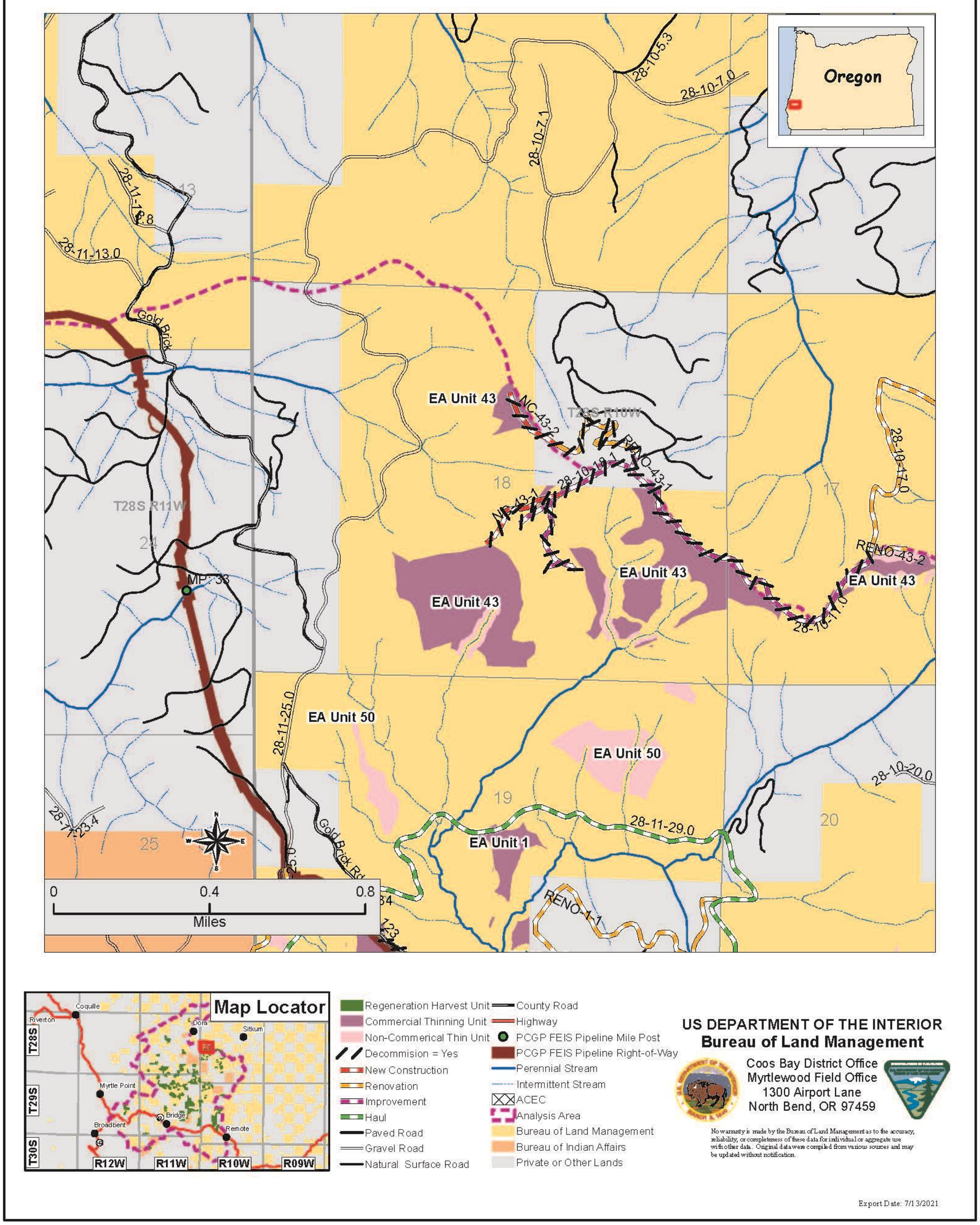
Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 3



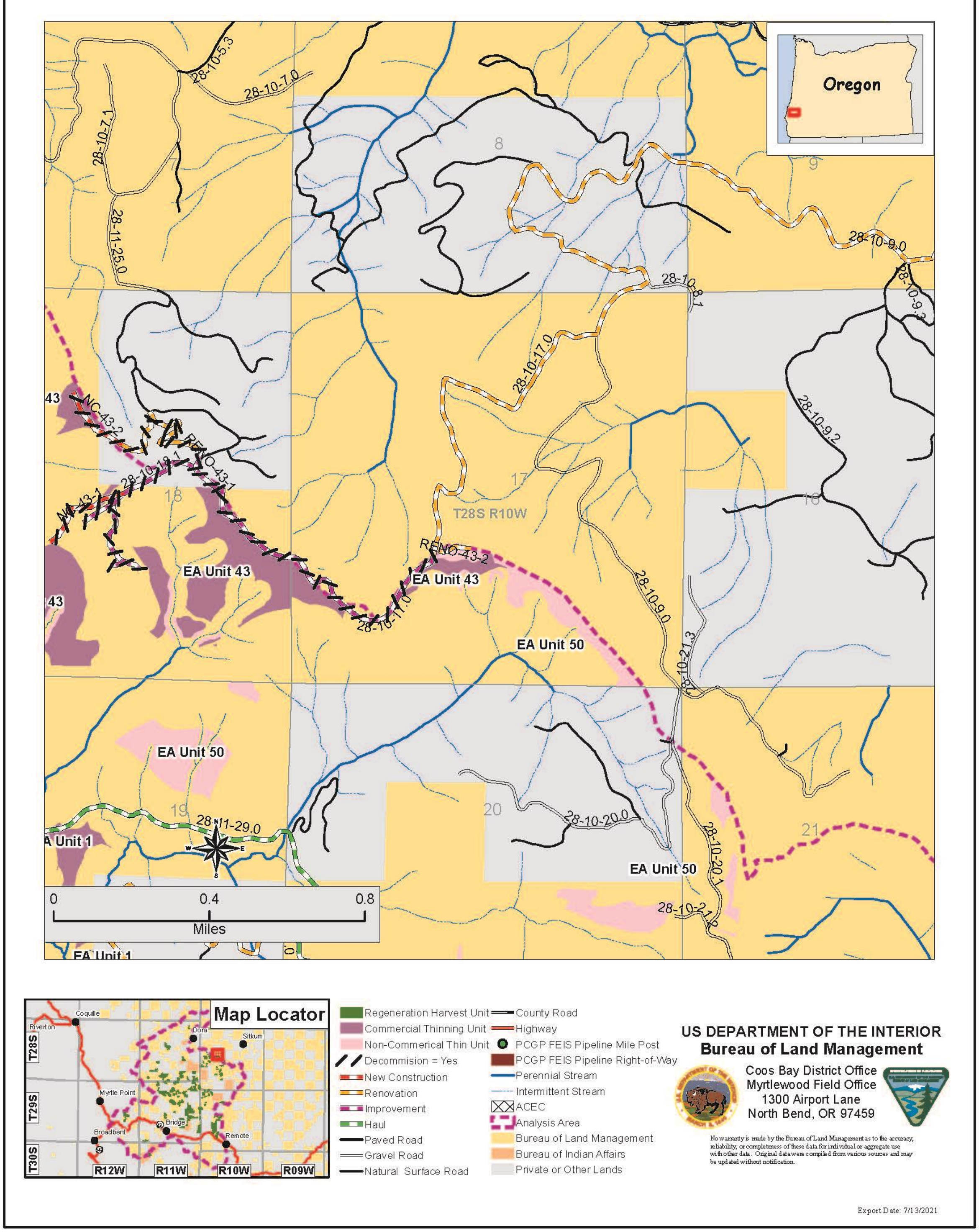
Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 4

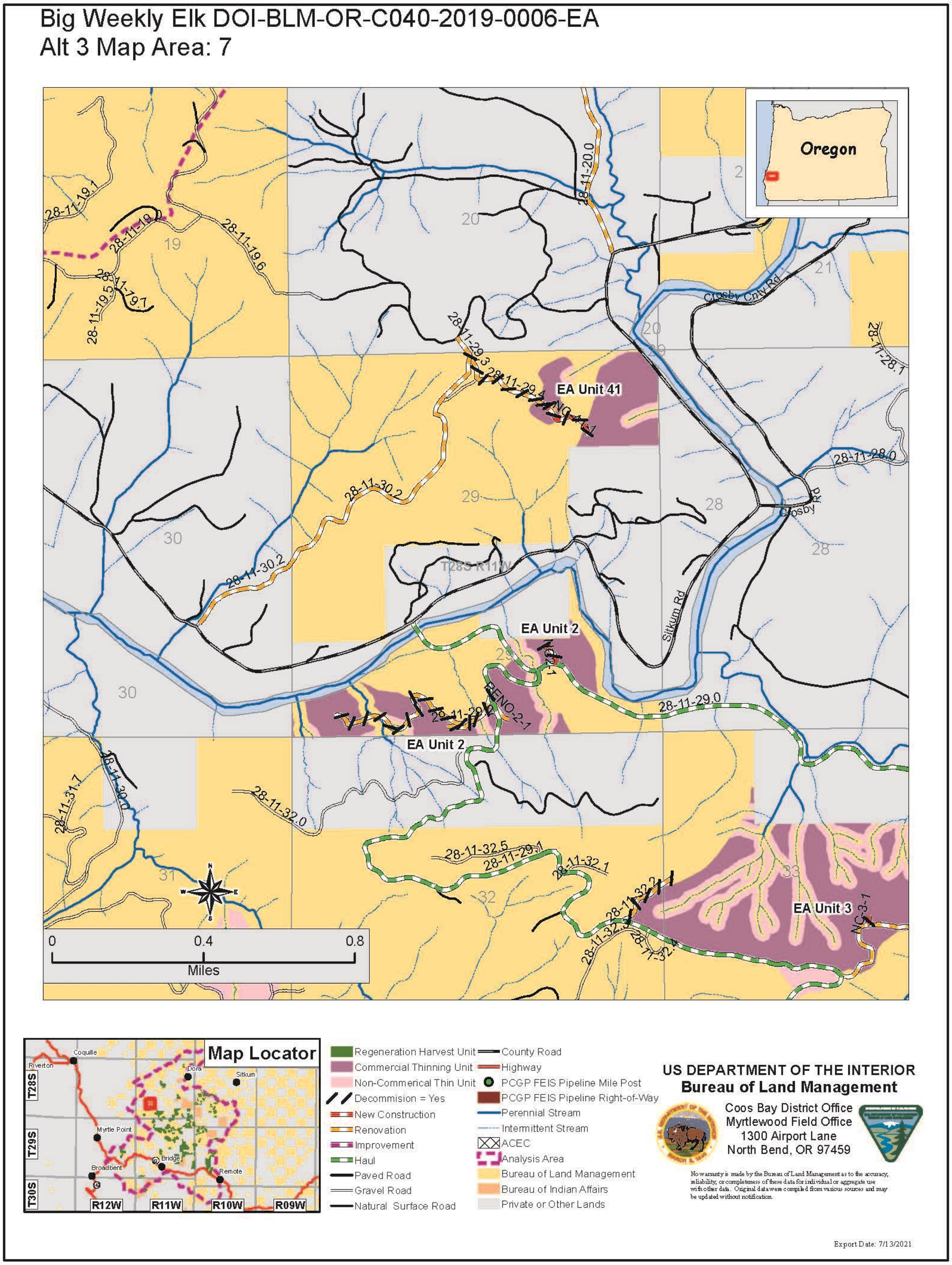


Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 5

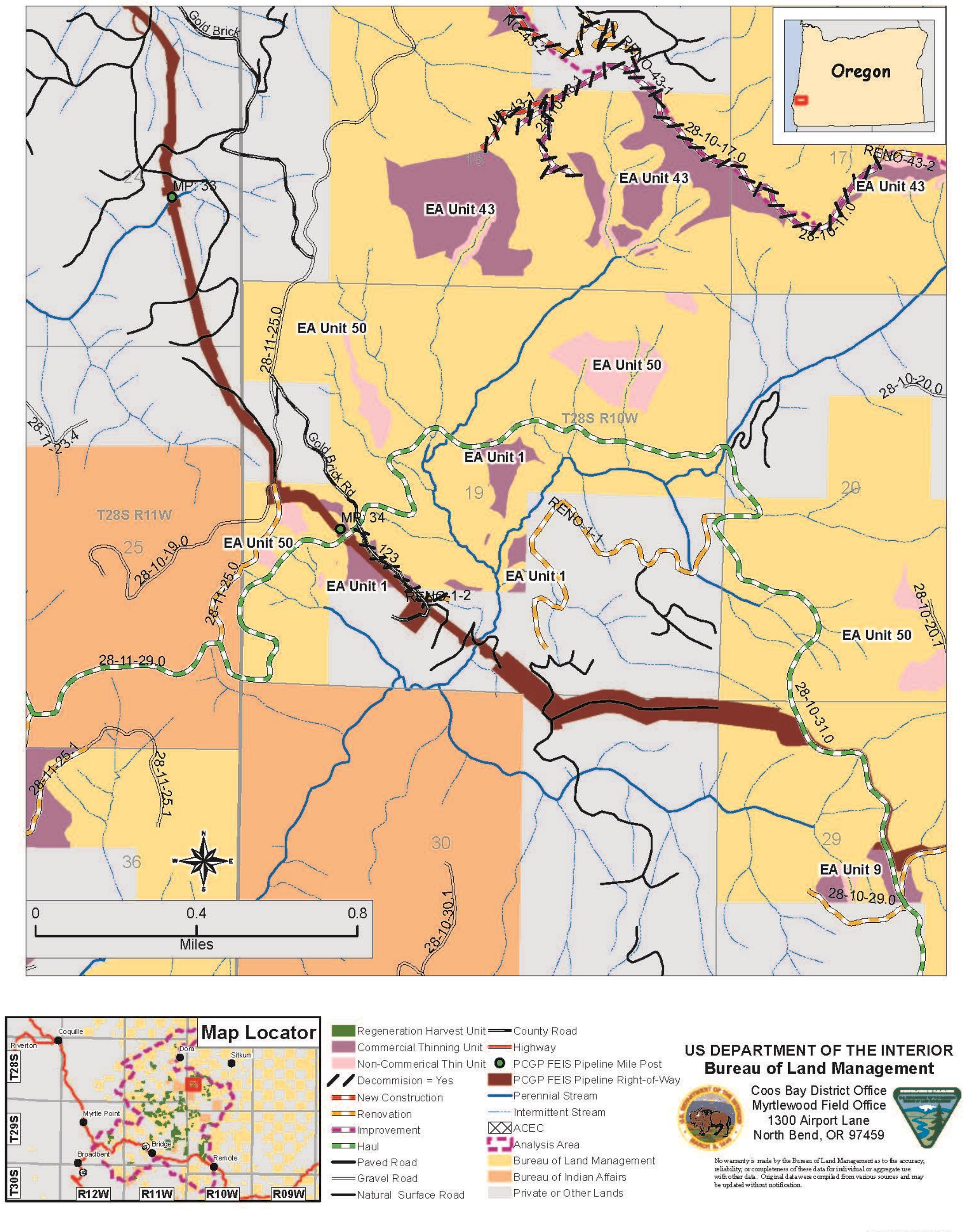


Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 6

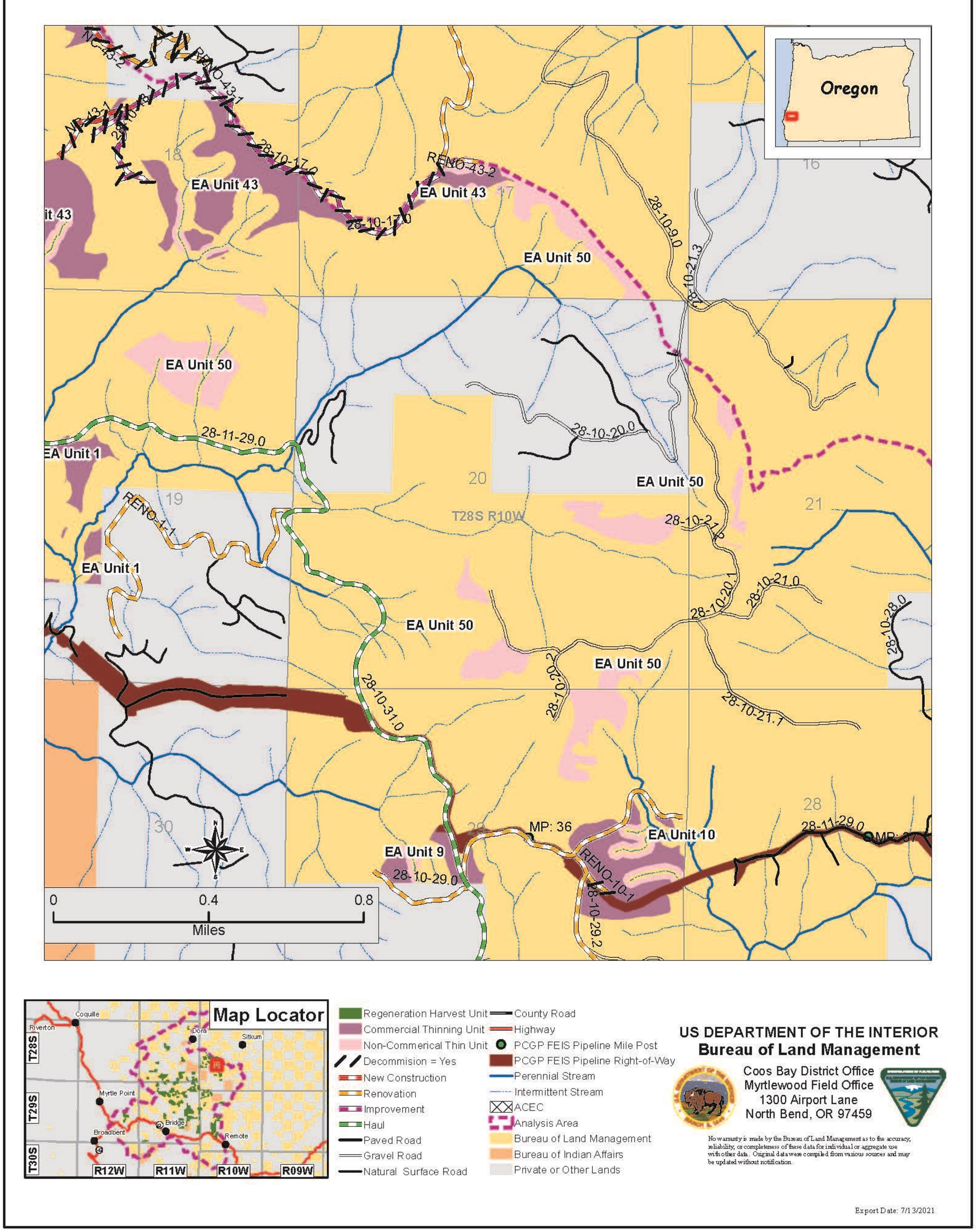



Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 7
Oregon
EA Unit 41
EA Unit 2
EA Unit 2
EA Unit 3
Crosby Cnty Rd
Crosby Rd
Sitkum Rd
T28S R11W
28-11-19.1
28-11-19.0
28-11-19.6
28-11-19.5
28-11-20.0
28-11-29.3
28-11-29.4
28-11-30.2
28-11-28.0
28-11-28.1
28-11-29.0
28-11-32.0
28-11-31.7
28-11-30.0
28-11-32.5
28-11-29.1
28-11-32.1
28-11-32.2
RENO-2-1
NC-3-1
0
0.4
0.8
Miles
Map Locator
Coquille
Riverton
Dora
Sitkum
Myrtle Point
Bridge
Broadbent
Remote
T28S
T29S
T30S
R12W
R11W
R10W
R09W
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commerical Thin Unit
Decommission = Yes
New Construction
Renovation
Improvement
Haul
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.
Export Date: 7/13/2021

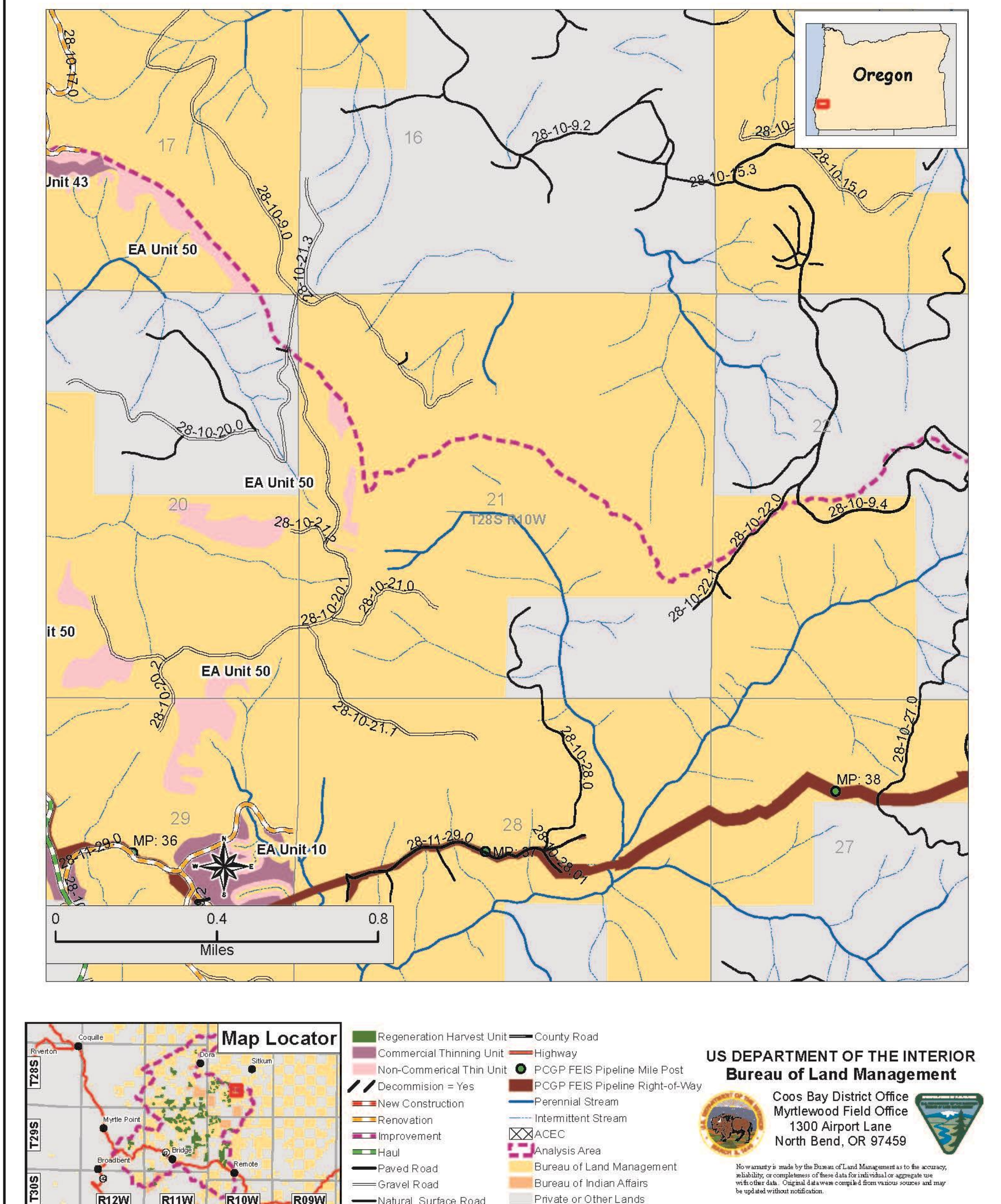
Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 8



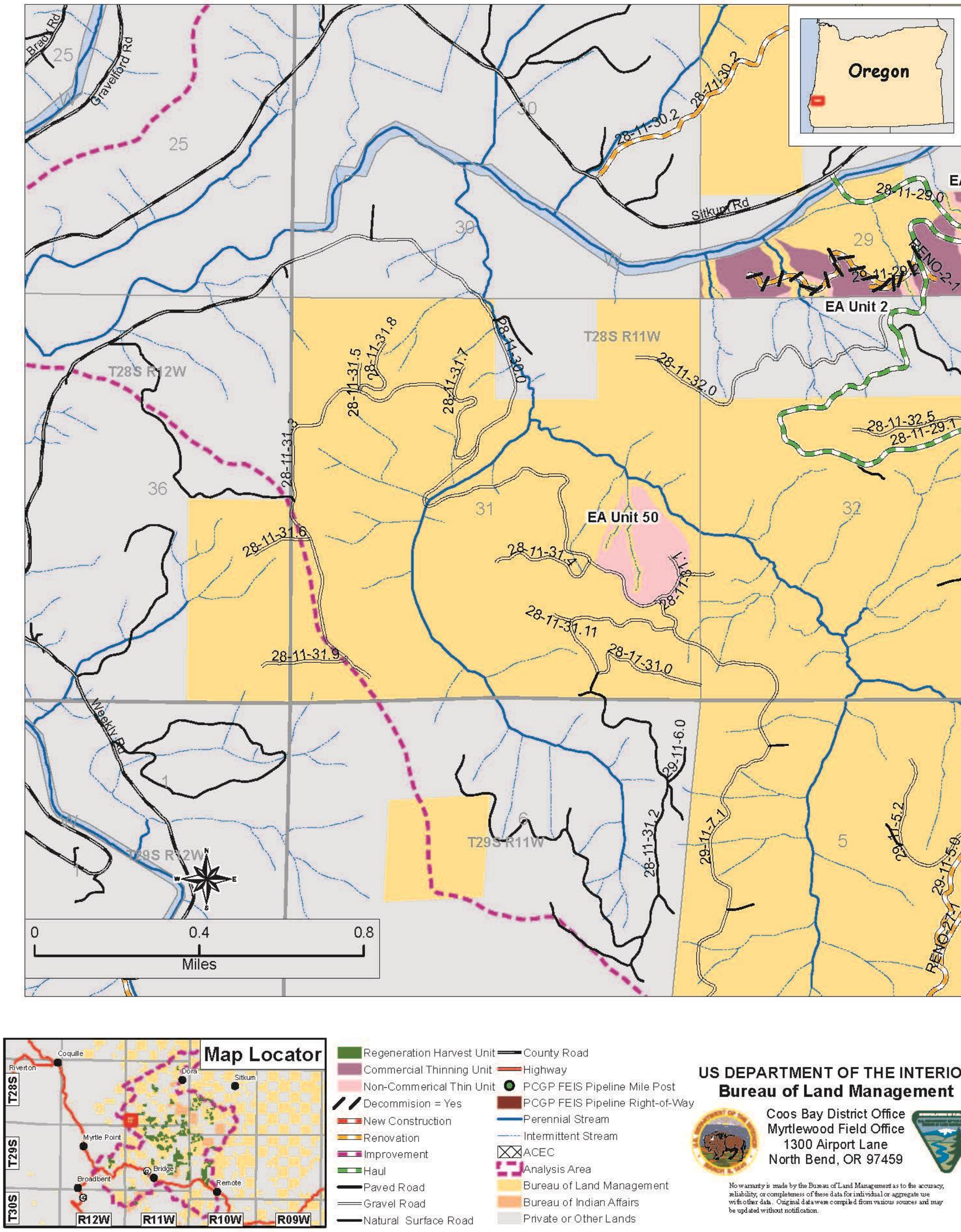
Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 9



Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 10



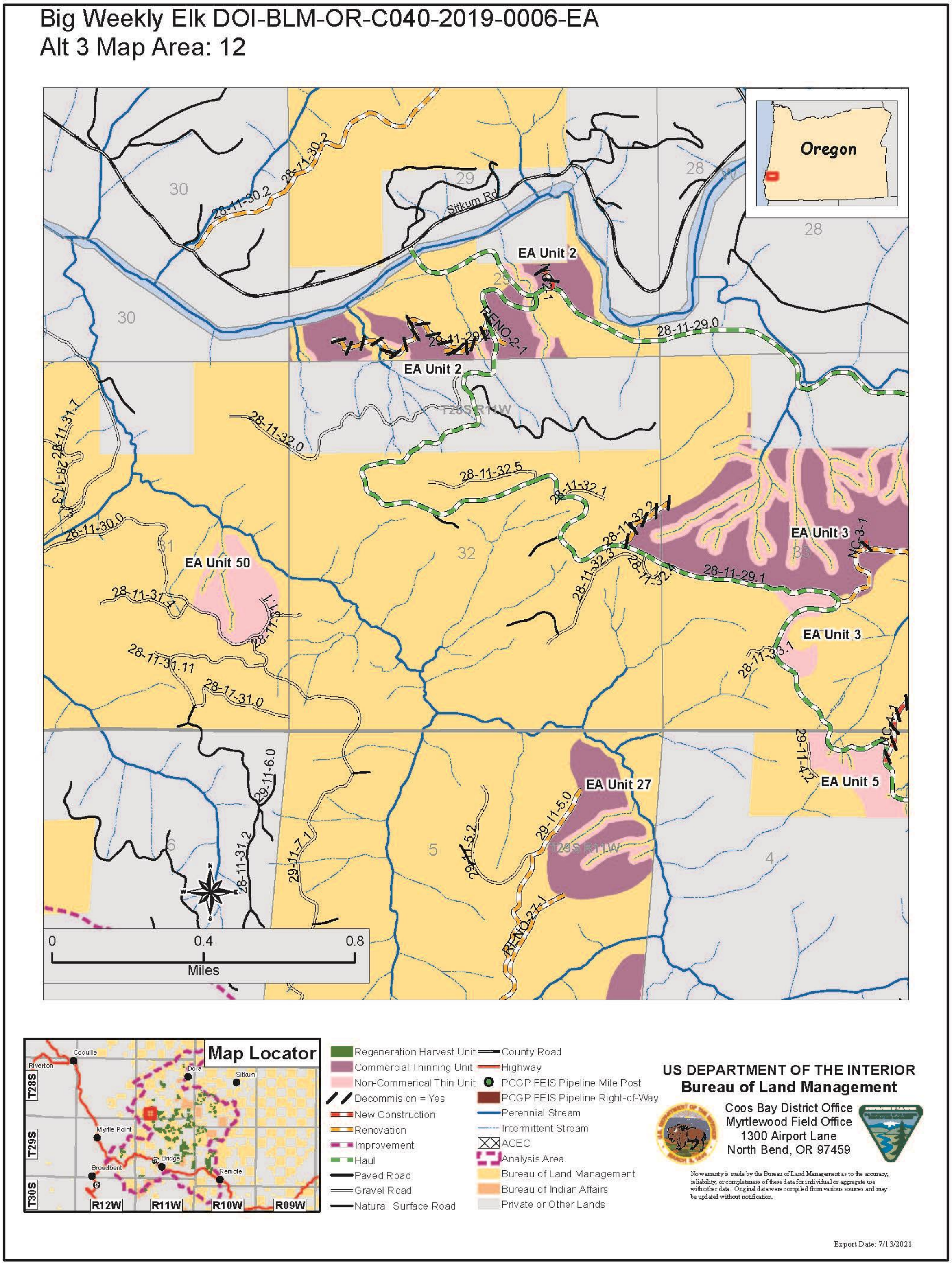
Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 11



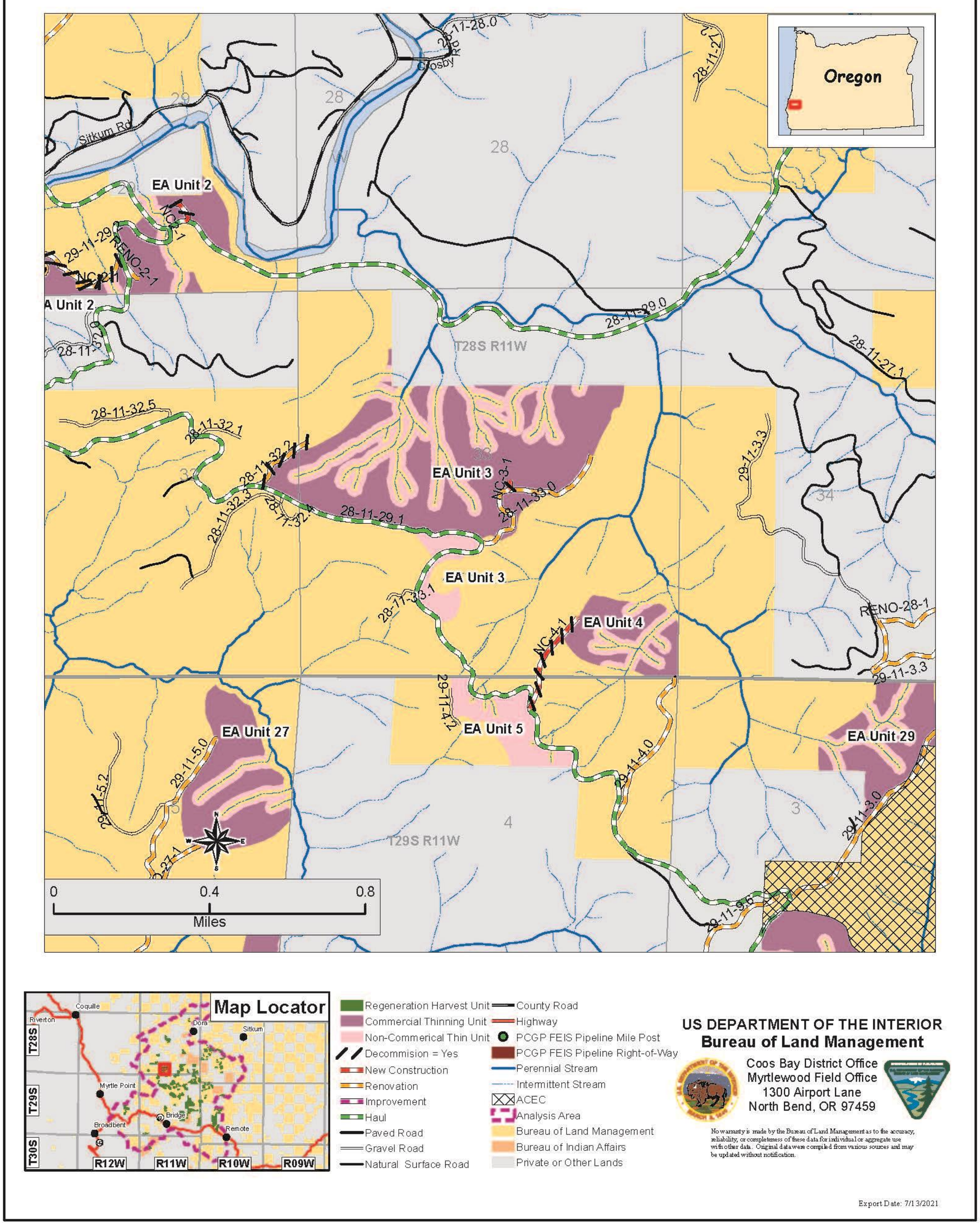
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459

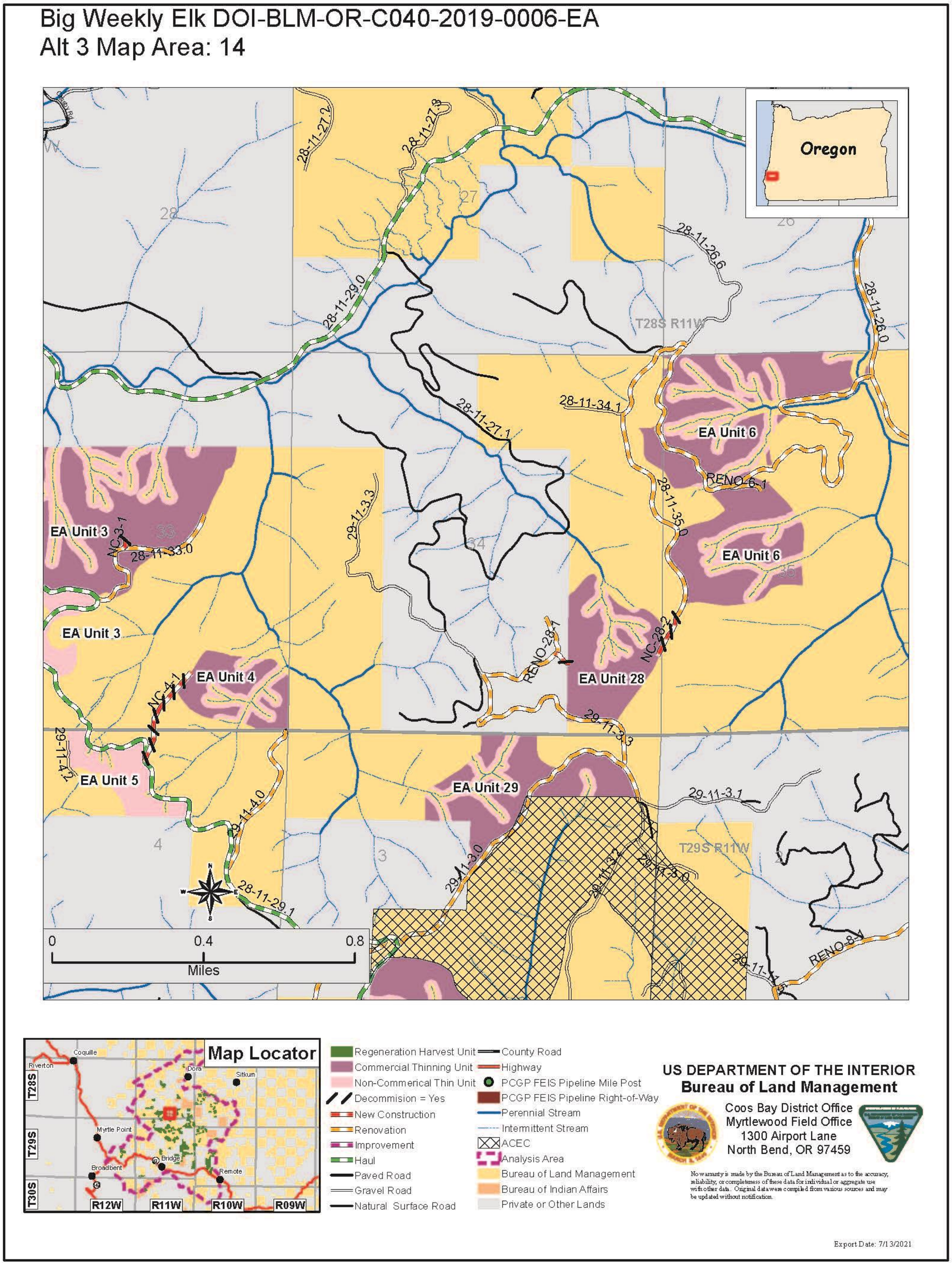
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.

Export Date: 7/13/2021

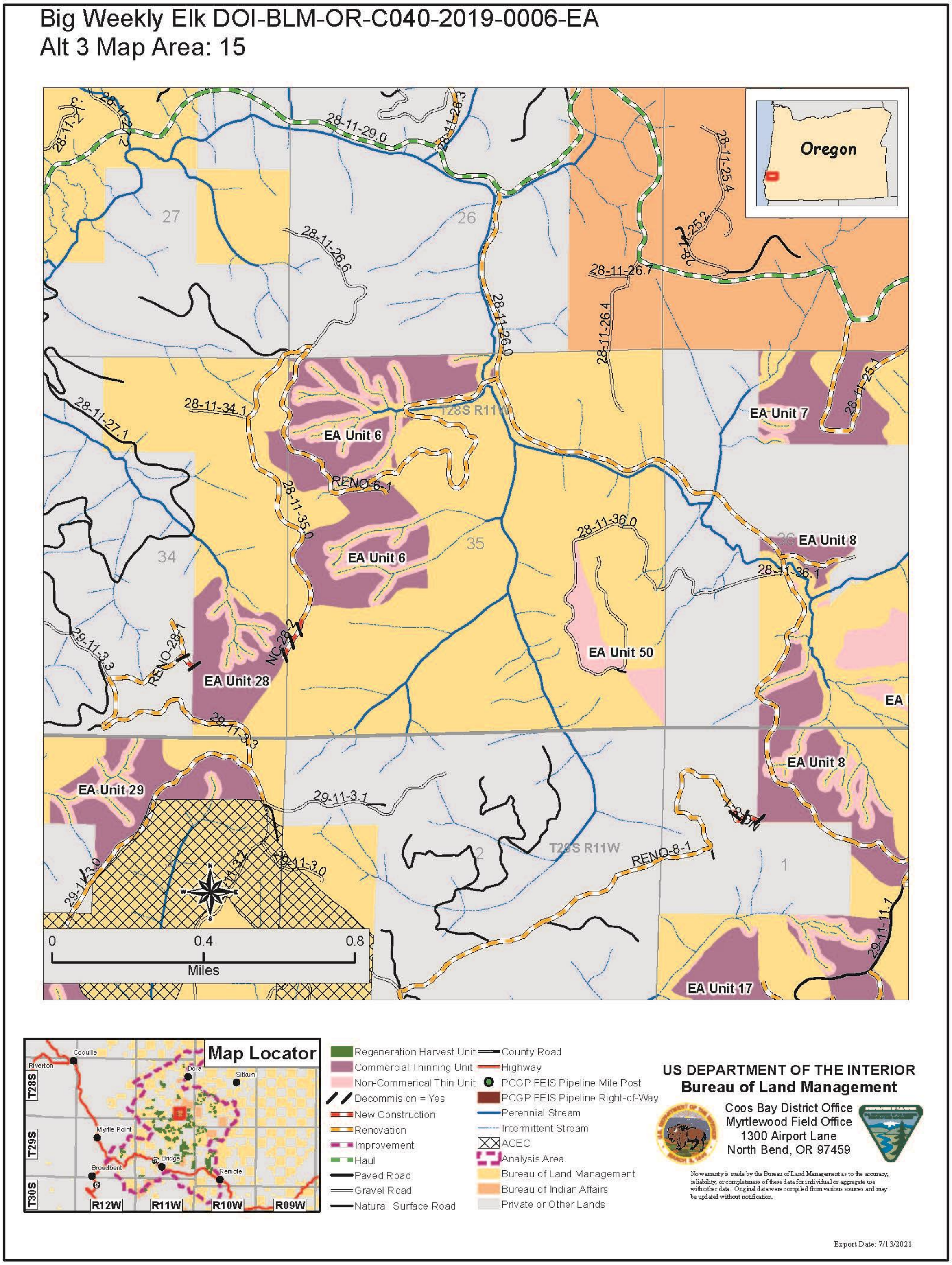

Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 12
Oregon
EA Unit 2
EA Unit 2
EA Unit 3
EA Unit 3
EA Unit 50
EA Unit 27
EA Unit 5
Sitkum Rd
28-11-30.2
28-11-29.0
28-11-32.0
28-11-32.5
28-11-32.1
28-11-29.1
28-11-30.0
28-11-31.0
28-11-31.11
28-11-31.7
28-11-31.2
29-11-6.0
29-11-7.1
29-11-5.0
29-11-5.2
29-11-4.2
RENO-2-1
RENO-27-1
0
0.4
0.8
Miles
Map Locator
Coquille
Riverton
Dora
Sitkum
Myrtle Point
Bridge
Broadbent
Remote
T28S
T29S
T30S
R12W
R11W
R10W
R09W
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commerical Thin Unit
Decommision = Yes
New Construction
Renovation
Improvement
Haul
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
Export Date: 7/13/2021

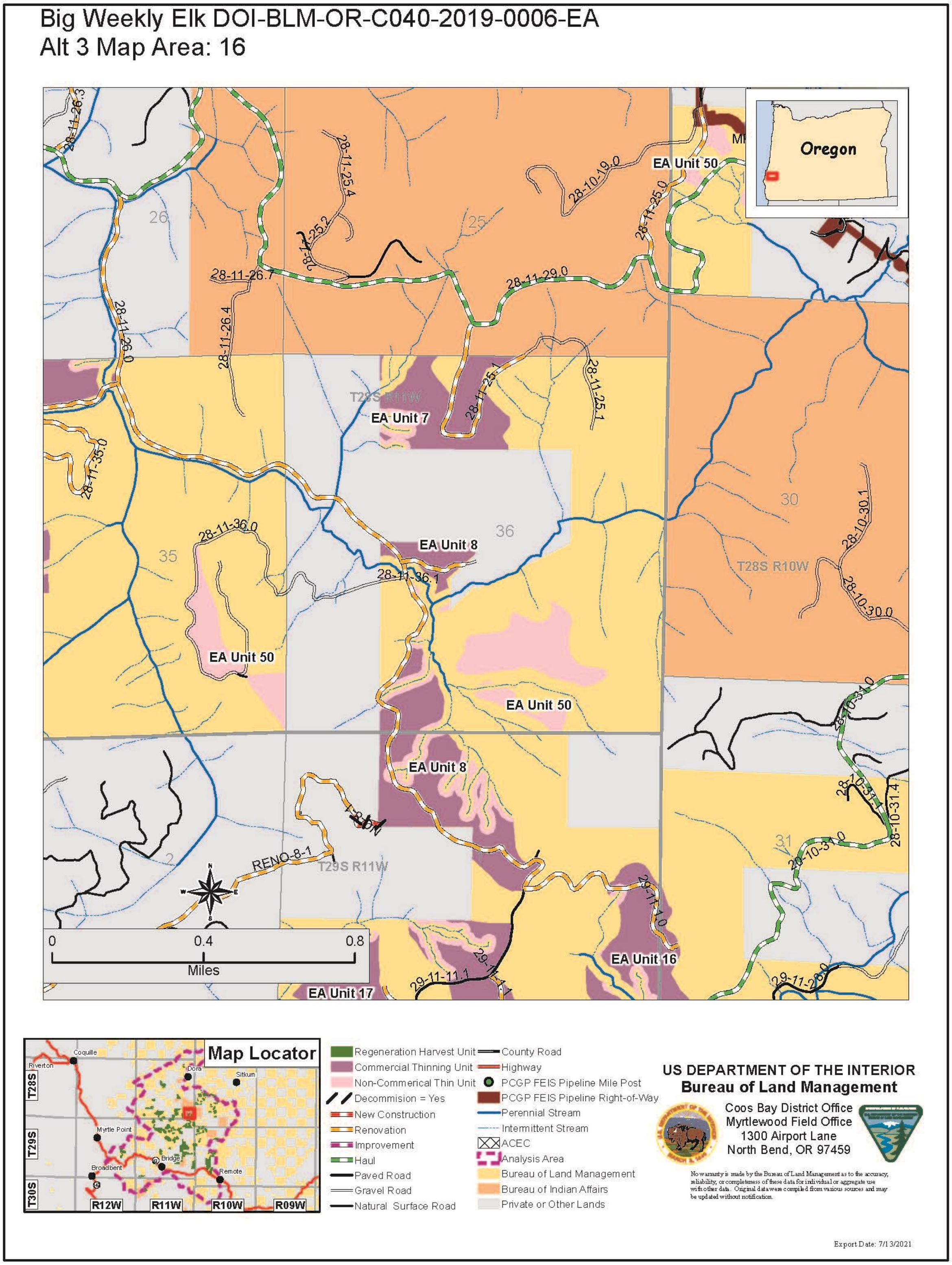
Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 13





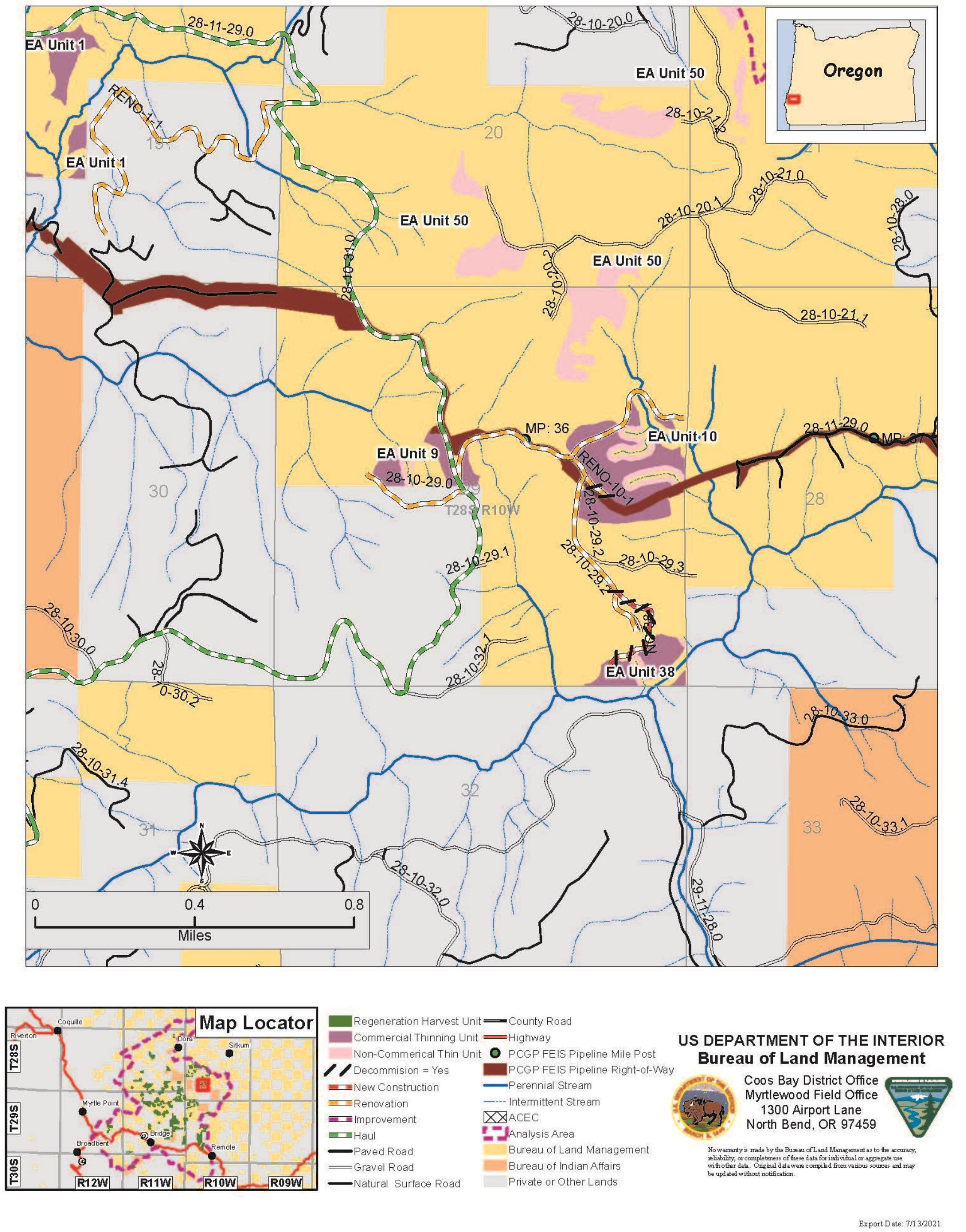
Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 14
Oregon
EA Unit 3
EA Unit 4
EA Unit 5
EA Unit 6
EA Unit 28
EA Unit 29
T28S R11W
T29S R11W
0
0.4
0.8
Miles
Map Locator
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commerical Thin Unit
Decommision = Yes
New Construction
Renovation
Improvement
Haul
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
Export Date: 7/13/2021


Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 15
Oregon
EA Unit 6
EA Unit 7
EA Unit 8
EA Unit 50
EA Unit 28
EA Unit 29
EA Unit 17
T28S R11W
T29S R11W
RENO-6-1
RENO-8-1
RENO-28-1
28-11-29.0
28-11-26.6
28-11-26.0
28-11-26.7
28-11-26.4
28-11-25.4
28-11-25.2
28-11-25.1
28-11-34.1
28-11-27.1
28-11-35.0
28-11-36.0
28-11-36.1
29-11-3.3
29-11-3.1
29-11-3.0
29-11-11.1
0
0.4
0.8
Miles
Map Locator
Coquille
Riverton
Dora
Sitkum
Myrtle Point
Bridge
Broadbent
Remote
T28S
T29S
T30S
R12W
R11W
R10W
R09W
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commerical Thin Unit
Decommision = Yes
New Construction
Renovation
Improvement
Haul
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.
Export Date: 7/13/2021

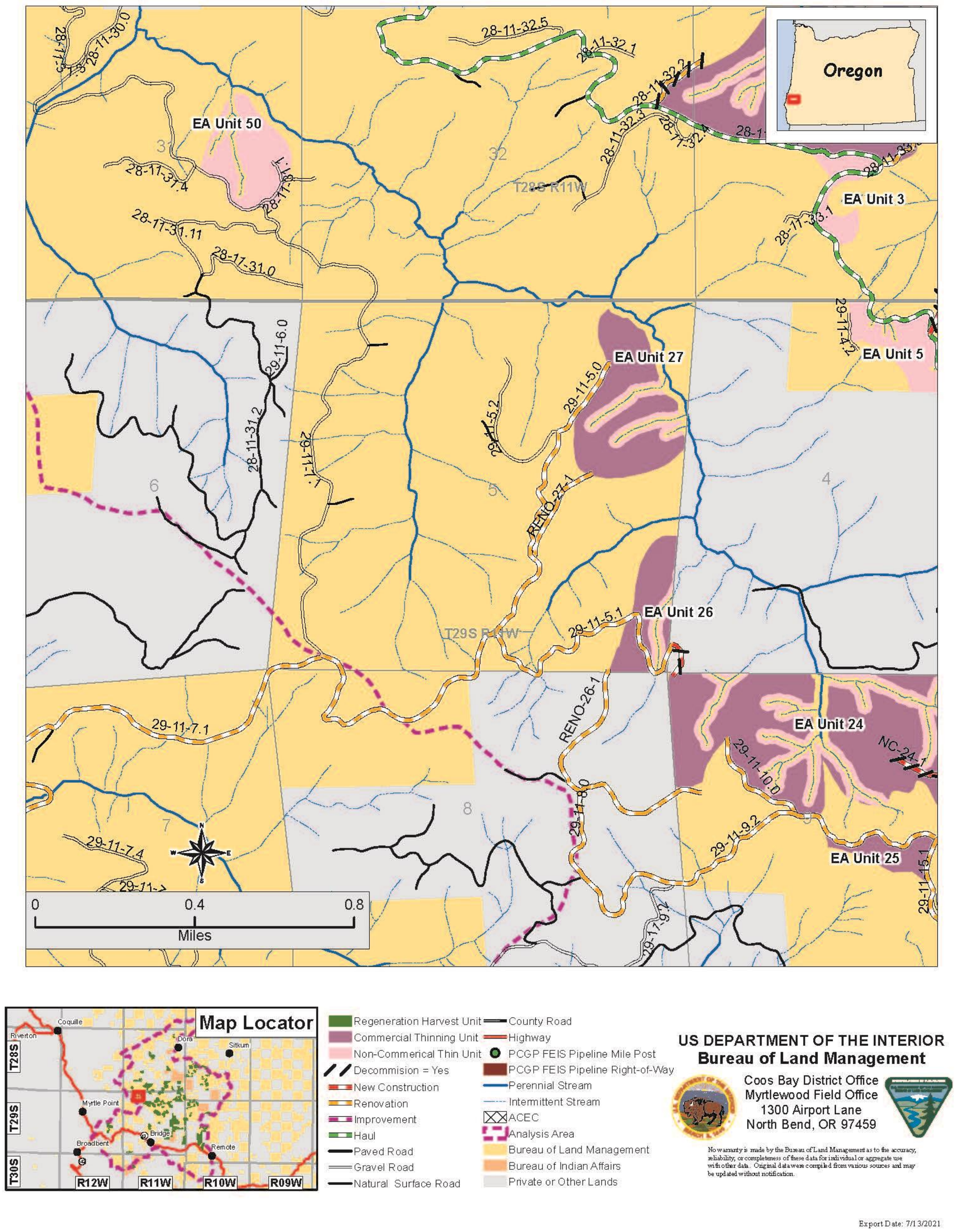


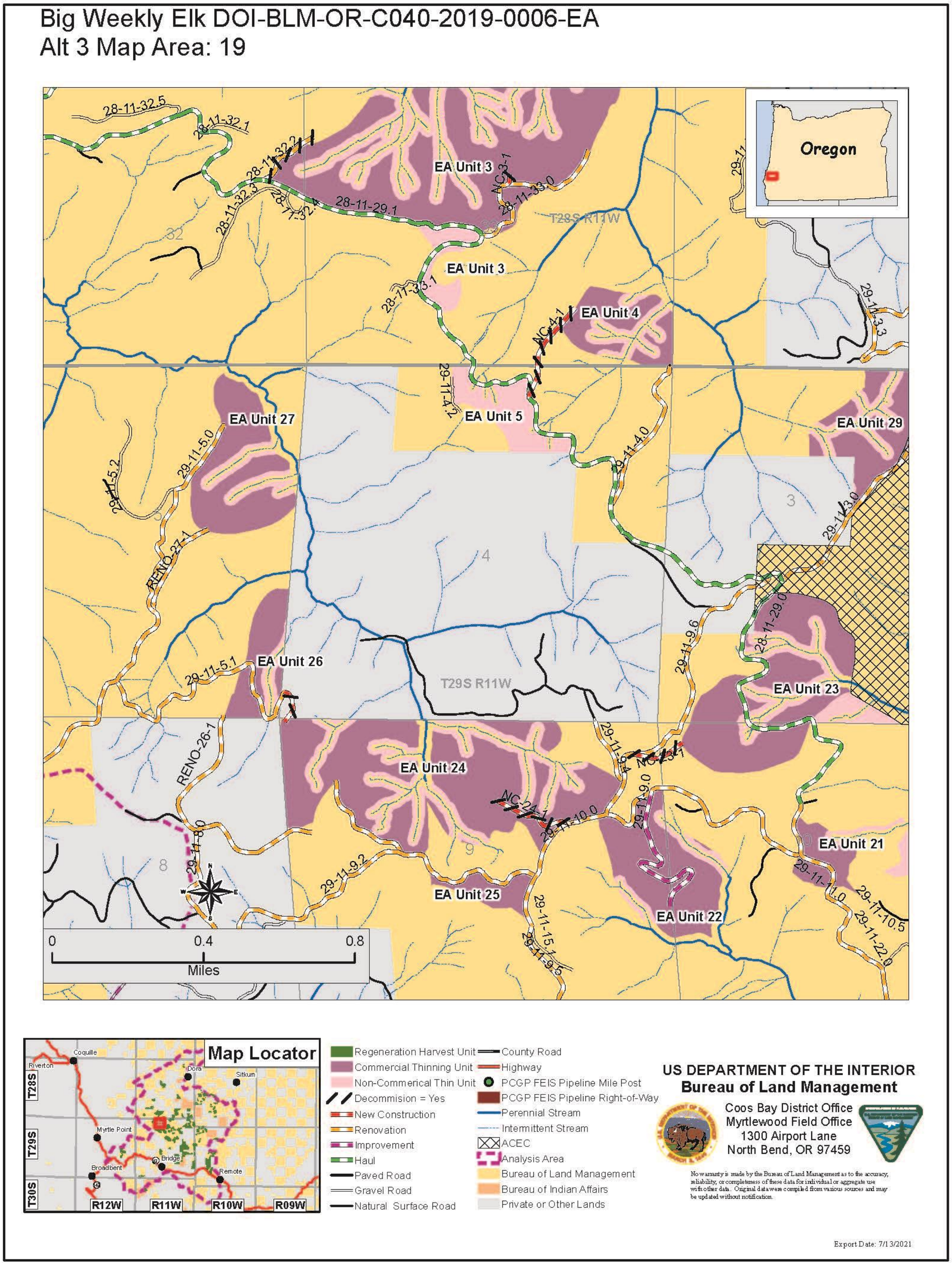
Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 16
Oregon
EA Unit 50
EA Unit 7
EA Unit 8
EA Unit 16
EA Unit 17
T28S R11W
T28S R10W
T29S R11W
28-11-26.3
28-11-25.4
28-11-25.2
28-10-19.0
28-11-25.0
28-11-26.7
28-11-29.0
28-11-26.4
28-11-26.0
28-11-25.1
28-11-35.0
28-11-36.0
28-11-36.1
28-10-30.1
28-10-30.0
28-10-31.0
28-10-31.4
29-11-1.0
29-11-11.1
29-11-2.0
RENO-8-1
0 0.4 0.8
Miles
Map Locator
Coquille
Riverton
Dora
Sitkum
Myrtle Point
Bridge
Broadbent
Remote
T28S T29S T30S
R12W R11W R10W R09W
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commerical Thin Unit
Decommision = Yes
New Construction
Renovation
Improvement
Haul
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.
Export Date: 7/13/2021

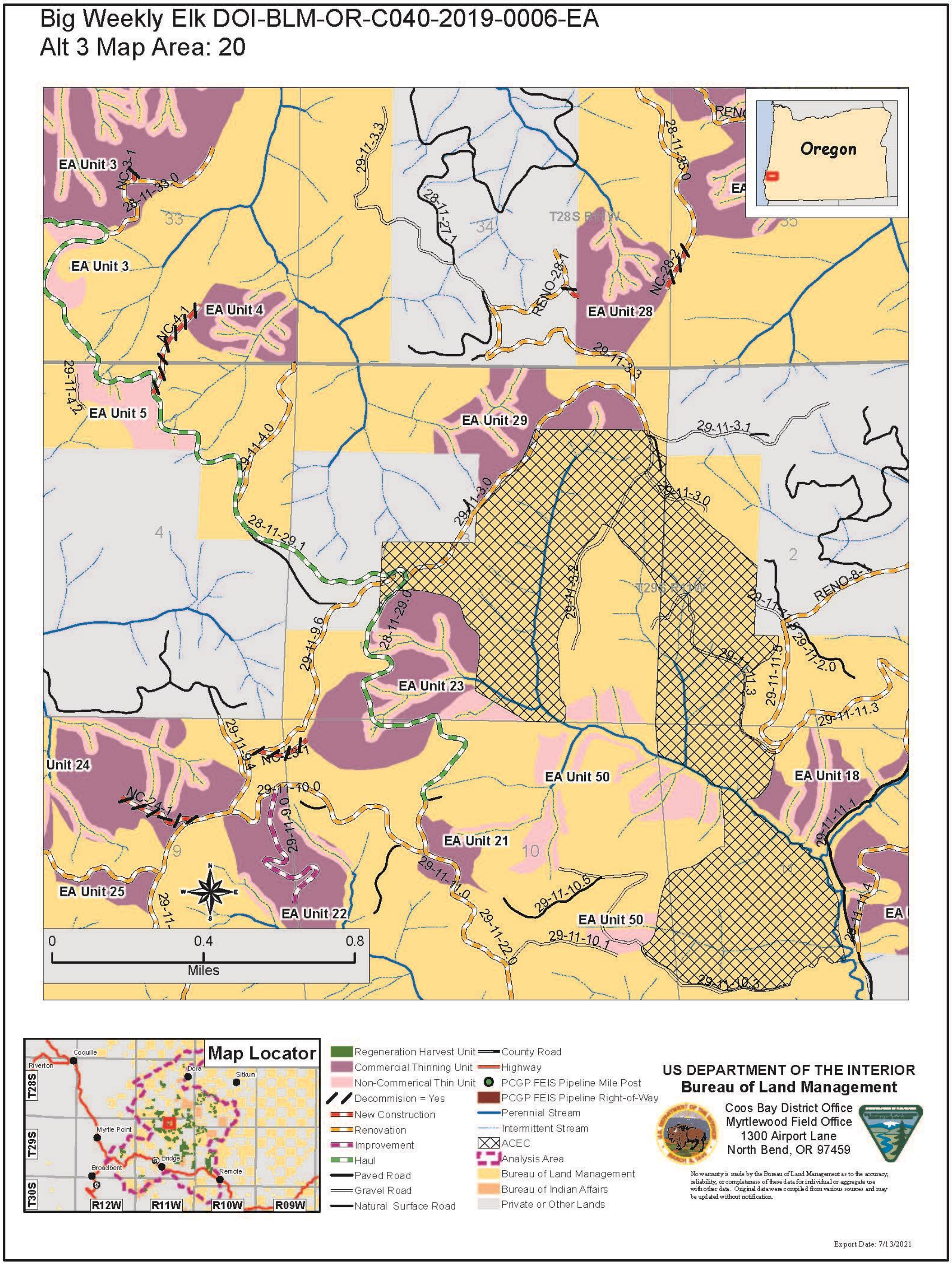
Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 17

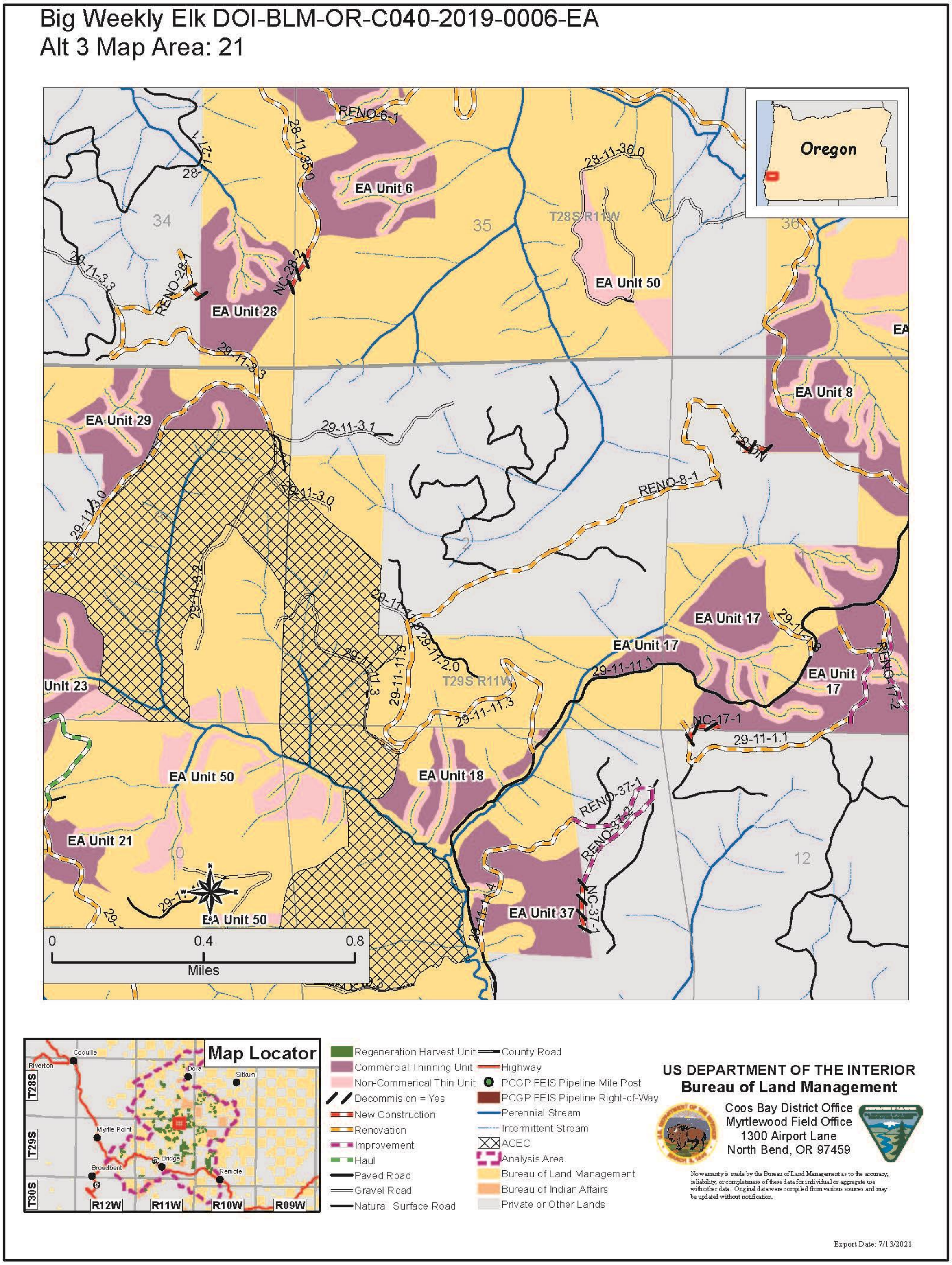


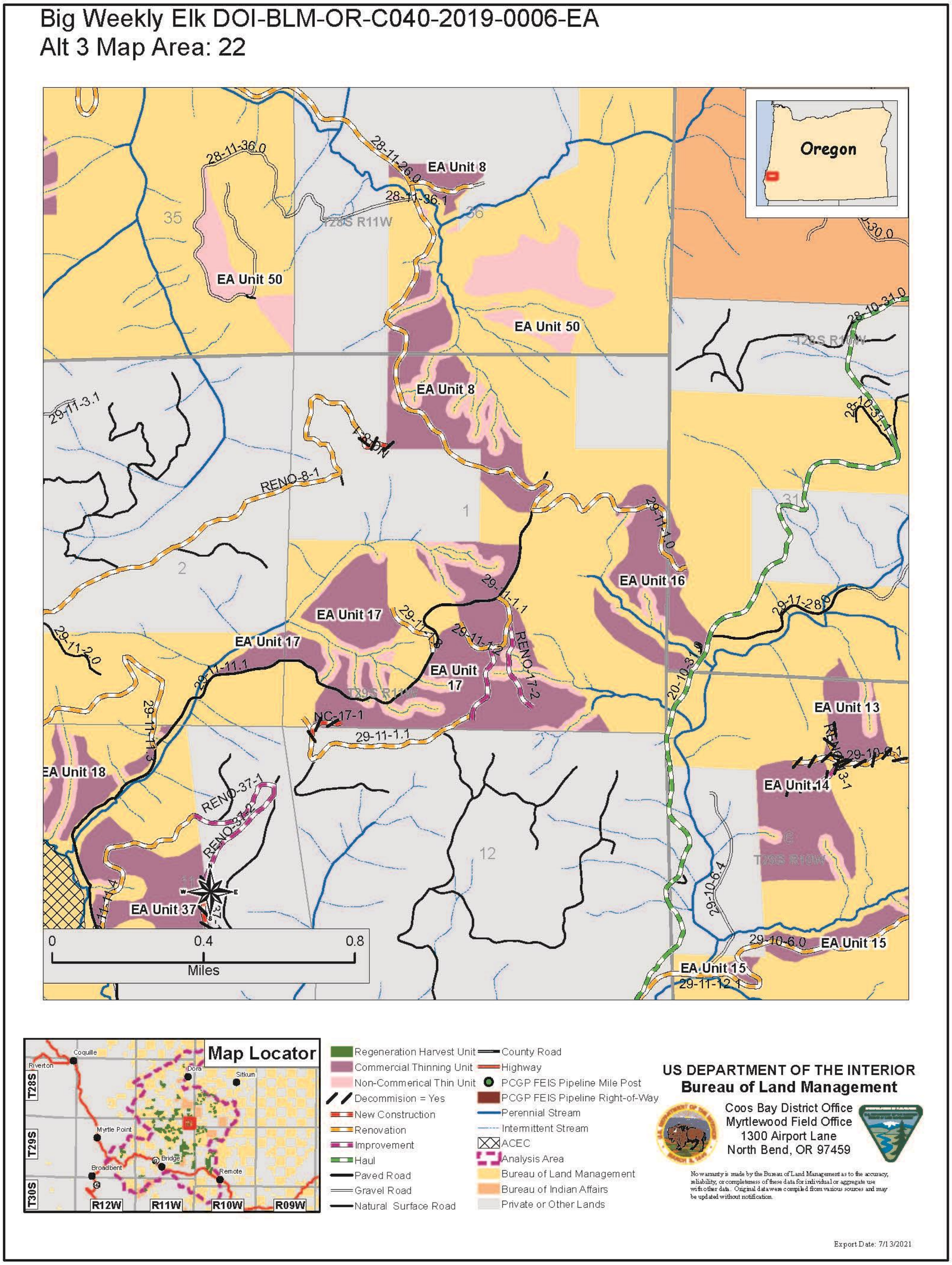
Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 18

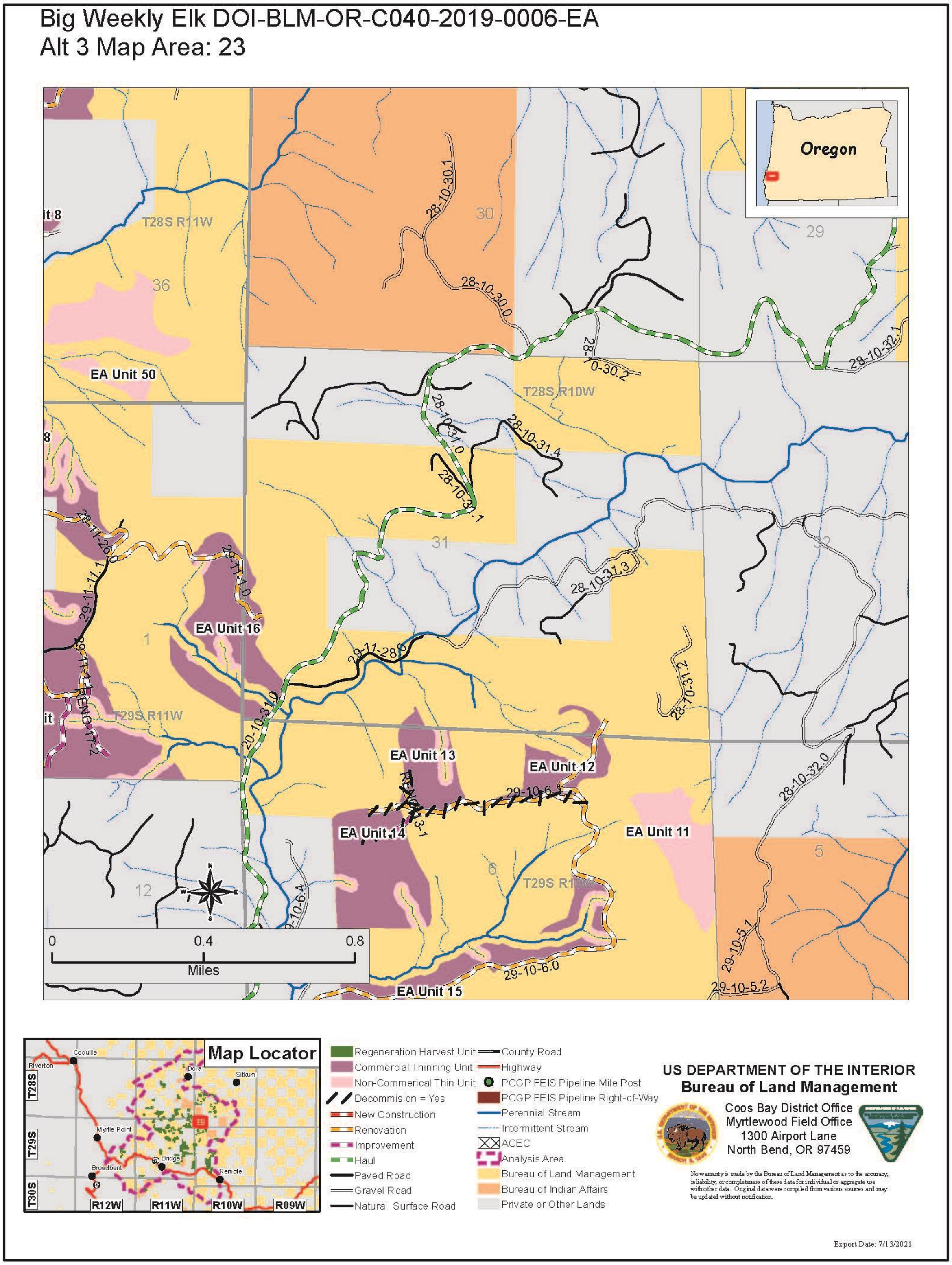


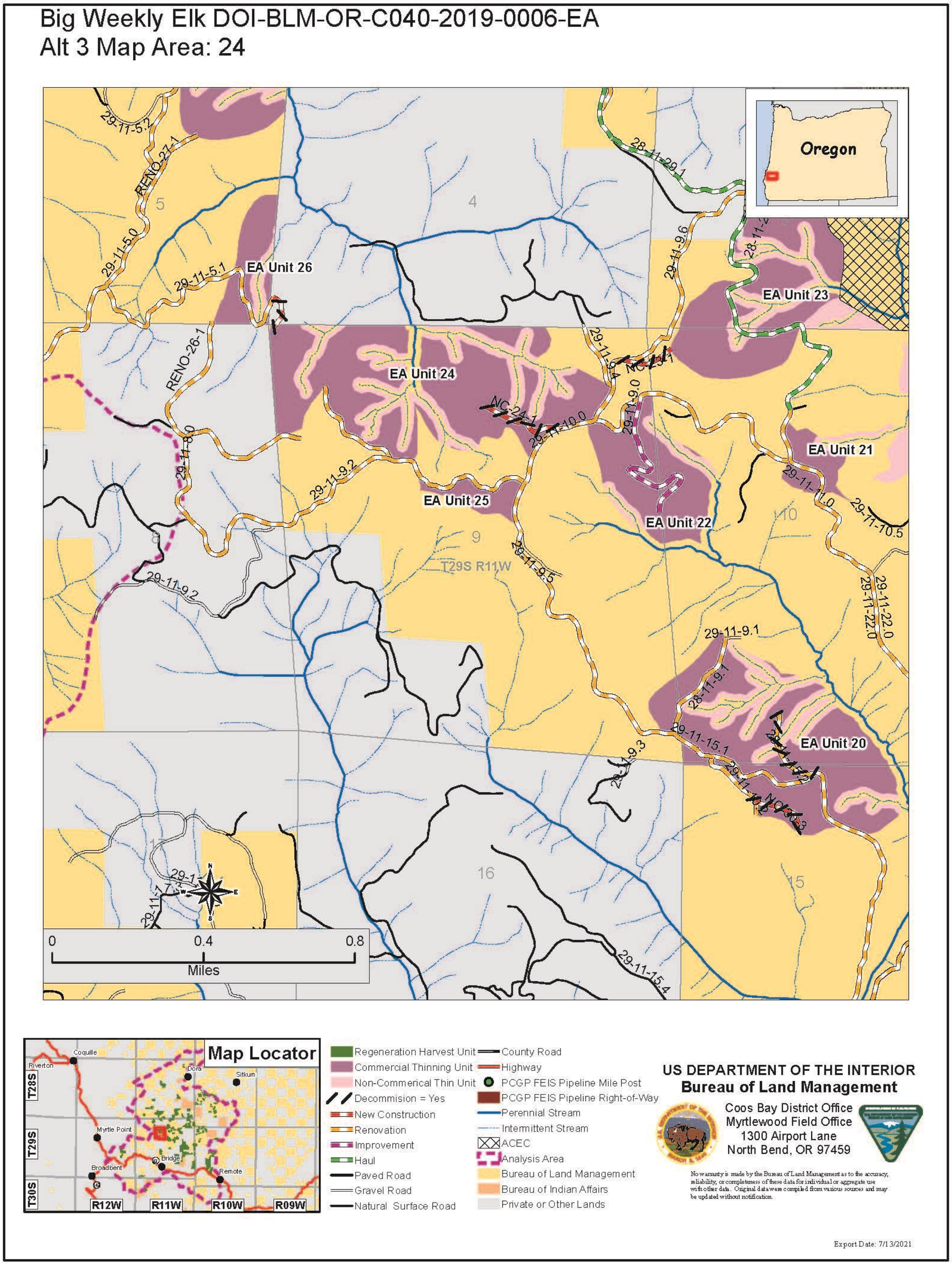

Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 19
Oregon
EA Unit 3
EA Unit 4
EA Unit 5
EA Unit 21
EA Unit 22
EA Unit 23
EA Unit 24
EA Unit 25
EA Unit 26
EA Unit 27
EA Unit 29
T28S R11W
T29S R11W
0
0.4
0.8
Miles
Map Locator
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commerical Thin Unit
Decommission = Yes
New Construction
Renovation
Improvement
Haul
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
Export Date: 7/13/2021

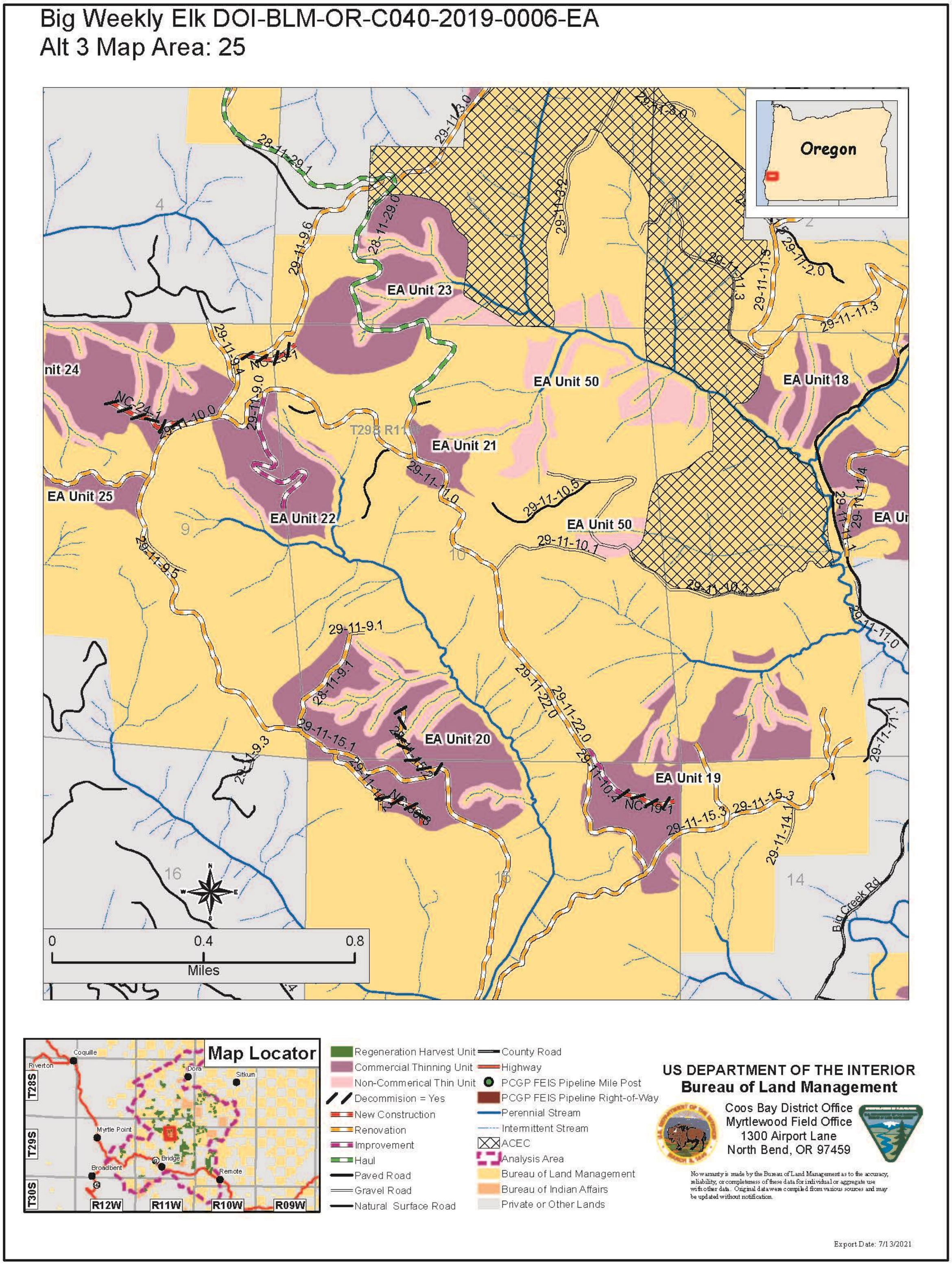

Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 20
Oregon
EA Unit 3
EA Unit 4
EA Unit 5
EA Unit 28
EA Unit 29
EA Unit 23
Unit 24
EA Unit 50
EA Unit 18
EA Unit 21
EA Unit 25
EA Unit 22
T28S R11W
T29S R11W
NC-3-1
NC-4-1
NC-28-2
NC-24-1
RENO-28-1
28-11-33.0
28-11-27.1
28-11-35.0
28-11-3.3
28-11-29.1
28-11-29.0
29-11-3.3
29-11-3.1
29-11-3.0
29-11-3.2
29-11-4.0
29-11-4.2
29-11-9.6
29-11-9.4
29-11-9.0
29-11-10.0
29-11-10.5
29-11-10.1
29-11-10.3
29-11-11.0
29-11-11.3
29-11-11.1
29-11-2.0
29-11-22.0
0
0.4
0.8
Miles
Map Locator
Coquille
Riverton
Dora
Sitkum
Myrtle Point
Broadbent
Bridge
Remote
T28S
T29S
T30S
R12W
R11W
R10W
R09W
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commerical Thin Unit
Decommission = Yes
New Construction
Renovation
Improvement
Haul
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
Export Date: 7/13/2021

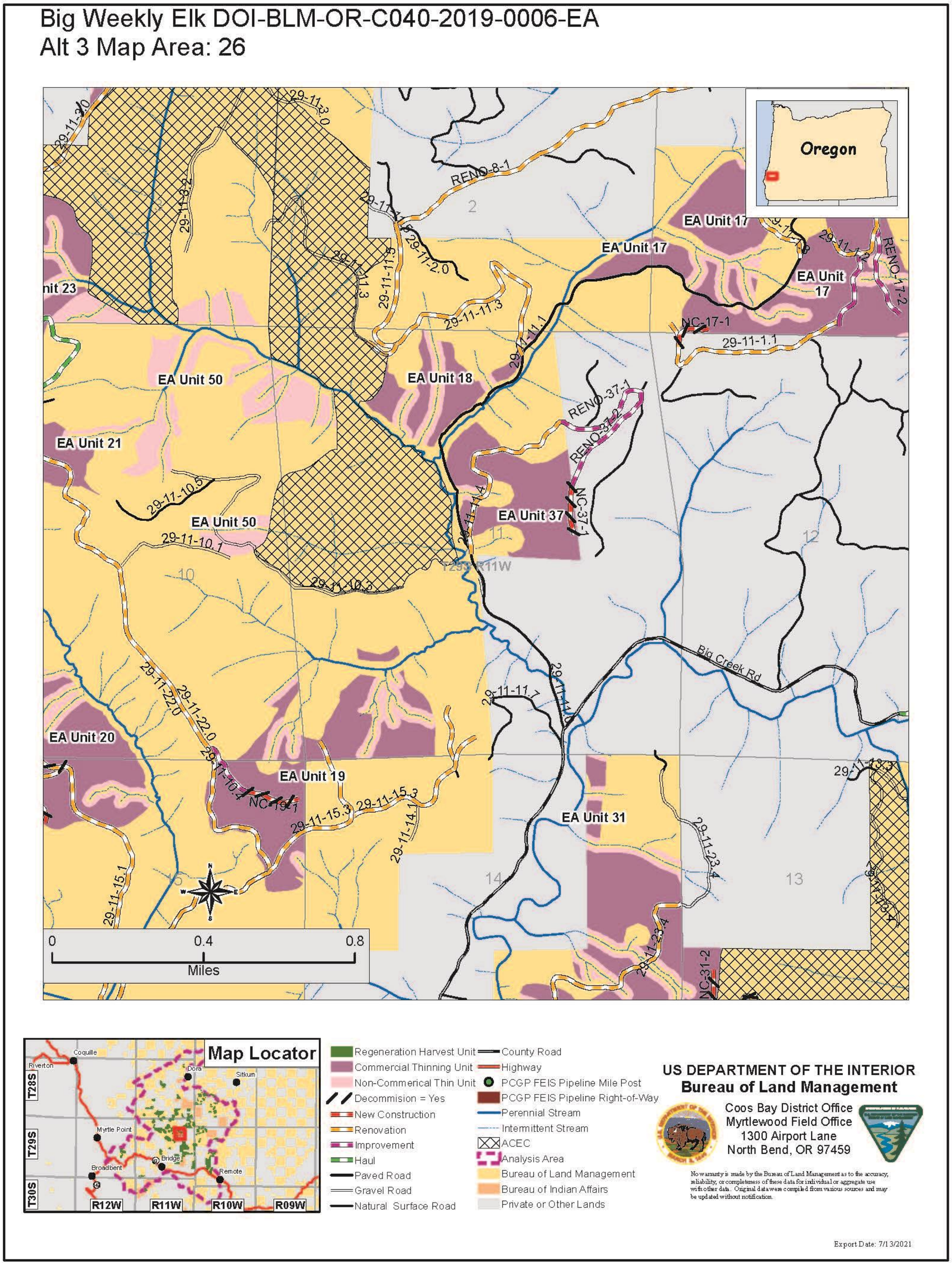

Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 21
Oregon
EA Unit 6
EA Unit 28
EA Unit 50
EA Unit 29
EA Unit 8
EA Unit 17
EA Unit 23
EA Unit 18
EA Unit 21
EA Unit 37
T28S R11W
T29S R11W
Miles
Map Locator
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commerical Thin Unit
Decommision = Yes
New Construction
Renovation
Improvement
Haul
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
Export Date: 7/13/2021


Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 22
Oregon
EA Unit 8
EA Unit 50
EA Unit 17
EA Unit 16
EA Unit 18
EA Unit 37
EA Unit 13
EA Unit 14
EA Unit 15
T28S R11W
T28S R10W
T29S R11W
T29S R10W
28-11-36.0
28-11-26.0
28-11-36.1
28-10-31.0
29-11-3.1
RENO-8-1
29-11-1.0
29-11-1.1
29-11-2.0
29-11-11.1
RENO-17-2
NC-17-1
RENO-37-1
RENO-37-2
29-11-28.0
20-10-3.0
29-10-6.0
29-10-6.4
29-11-12.1
0
0.4
0.8
Miles
Map Locator
Coquille
Riverton
Dora
Sitkum
Myrtle Point
Bridge
Broadbent
Remote
T28S
T29S
T30S
R12W
R11W
R10W
R09W
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commerical Thin Unit
Decommission = Yes
New Construction
Renovation
Improvement
Haul
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
Export Date: 7/13/2021

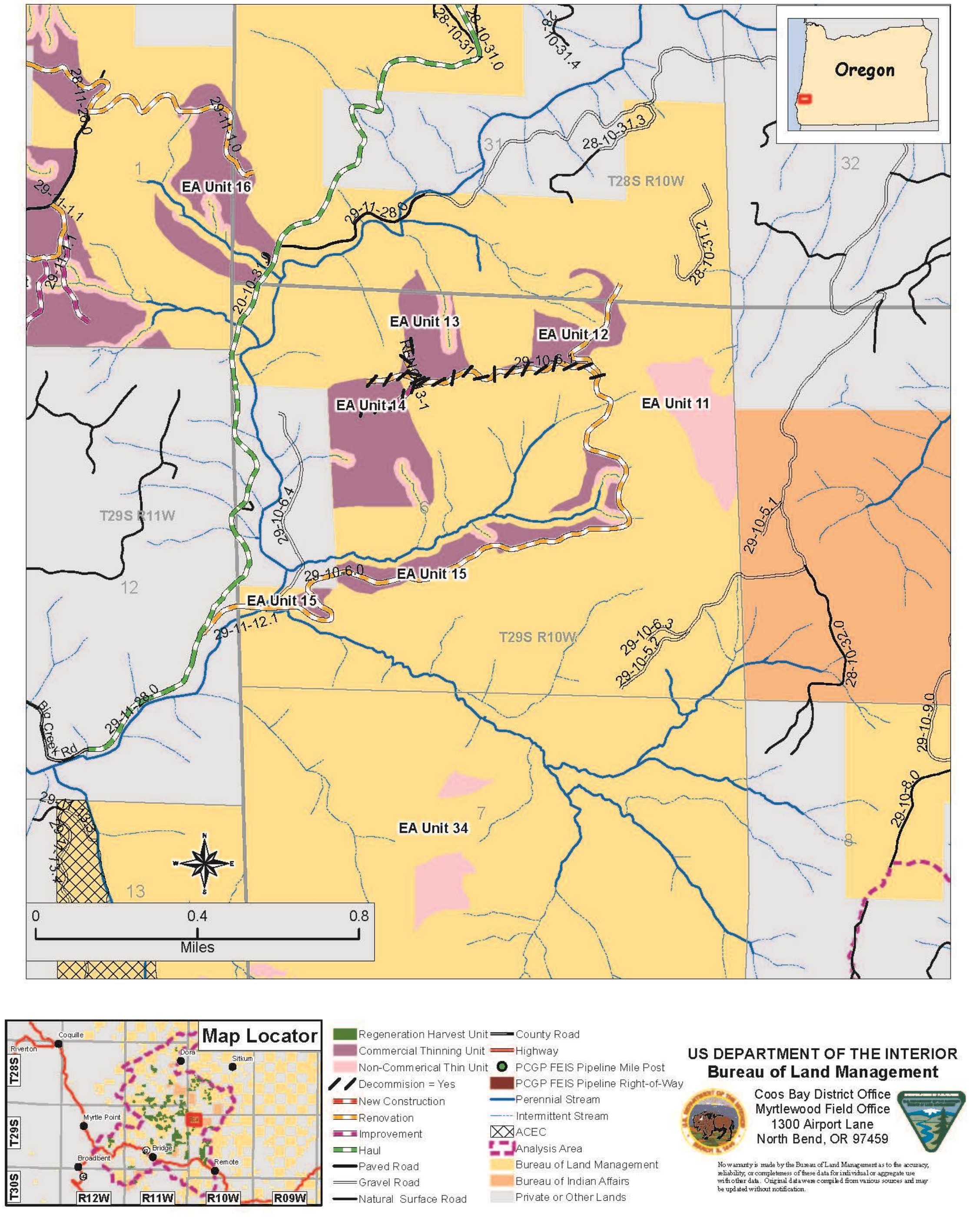

Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 23
Oregon
EA Unit 50
EA Unit 16
EA Unit 13
EA Unit 12
EA Unit 14
EA Unit 11
EA Unit 15
T28S R11W
T28S R10W
T29S R11W
28-10-30.1
28-10-30.0
28-10-32.1
28-10-31.4
28-10-31.3
28-10-31.2
28-10-32.0
29-11-28.0
29-10-6.1
29-10-6.0
29-10-5.1
29-10-5.2
0
0.4
0.8
Miles
Map Locator
Coquille
Riverton
Dora
Sitkum
Myrtle Point
Bridge
Broadbent
Remote
T28S
T29S
T30S
R12W
R11W
R10W
R09W
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commerical Thin Unit
Decommission = Yes
New Construction
Renovation
Improvement
Haul
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
Export Date: 7/13/2021

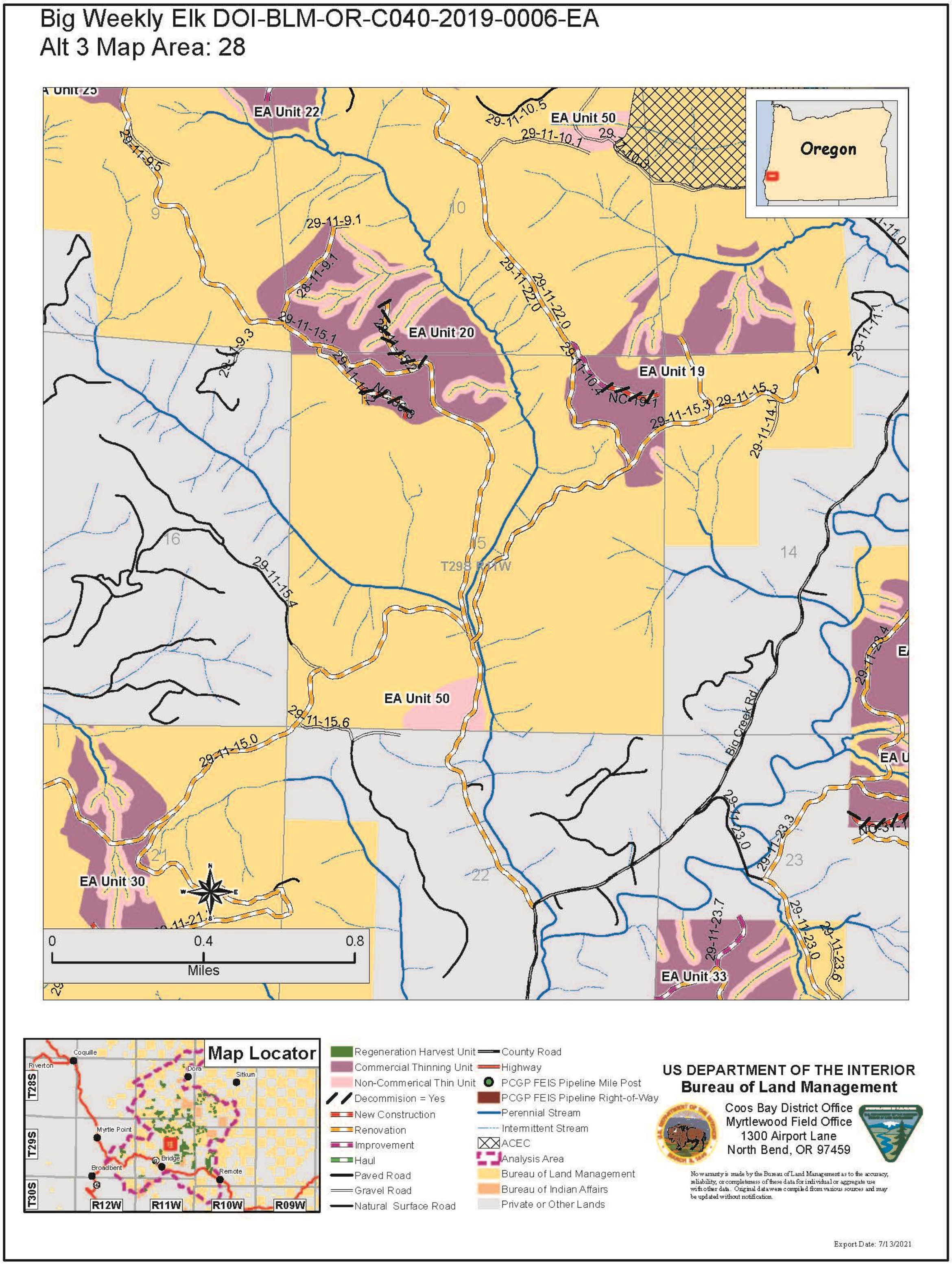

Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 24
Oregon
EA Unit 20
EA Unit 21
EA Unit 22
EA Unit 23
EA Unit 24
EA Unit 25
EA Unit 26
T29S R11W
4
5
9
10
15
16
29-11-5.2
RENO-27-1
29-11-5.0
29-11-5.1
RENO-26-1
29-11-8.0
29-11-9.2
29-11-9.5
29-11-9.0
29-11-10.0
29-11-11.0
29-11-10.5
29-11-22.0
29-11-9.1
29-11-15.1
29-11-9.3
29-11-15.4
28-11-29.1
28-11-9.1
29-11-9.6
NC-24-1
NC-23-1
0
0.4
0.8
Miles
Map Locator
Coquille
Riverton
Dora
Sitkum
Myrtle Point
Bridge
Broadbent
Remote
T28S
T29S
T30S
R12W
R11W
R10W
R09W
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commerical Thin Unit
Decommision = Yes
New Construction
Renovation
Improvement
Haul
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
Export Date: 7/13/2021


Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 25
Oregon
EA Unit 23
EA Unit 50
EA Unit 18
EA Unit 21
EA Unit 25
EA Unit 22
EA Unit 20
EA Unit 19
Map Locator
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commerical Thin Unit
Decommission = Yes
New Construction
Renovation
Improvement
Haul
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
Export Date: 7/13/2021

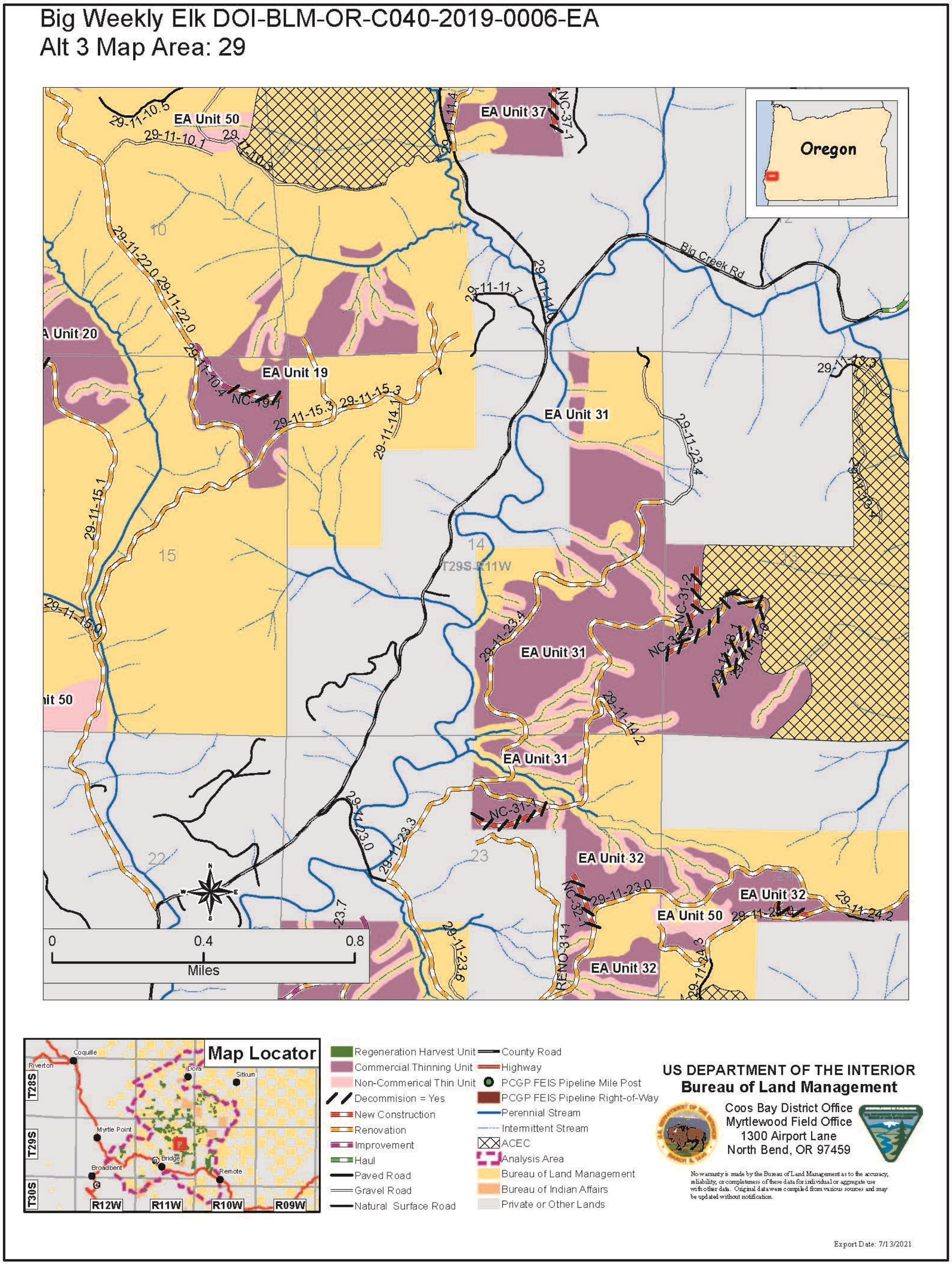

Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 26
Oregon
EA Unit 17
EA Unit 18
EA Unit 50
EA Unit 21
EA Unit 37
EA Unit 20
EA Unit 19
EA Unit 31
EA Unit 23
RENO-8-1
RENO-37-1
RENO-37-2
RENO-17-2
NC-17-1
NC-37-1
NC-19-1
NC-31-2
Big Creek Rd
T29S-R11W
0
0.4
0.8
Miles
Map Locator
Coquille
Riverton
Dora
Sitkum
Myrtle Point
Bridge
Broadbent
Remote
T28S
T29S
T30S
R12W
R11W
R10W
R09W
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commerical Thin Unit
Decommission = Yes
New Construction
Renovation
Improvement
Haul
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
Export Date: 7/13/2021

Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 27

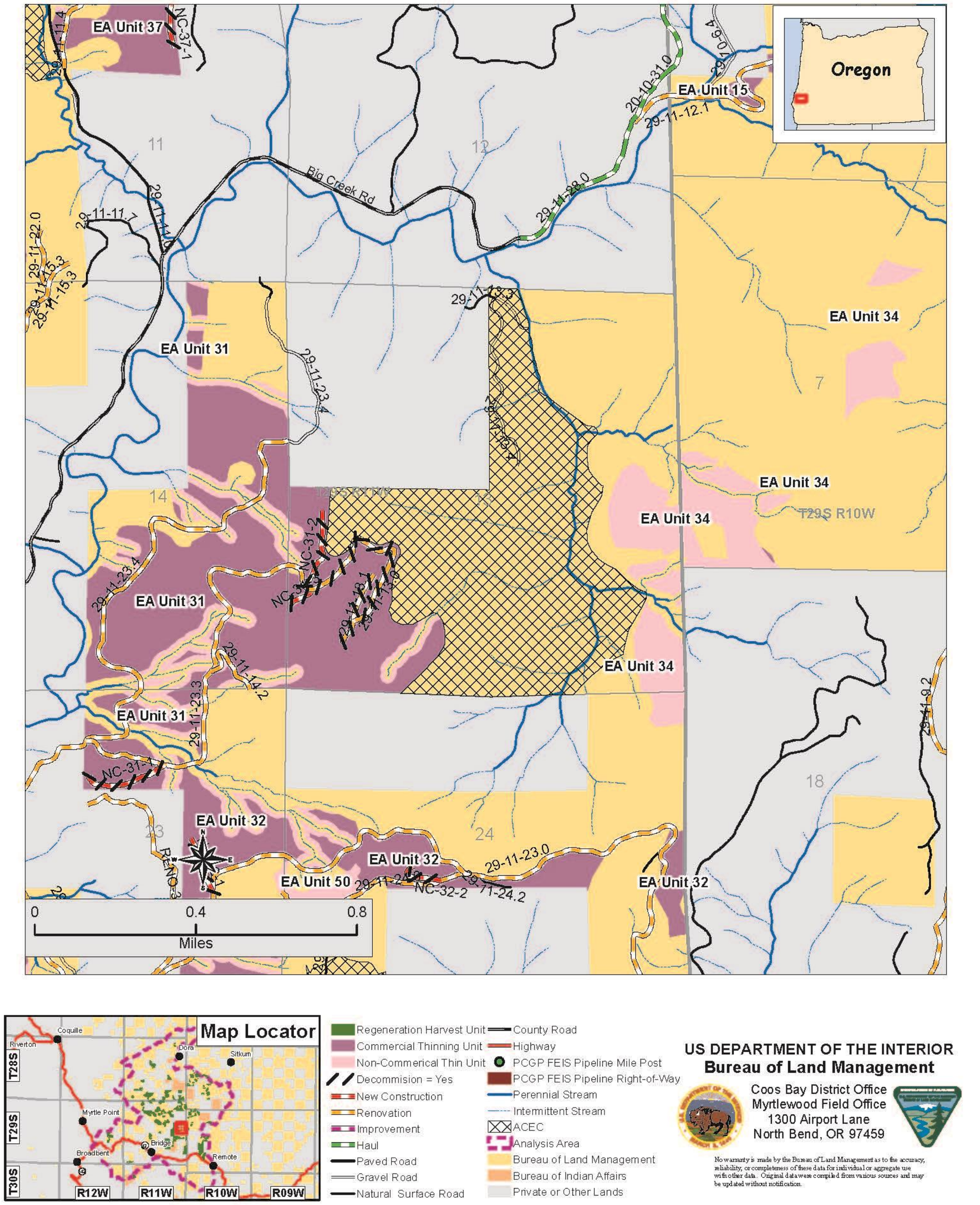


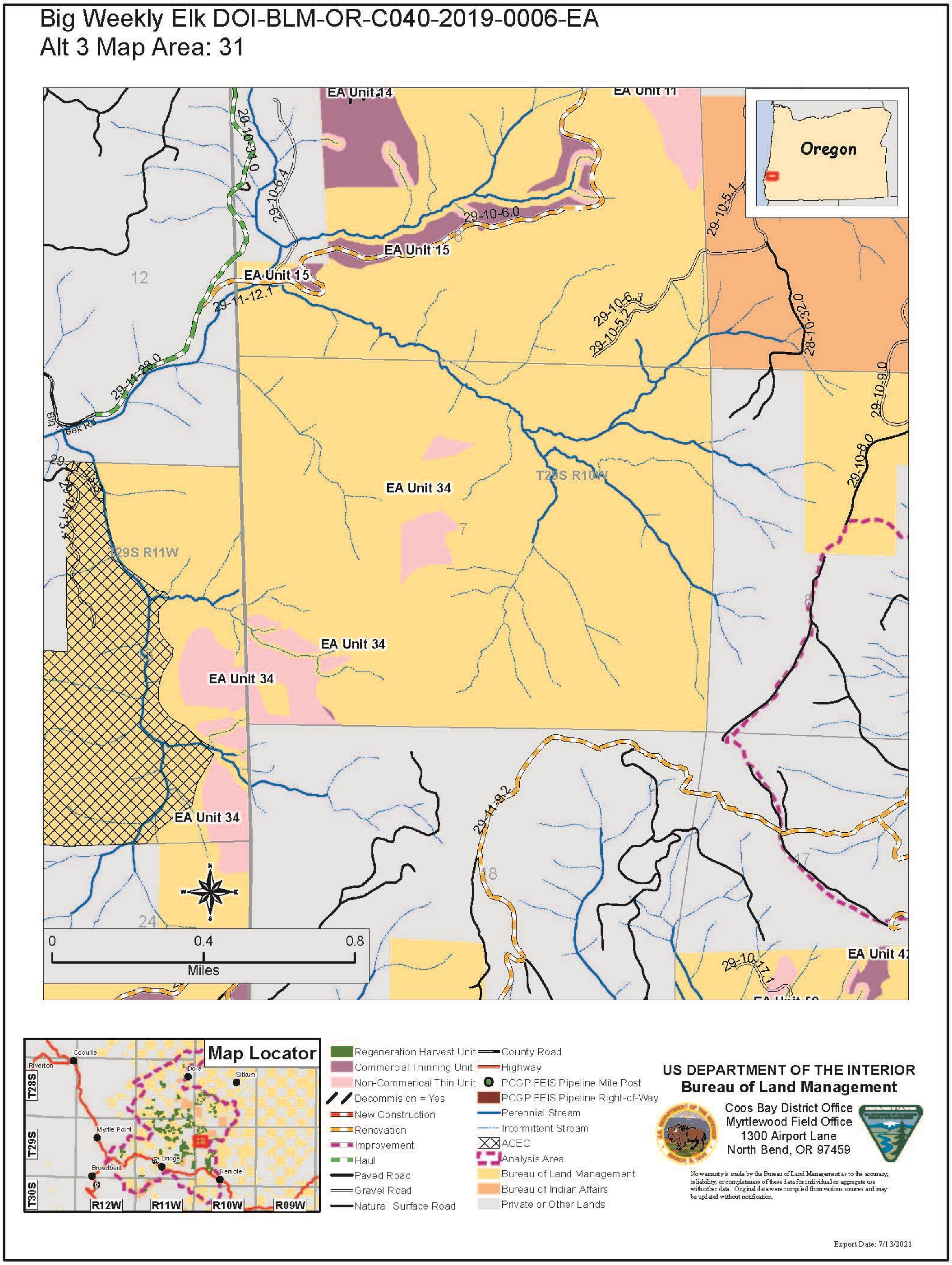


Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 28
EA Unit 22
EA Unit 50
EA Unit 20
EA Unit 19
EA Unit 30
EA Unit 33
Oregon
T29S R11W
Big Creek Rd
Map Locator
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commerical Thin Unit
Decommision = Yes
New Construction
Renovation
Improvement
Haul
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
Export Date: 7/13/2021

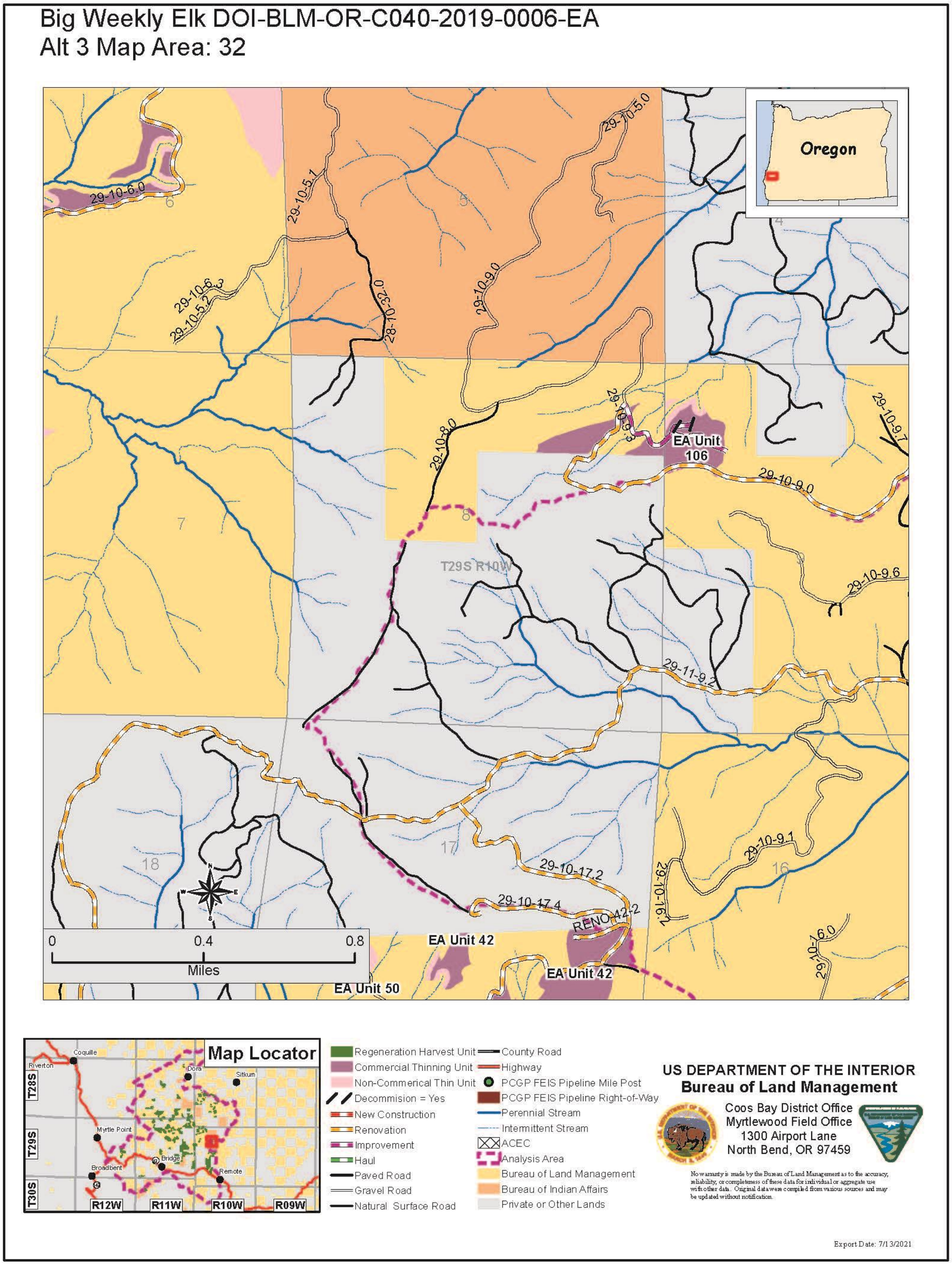

Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 29
Oregon
EA Unit 50
EA Unit 37
EA Unit 19
EA Unit 31
EA Unit 32
Big Creek Rd
T29S-R11W
0
0.4
0.8
Miles
Map Locator
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commerical Thin Unit
Decommision = Yes
New Construction
Renovation
Improvement
Haul
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
Export Date: 7/13/2021

Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 30

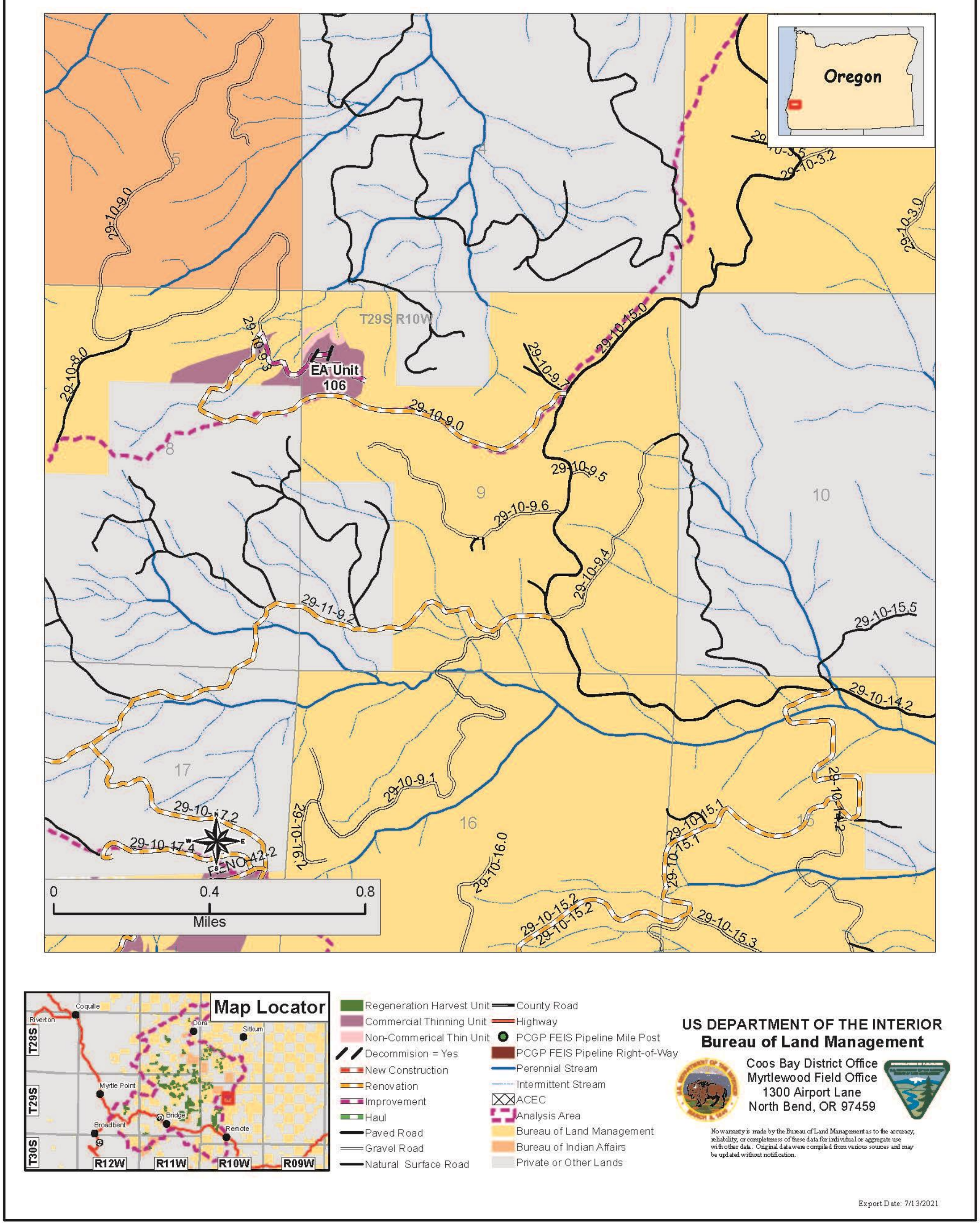



Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 31
EA Unit 14
EA Unit 11
EA Unit 15
EA Unit 15
EA Unit 34
EA Unit 34
EA Unit 34
EA Unit 34
EA Unit 34
EA Unit 42
Oregon
T28S R10W
T29S R11W
29-10-6.0
29-10-6.4
29-10-31.0
29-11-12.1
29-11-28.0
29-10-5.1
29-10-6.3
29-10-5.2
28-10-32.0
29-10-9.0
29-10-8.0
29-11-9.2
29-10-17.1
Big Creek Rd
12
7
18
17
24
0
0.4
0.8
Miles
Map Locator
Coquille
Riverton
Dora
Sitkum
Myrtle Point
Bridge
Broadbent
Remote
T28S
T29S
T30S
R12W
R11W
R10W
R09W
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commerical Thin Unit
Decommision = Yes
New Construction
Renovation
Improvement
Haul
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.
Export Date: 7/13/2021

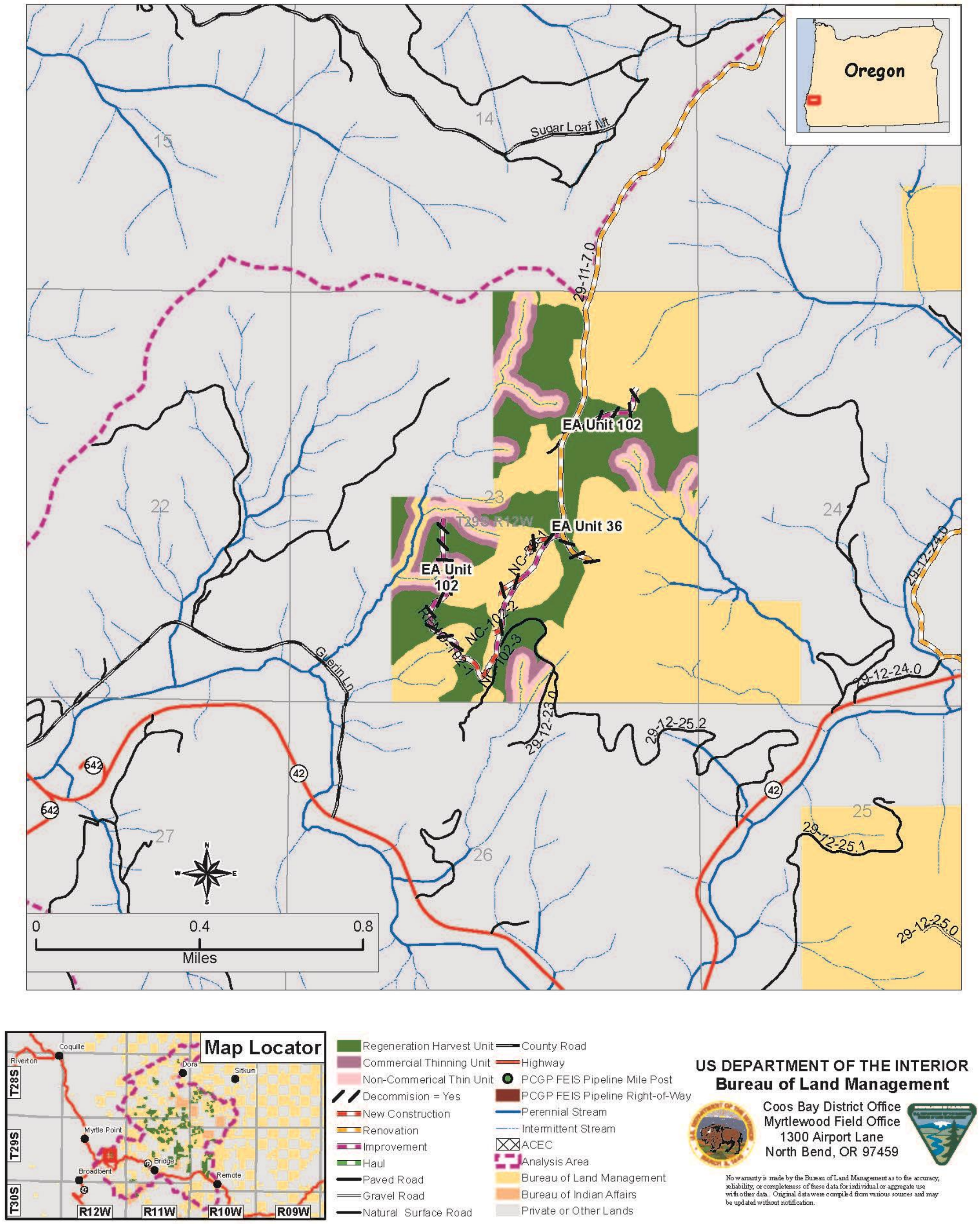
Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 32



Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 33

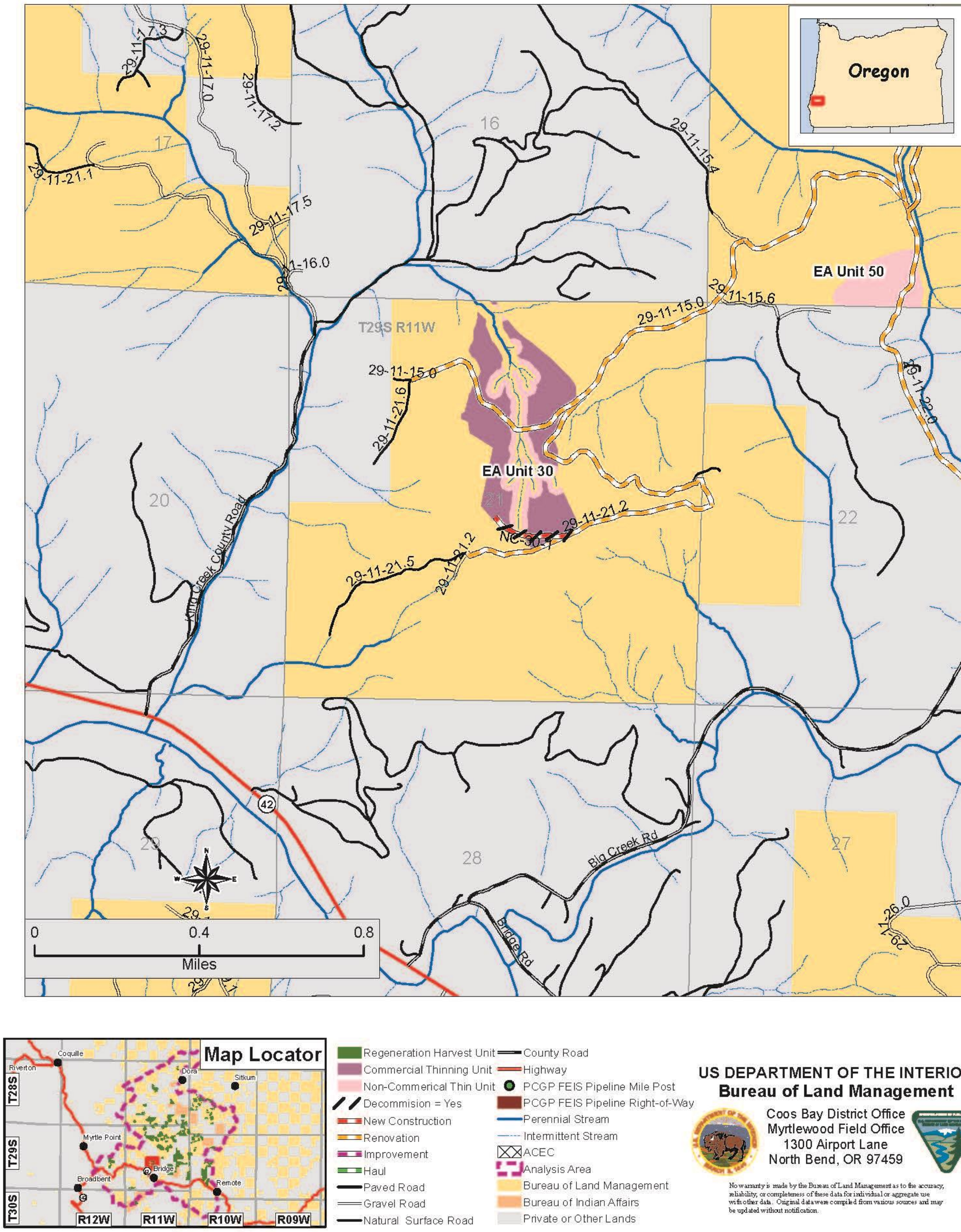


Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 34



Export Date: 7/13/2021

Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 35

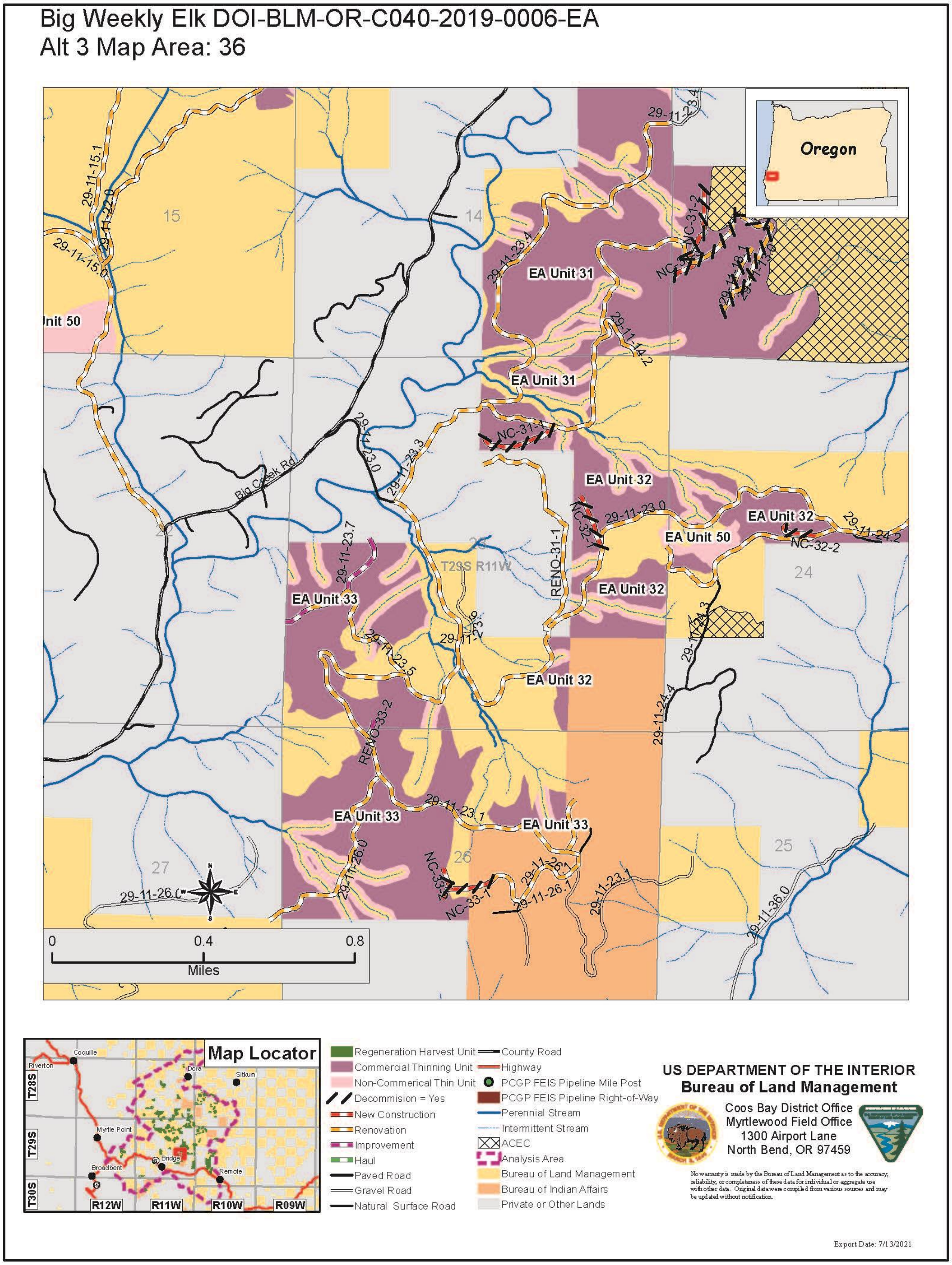


US DEPARTMENT OF THE INTERIOR
Bureau of Land Management

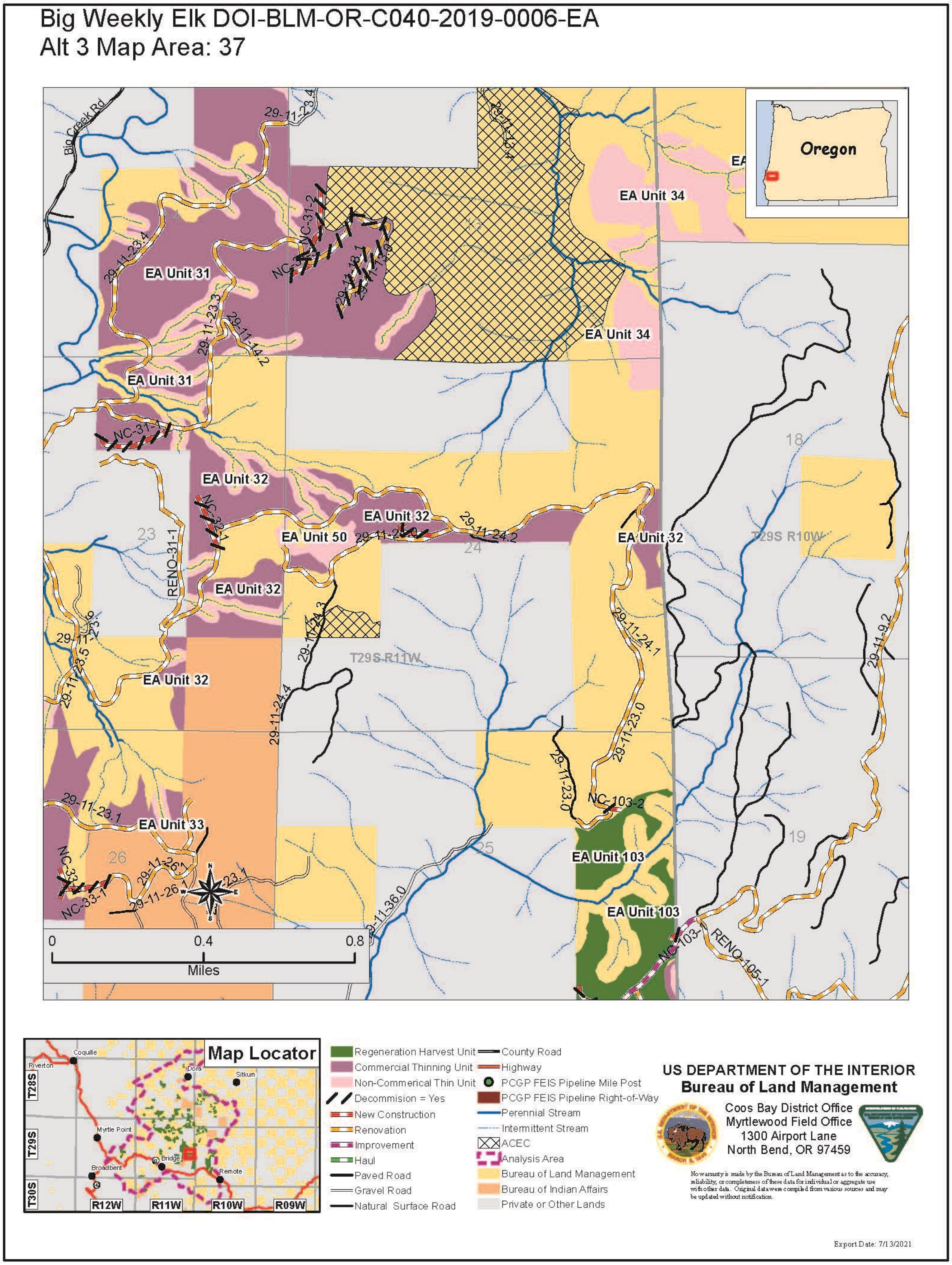
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.

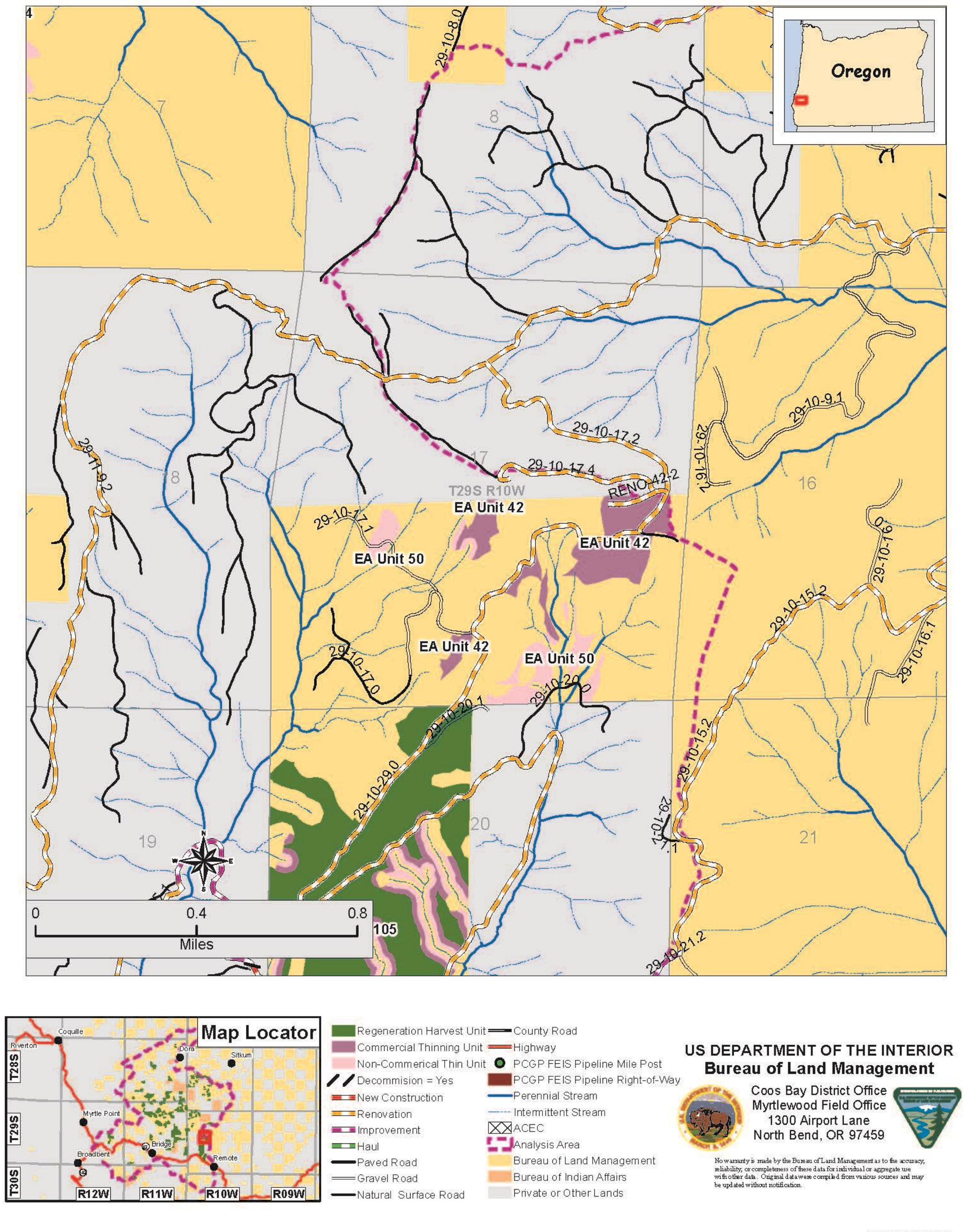
Export Date: 7/13/2021



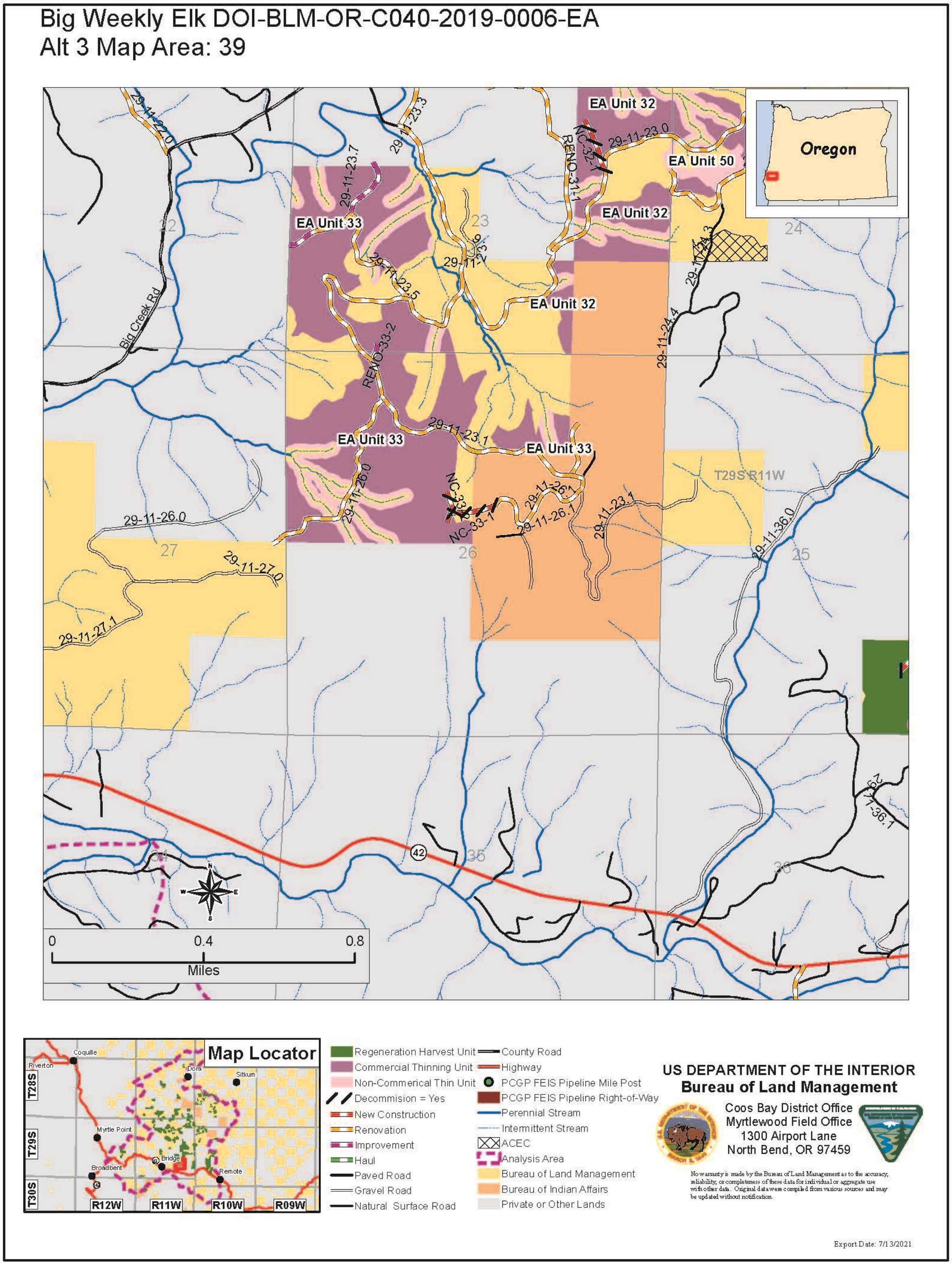
Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 36
Oregon
EA Unit 31
EA Unit 32
EA Unit 33
EA Unit 50
T29S R11W
Big Creek Rd
0
0.4
0.8
Miles
Map Locator
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commerical Thin Unit
Decommission = Yes
New Construction
Renovation
Improvement
Haul
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.
Export Date: 7/13/2021


Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 37
Oregon
EA Unit 31
EA Unit 32
EA Unit 33
EA Unit 34
EA Unit 50
EA Unit 103
T29S R11W
T29S R10W
Big Creek Rd
Miles
Map Locator
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commerical Thin Unit
Decommision = Yes
New Construction
Renovation
Improvement
Haul
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
Export Date: 7/13/2021

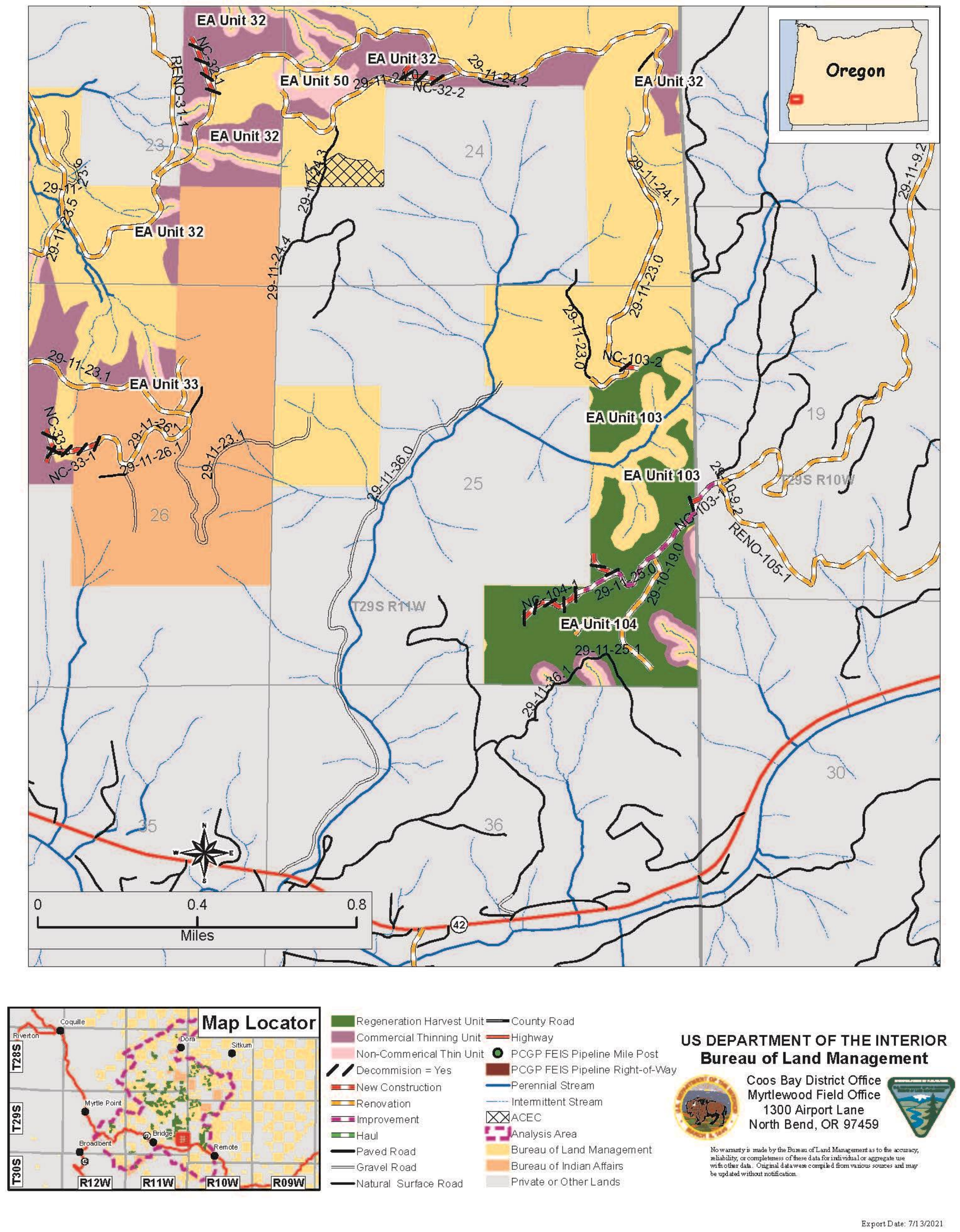
Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 38

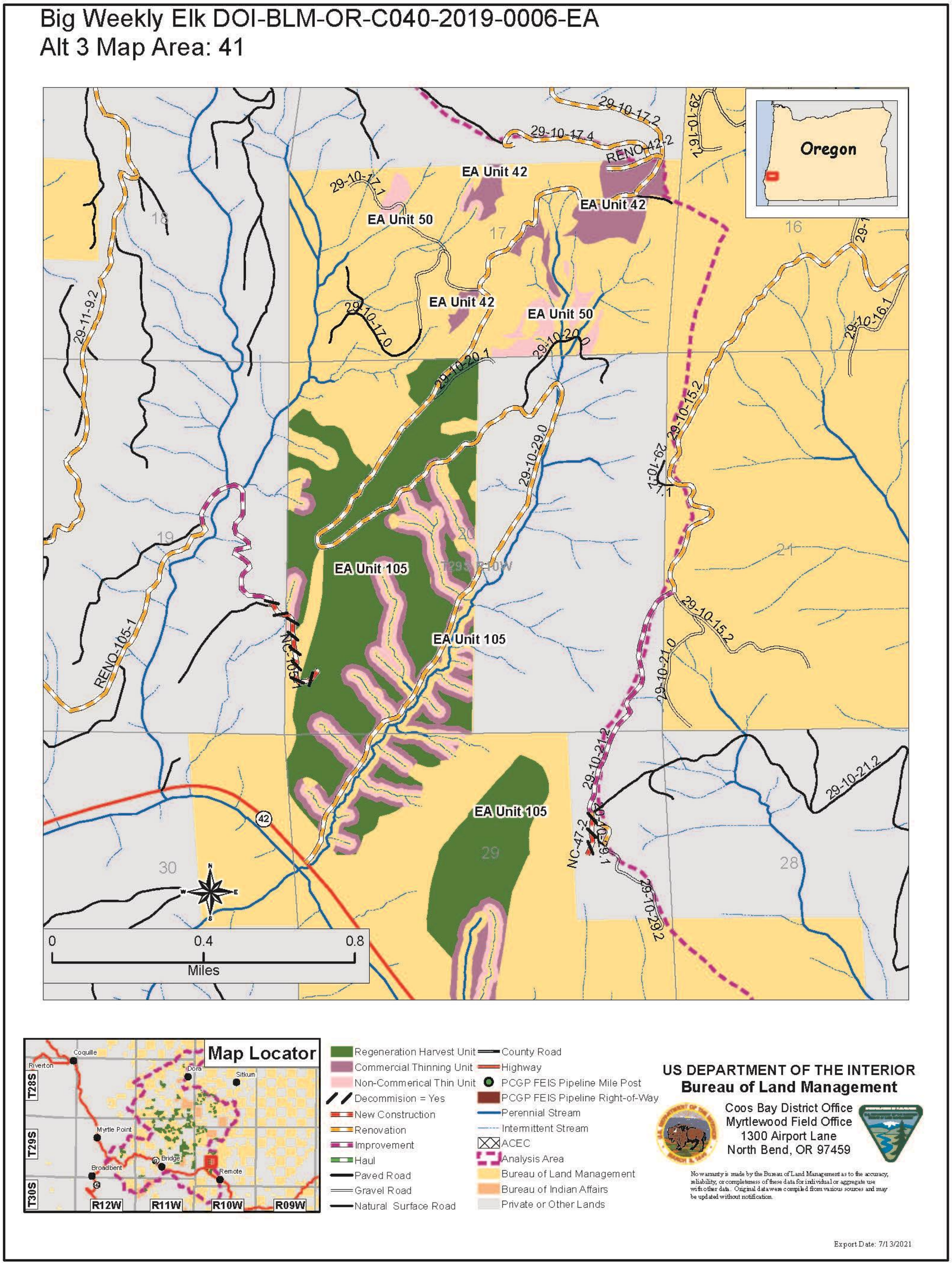


Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 39

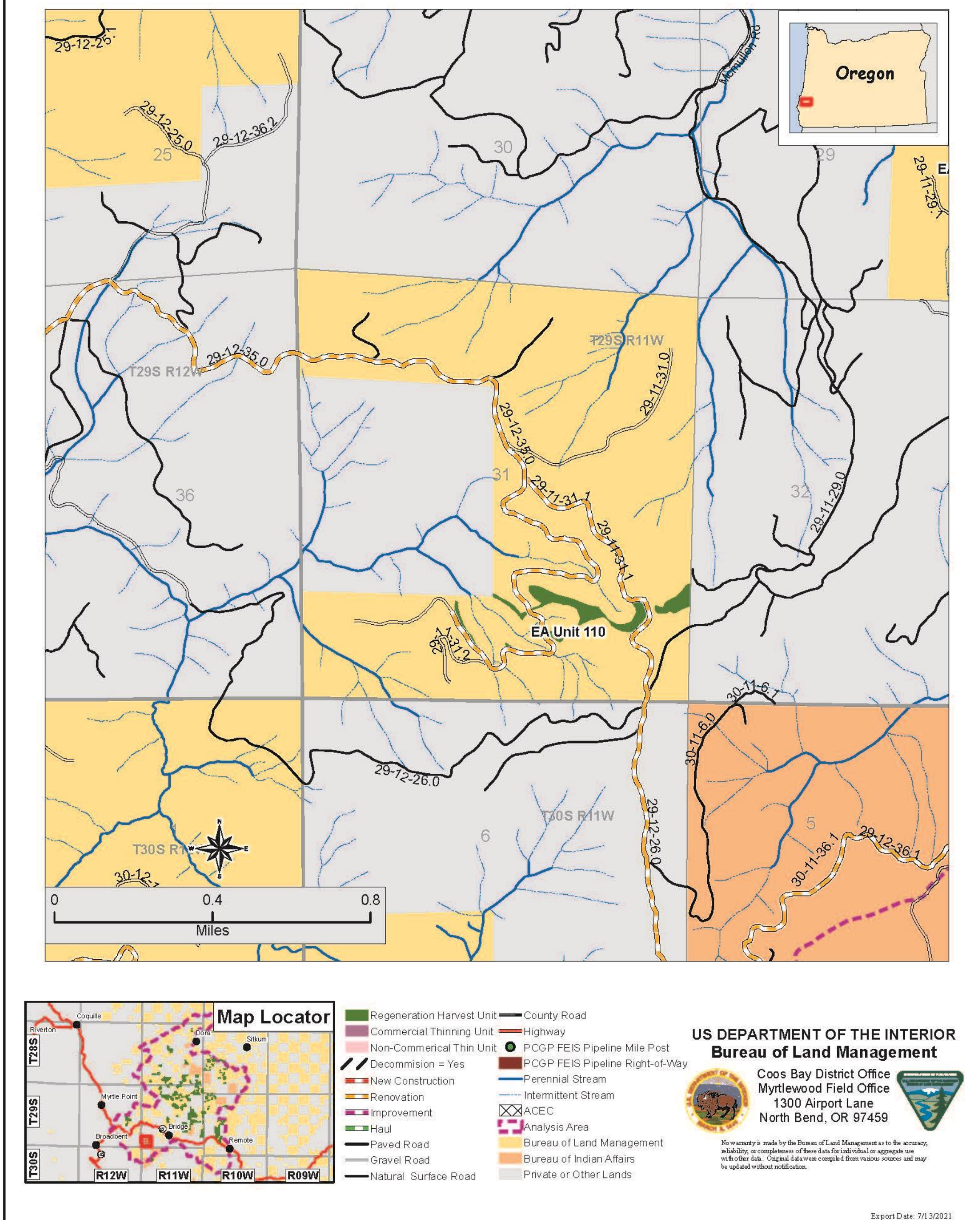


Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 40

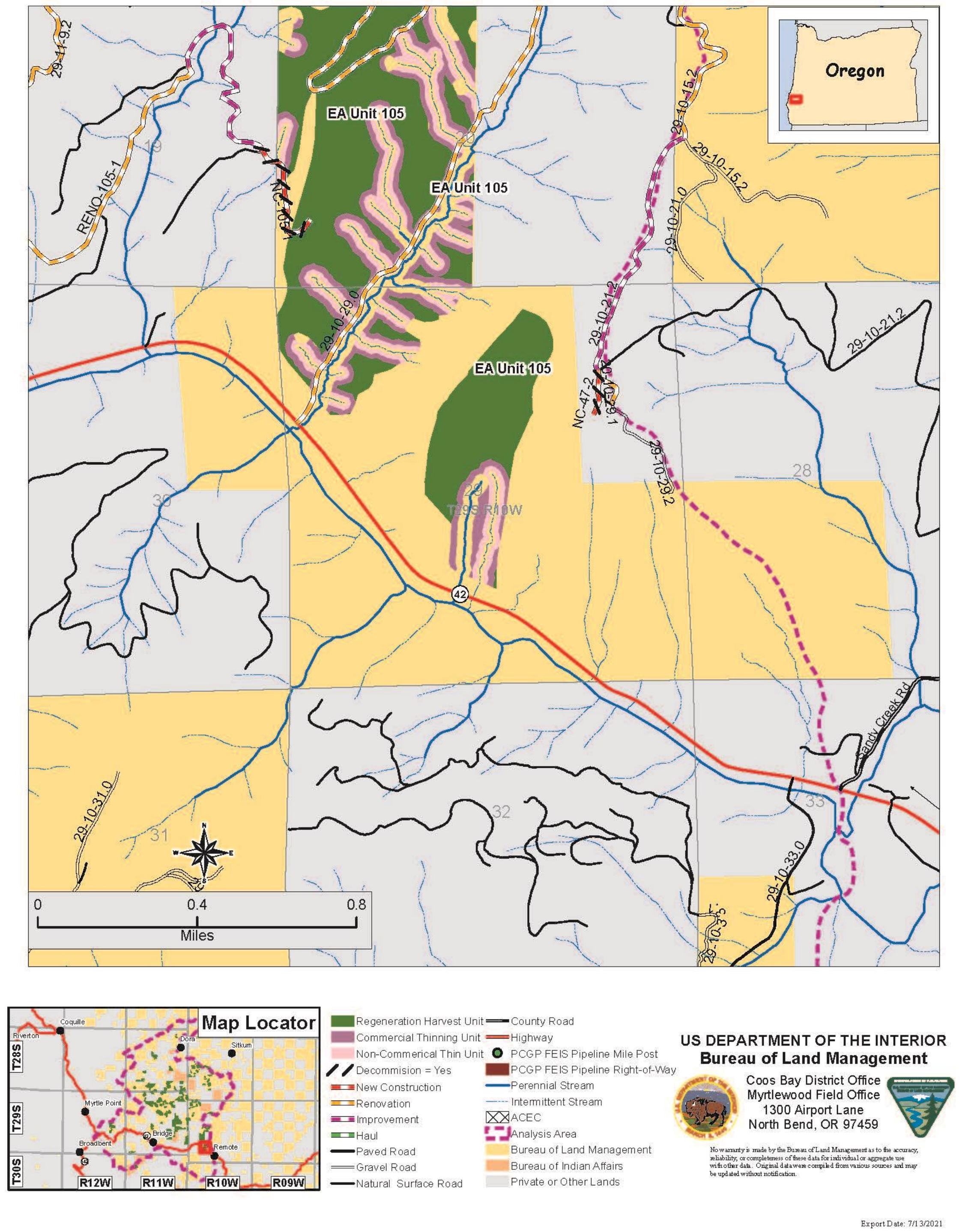



Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 41
Oregon
EA Unit 42
EA Unit 50
EA Unit 105
29-10-17.2
29-10-17.4
RENO-42-2
29-10-17.1
29-10-17.0
29-10-20.1
29-10-20.0
29-10-29.0
29-10-15.2
29-10-16.1
29-10-21.0
29-10-21.2
29-10-29.2
29-11-9.2
RENO-105-1
NC-47-2
T29S R10W
0 0.4 0.8
Miles
Map Locator
Coquille
Riverton
Dora
Sitkum
Myrtle Point
Bridge
Broadbent
Remote
T28S
T29S
T30S
R12W R11W R10W R09W
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commerical Thin Unit
Decommision = Yes
New Construction
Renovation
Improvement
Haul
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.
Export Date: 7/13/2021

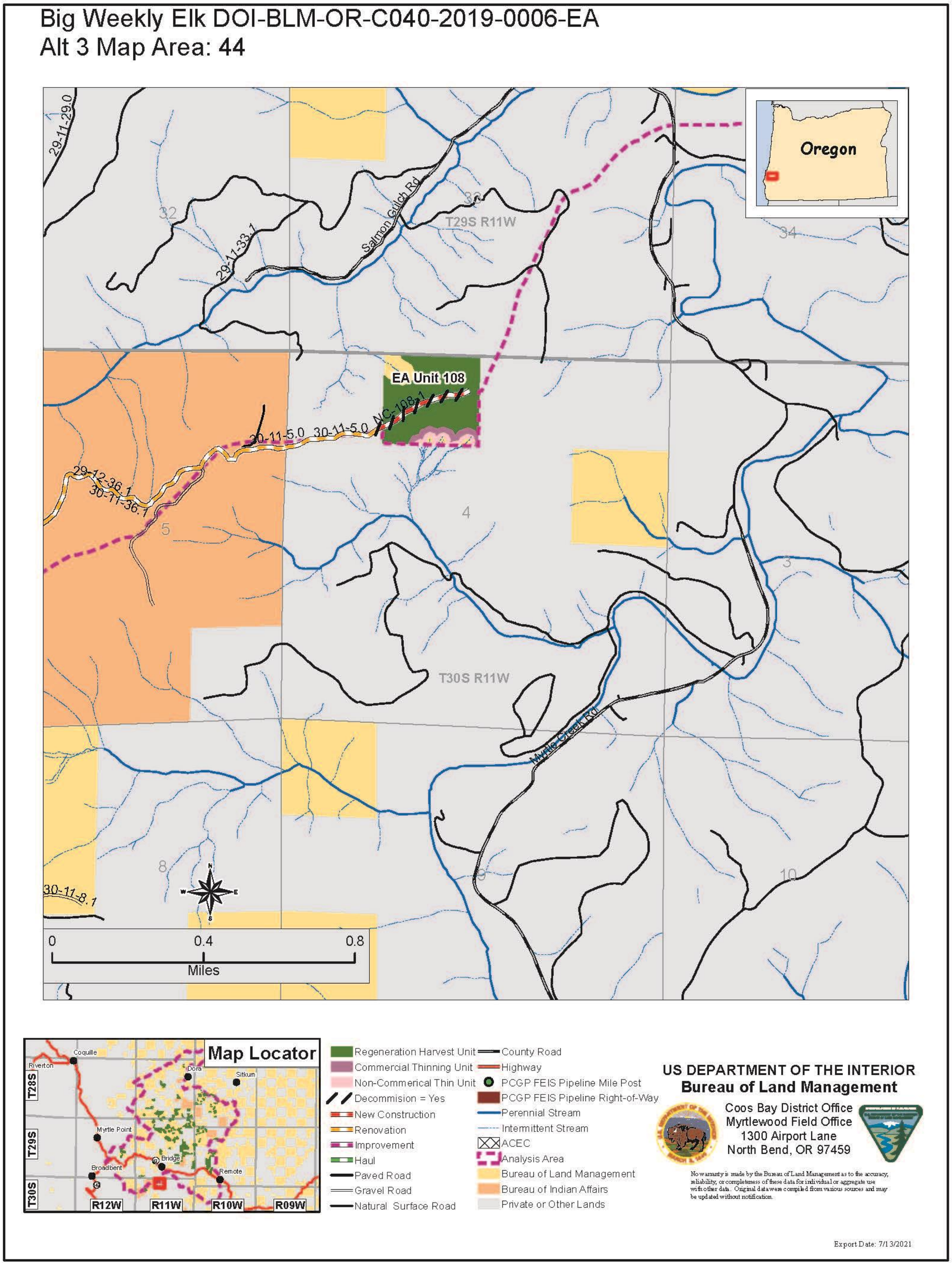
Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 42



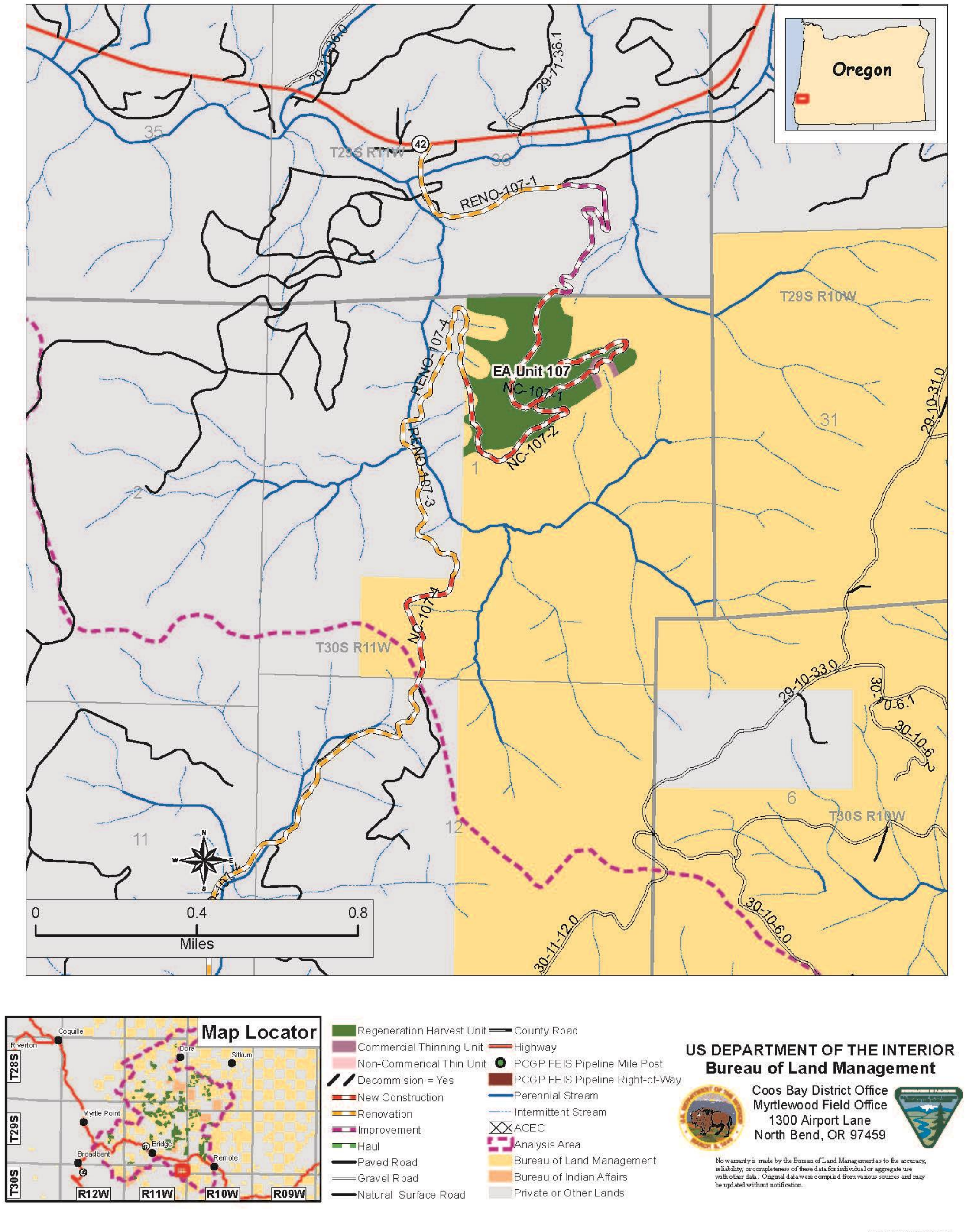
Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 43

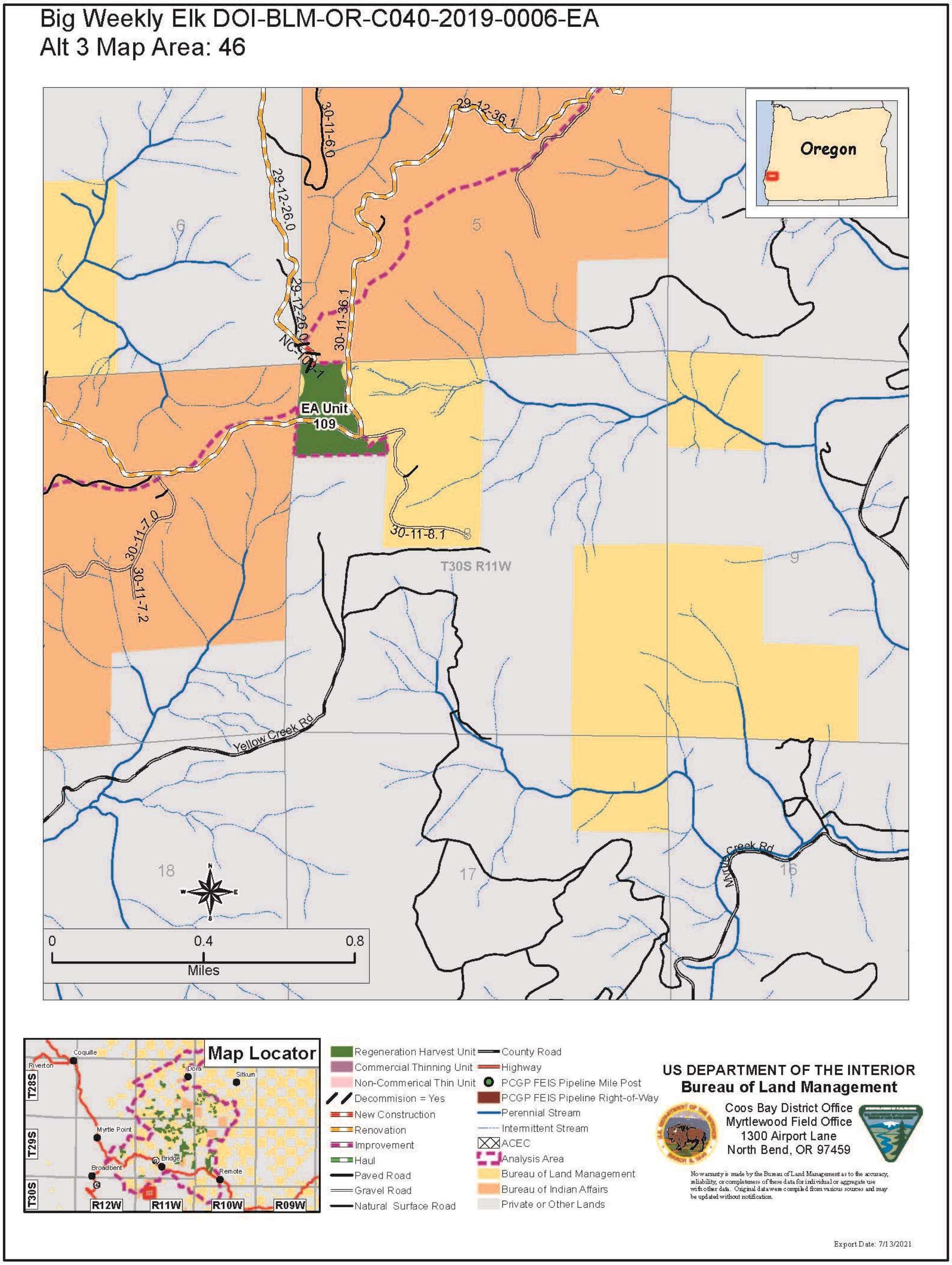


Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 44



Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 45





Big Weekly Elk DOI-BLM-OR-C040-2019-0006-EA
Alt 3 Map Area: 46
Oregon
EA Unit 109
T30S R11W
Yellow Creek Rd
Myrtle Creek Rd
29-12-36.1
30-11-6.0
29-12-26.0
30-11-36.1
30-11-8.1
30-11-7.0
30-11-7.2
0
0.4
0.8
Miles
Map Locator
Regeneration Harvest Unit
Commercial Thinning Unit
Non-Commerical Thin Unit
Decommision = Yes
New Construction
Renovation
Improvement
Haul
Paved Road
Gravel Road
Natural Surface Road
County Road
Highway
PCGP FEIS Pipeline Mile Post
PCGP FEIS Pipeline Right-of-Way
Perennial Stream
Intermittent Stream
ACEC
Analysis Area
Bureau of Land Management
Bureau of Indian Affairs
Private or Other Lands
US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1300 Airport Lane
North Bend, OR 97459
Export Date: 7/13/2021

Appendix D: Alternative 2 and 3 Proposed Road Activities by Unit

Table 25. Summary of Proposed Transportation Management Actions in Each Land Use Allocations

Land Use Allocation	Actions Common to both Action Alternatives (miles)			
	New Construct	Renovation	Improvement	Haul
Harvest Land Base (miles)	0	.2	0.2	0.0
HLB LITA	0	0.0	0.0	0.0
HLB MITA	0	.2	0.2	0.0
Late Successional Reserve (miles)	0	41.33	3.01	7.3
Riparian Reserve (miles)	0	18.3	0.4	2.9
TPCC-DDR (miles)	0	0.0	0.0	0.0
Current Roads-DDR (miles)	0	8.8	0.8	0.0
Area of Critical Concern-DDR (miles)	0	0.4	0.0	0.1
Private (miles)	0	27.9	1.6	10.1
Project Size All LUA's Combined (miles)	0	97.0	6.0	20.4
Alternative 3 Including Common to Both				
Harvest Land Base (miles)	2.8	0.2	0.3	0.0
HLB LITA	1.2	0.0	0.0	0.0
HLB MITA	1.1	0.2	0.3	0.0
Late Successional Reserve (miles)	3.5	43.7	3.1	7.3
Riparian Reserve (miles)	0.6*	19.7	.6	2.9
TPCC-DDR (miles)	0.1	0.0	0.0	0.0
Current Roads-DDR (miles)	0.1	9.5	.8	0.0
Area of Critical Concern-DDR (miles)	0.0	0.4	0.0	0.1
Private (miles)	0.7	38.2	2.8	10.1
Project Size All LUA's Combined (miles)	7.4	111.7	7.6	20.4

*The 0.6 miles of NC road in the RR is comprised of 23 different segments. Two of the longest pieces of New Construction in RR is Ridge top construction and the third longest piece is mid slope on a mild 5% slope.

Table 26. Summary of Road Activities Related to Both Actions.

Category	Activity	Mileage
Timber Haul	All Season/Gravel Roads	84.79
	All Season/Paved Roads	24.99
Travel Management	Improvement	6.0
	Renovation	117.4
	Decommissioning	5.5

Table 27. Travel Management Alternative 2

Unit Name	EA Road Number	Improvements (miles)	New Construction (miles)	Renovation (miles)	Totals (miles)	Decommission (miles)
Anderson Brown CT	28-11-15.2	0	0	0.23	0.23	0.23
	28-11-9.1	0	0	0.30	0.30	0
	29-11-1.0	0	0	0.62	0.62	0
	29-11-1.1	0.19	0	0.76	0.95	0
	29-11-1.2	0	0	0.12	0.12	0
	29-11-1.3	0	0	0.18	0.18	0
	29-11-10.2	0	0	0.21	0.21	0
	29-11-10.4	0.16	0	0	0.16	0
	29-11-11.3	0	0	0.83	0.83	0
	29-11-11.4	0	0	0.58	0.58	0
	29-11-14.0	0	0	0.23	0.23	0
	29-11-15.0	0	0	3.36	3.36	0
	29-11-15.1	0	0	1.29	1.29	0
	29-11-15.3	0	0	0.65	0.65	0
	29-11-21.2	0	0	2.71	2.71	0
	29-11-22.0	0	0	2.98	2.98	0
	RENO-17-1	0.02	0	0	0.02	0
	RENO-17-2	0.25	0	0	0.25	0
	RENO-37-1	0.29	0	0	0.29	0
	RENO-37-2	0.30	0	0	0.30	0
Bear & Elk CT	123	0	0	0.26	0.26	0.26
	28-10-29.0	0	0	0.29	0.29	0
	28-10-29.2	0	0	0.06	0.06	0
	28-11-29.0	0	0	.79	.79	0
	29-10-6.0	0	0	1.88	1.88	0
	29-10-6.1	0	0	0.62	0.62	0.62
	29-11-12.1	0	0	0.24	0.24	0
	RENO-10-1	0	0	0.08	0.08	0.08
	RENO-1-1	0	0	1.22	1.22	0
	RENO-1-2	0	0	0.06	0.06	0.06
	RENO-13-1	0	0	0.10	0.10	0.10
	RENO-14-1	0.19	0	0	0.19	0.19
Casey Jones CT	29-11-13.0	0	0	0.37	0.37	0.37
	29-11-13.1	0	0	0.13	0.13	0.13
	29-11-14.2	0	0	0.20	0.20	0
	29-11-23.0	0	0	2.02	2.02	0
	29-11-23.1	0	0	1.24	1.24	0
	29-11-23.3	0	0	1.70	1.70	0.23

Unit Name	EA Road Number	Improvements (miles)	New Construction (miles)	Renovation (miles)	Totals (miles)	Decommission (miles)
	29-11-23.4	0	0	1.32	1.32	0
	29-11-23.5	0.08	0	0.71	0.79	0
	29-11-23.7	0.17	0	0	0.17	0
	29-11-24.0	0	0	0.61	0.61	0
	29-11-26.0	0	0	.58	.58	0
	RENO-33-1	0	0	0.15	0.15	0
	RENO-33-2	0.05	0	0	0.05	0
Elk Cr. Ridge CT	28-11-32.2	0	0	0.18	0.18	0.18
	28-11-33.0	0	0	0.49	0.49	0
	29-11-29.2	0	0	0.60	0.60	0.60
	29-11-3.0	0	0	0.97	0.97	0
	29-11-3.3	0	0	0.34	0.34	0
	29-11-4.0	0	0	0.44	0.44	0
	RENO-2-1	0	0	0.06	0.06	0
King Salmon	29-11-31.1	0	0	0.84	0.84	0
	29-12-26.0	0	0	1.71	1.71	0
	29-12-35.0	0	0	3.43	3.43	0
	30-11-36.1	0	0	7.35	7.35	0
Lower Frenchie	20-10-29.1	0	0	0.11	0.11	0
	29-10-14.2	0	0	0.68	0.68	0
	29-10-15.1	0	0	0.83	0.83	0
	29-10-15.2	0	0	2.22	2.22	0
	29-10-17.2	0	0	0.79	0.79	0
	29-10-17.4	0	0	0.49	0.49	0
	29-10-21.2	0.67	0	0	0.67	0
	29-10-29.0	0	0	3.79	3.79	0
	RENO-42-2	0	0	0.13	0.13	0
New Yankee	28-11-20.0	0	0	0.53	0.53	0
	28-11-20.2	0	0	1.31	1.31	0
	28-11-3.1	0	0	1.29	1.29	0
Sheep Mt CT	28-10-17.0	0.80	0	1.07	1.87	0.80
	28-10-18.1	0.50	0	0	0.50	0.50
	RENO-43-1	0.11	0	0.46	0.58	0.58
	RENO-43-2	0.09	0	0.10	0.19	0.09
Small Sandy	RENO-43-3	0.03	0	0	0.03	0.03
	29-10-9.0	0	0	1.37	1.37	0
	29-10-9.3	0.28	0	0	0.28	0.06
	RENO-106-1	0.16	0	0	0.16	0

Unit Name	EA Road Number	Improvements (miles)	New Construction (miles)	Renovation (miles)	Totals (miles)	Decommission (miles)
South Elk 23 CT	28-11-23.2	0	0	0.08	0.08	0
	28-11-25.1	0	0	0.65	0.65	0
	28-11-26.0	0	0	2.78	2.78	0
	28-11-26.3	0	0	1.14	1.14	0
	28-11-35.0	0	0	2.49	2.49	0
	28-11-36.1	0	0	0.18	0.18	0
	RENO-101-1	0	0	0.17	0.17	0
	RENO-6-1	0	0	0.09	0.09	0
Sugar Rush	29-11-7.0	0	0	2.94	2.94	0.11
	29-12-23.1	0.22	0	0	0.22	0.22
	29-12-24.0	0	0	3.38	3.38	0
	RENO-102-1	0.36	0	0	0.36	0
The Belieus	29-10-19.0	0.26	0	0.35	0.61	0
	29-11-23.0	0	0	1.69	1.69	0
	29-11-25.0	0.28	0	0	0.28	0
	29-11-25.1	0	0	0.14	0.14	0
	29-11-9.2	0	0	5.12	5.12	0
Weekend Falls CT	28-11-29.1	0	0	0.14	0.14	0
	29-11-10.0	0	0	1.72	1.72	0
	29-11-11.0	0	0	0.10	0.10	0
	29-11-15.1	0	0	0.93	0.93	0
	29-11-22.0	0	0	0.88	0.88	0
	29-11-5.0	0	0	1.59	1.59	0
	29-11-5.1	0	0	0.76	0.76	0
	29-11-7.1	0	0	1.65	1.65	0
	29-11-8.0	0	0	0.97	0.97	0
	29-11-9.0	0.55	0	0	0.55	0
	29-11-9.2	0	0	0.38	0.38	0
	29-11-9.4	0	0	0.10	0.10	0
	29-11-9.6	0	0	0.78	0.78	0
	29-12-1.1	0	0	0.89	0.89	0
	RENO-26-1	0	0	0.37	0.37	0
	RENO-27-1	0	0	0.27	0.27	0
Multiple TS	20-10-31.0	0	0	1.98	1.98	0
	28-10-31.0	0	0	3.62	3.62	0
	28-11-29.0	0	0	9.90	9.90	0
	28-11-29.1	0	0	4.49	4.49	0
	29-11-28.0	0	0	0.43	0.43	0

Unit Name	EA Road Number	Improvements (miles)	New Construction (miles)	Renovation (miles)	Totals (miles)	Decommission (miles)
Total		6.01	0	117.38	123.40	5.5

Table 28. Travel Management Alternative 3

Timber Sale	EA Road Number	Improvements (miles)	New Construction (miles)	Renovation (miles)	Totals (miles)	Decommission (miles)
Anderson Brown CT	28-11-15.2	0	0	0.23	0.23	0.23
	28-11-9.1	0	0	0.30	0.30	0
	29-11-1.0	0	0	0.62	0.62	0
	29-11-1.1	0.19	0	0.76	0.95	0
	29-11-1.2	0	0	0.12	0.12	0
	29-11-1.3	0	0	0.18	0.18	0
	29-11-10.2	0	0	0.21	0.21	0
	29-11-10.4	0.16	0	0	0.16	0
	29-11-11.3	0	0	0.83	0.83	0
	29-11-11.4	0	0	0.58	0.58	0
	29-11-14.0	0	0	0.23	0.23	0
	29-11-15.0	0	0	3.36	3.36	0
	29-11-15.1	0	0	1.29	1.29	0
	29-11-15.3	0	0	0.74	0.74	0
	29-11-21.2	0	0	2.71	2.71	0
	29-11-22.0	0	0	2.98	2.98	0
	NC-17-1	0	0.10	0	0.10	0.10
	NC-19-1	0	0.14	0	0.14	0.14
	NC-30-1	0	0.2	0	0.2	0..2
	NC-30-3	0	0.16	0	0.16	0.16
	NC-37-1	0	0.13	0	0.13	0.13
	RENO-17-1	0.02	0	0	0.02	0
	RENO-17-2	0.25	0	0	0.25	0
	RENO-37-1	0.29	0	0	0.29	0
	RENO-37-2	0.30	0	0	0.30	0
Bear & Elk CT	123	0	0	0.26	0.26	0.26
	28-10-29.0	0	0	0.29	0.29	0
	28-10-29.2	0	0	0.51	0.51	0
	28-11-25.0	0	0	0.48	0.48	0
	28-11-29.0	0	0	.79	.79	0
	29-10-6.0	0	0	1.88	1.88	0
	29-10-6.1	0	0	0.62	0.62	0.62
	29-11-12.1	0	0	0.24	0.24	0
	NC-38-1	0	0.30	0	0.30	0.30

Timber Sale	EA Road Number	Improvements (miles)	New Construction (miles)	Renovation (miles)	Totals (miles)	Decommission (miles)
	RENO-10-1	0	0	0.08	0.08	0.08
	RENO-1-1	0	0	1.22	1.22	0
	RENO-1-2	0	0	0.06	0.06	0.06
	RENO-13-1	0	0	0.10	0.10	0.10
	RENO-14-1	0.19	0	0	0.19	0.19
Casey Jones CT	29-11-13.0	0	0	0.37	0.37	0.37
	29-11-13.1	0	0	0.13	0.13	0.13
	29-11-14.2	0	0	0.20	0.20	0
	29-11-23.0	0	0	2.02	2.02	0
	29-11-23.1	0	0	1.30	1.30	0
	29-11-23.3	0	0	1.70	1.70	.23
	29-11-23.4	0	0	1.32	1.32	0
	29-11-23.5	0.08	0	0.71	0.79	0
	29-11-23.7	0.17	0	0	0.17	0
	29-11-24.0	0	0	0.61	0.61	0
	29-11-26.0	0	0	.58	.58	0
	29-11-26.1	0	0	0.36	0.36	0
	NC-31-1	0	0.21	0	0.21	0.21
	NC-31-2	0	0.20	0	0.20	0.20
	NC-31-3	0	0.07	0	0.07	0.07
	NC-32-1	0	0.15	0	0.15	0.15
	NC-32-2	0	0.11	0	0.11	0.11
	NC-33-1	0	0.15	0	0.15	0.15
	NC-33-2	0	0.06	0	0.06	0.06
	RENO-31-1	0	0	0.65	0.65	0
	RENO-33-1	0	0	0.15	0.15	0
	RENO-33-2	0.05	0	0	0.05	0
Elk Cr. Ridge CT	28-11-29.3	0	0	0.06	0.06	0
	28-11-29.4	0	0	0.30	0.30	0.30
	28-11-30.2	0	0	1.21	1.21	0
	28-11-32.2	0	0	0.18	0.18	0.18
	28-11-33.0	0	0	0.49	0.49	0
	29-11-29.2	0	0	0.60	0.60	0.60
	29-11-3.0	0	0	0.97	0.97	0
	29-11-3.3	0	0	0.70	0.70	0
	29-11-4.0	0	0	0.44	0.44	0
	NC2-1	0	0.07	0	0.07	0.07
	NC-2-1	0	0	0.07	0.07	0.07

Timber Sale	EA Road Number	Improvements (miles)	New Construction (miles)	Renovation (miles)	Totals (miles)	Decommission (miles)
	NC-28-1	0	0.05	0	0.05	0.05
	NC-28-2	0	0.11	0	0.11	0.11
	NC-3-1	0	0.03	0	0.03	0.03
	NC-4-1	0	0.27	0	0.27	0.27
	NC-41-1	0	0.17	0	0.17	0.17
	RENO-2-1	0	0	0.06	0.06	0
	RENO-28-1	0	0	0.32	0.32	0
King Salmon	29-11-31.1	0	0	0.84	0.84	0
	29-12-26.0	0	0	1.71	1.71	0
	29-12-35.0	0	0	3.43	3.43	0
	30-11-36.1	0	0	8.70	8.70	0
	30-11-5.0	0	0	0.53	0.53	0
	NC-108-1	0	0.27	0	0.27	0.27
	NC-109-1	0	0.08	0	0.08	0.08
Lower Frenchie	20-10-29.1	0	0	0.11	0.11	0
	29-10-14.2	0	0	0.68	0.68	0
	29-10-15.1	0	0	0.83	0.83	0
	29-10-15.2	0	0	2.22	2.22	0
	29-10-17.2	0	0	0.79	0.79	0
	29-10-17.4	0	0	0.49	0.49	0
	29-10-21.2	0.67	0	0	0.67	0
	29-10-29.0	0	0	3.79	3.79	0
	NC-105-1	0	0.31	0	0.31	0.31
	NC-47-2	0	0.10	0	0.10	0.10
	RENO-105-1	0.62	0	1.35	1.97	0
	RENO-42-2	0	0	0.13	0.13	0
New Yankee	28-11-17.0	0	0	0.58	0.58	0
	28-11-17.5	0	0	1.07	1.07	0
	28-11-20.0	0	0	1.09	1.09	0
	28-11-20.2	0	0	1.31	1.31	0
	28-11-3.1	0	0	1.29	1.29	0
	NC-100-1	0	0.07	0	0.07	0.07
	NC-100-2	0	0.11	0	0.11	0.11
	NC-111-1	0	0.22	0	0.22	0
	NC-111-2	0	0.04	0	0.04	0.04
Rock Slide	NC-107-1	0	0.87	0	0.87	0
	NC-107-2	0	0.57	0	0.57	0
	NC-107-4	0	0.38	0	0.38	0

Timber Sale	EA Road Number	Improvements (miles)	New Construction (miles)	Renovation (miles)	Totals (miles)	Decommission (miles)
	RENO-107-1	0.60	0	0.52	1.12	0
	RENO-107-2	0	0	1.94	1.94	0
	RENO-107-3	0	0	0.48	0.48	0
	RENO-107-4	0	0	0.54	0.54	0
Sheep Mt, CT	28-10-17.0	0.80	0	1.07	1.87	0.80
	28-10-18.1	0.50	0	0	0.50	0.50
	28-10-9.0	0	0	2.43	2.43	0
	NC-43-1	0	0.25	0	0.25	0.25
	NC-43-2	0	0.19	0	0.19	0.19
	RENO-43-1	0.11	0	0.46	0.58	0.58
	RENO-43-2	0.09	0	0.10	0.19	0.09
	RENO-43-3	0.03	0	0	0.03	0.03
Small Sandy	29-10-9.0	0	0	1.35	1.35	0
	29-10-9.3	0.28	0	0	0.28	0.06
	RENO-106-1	0.16	0	0	0.16	0
South Elk 23 CT	28-11-23.2	0	0	0.08	0.08	0
	28-11-25.1	0	0	0.65	0.65	0
	28-11-26.0	0	0	2.78	2.78	0
	28-11-26.3	0	0	1.14	1.14	0
	28-11-35.0	0	0	2.49	2.49	0
	28-11-36.1	0	0	0.18	0.18	0
	29-11-11.5	0	0	0.39	0.39	0
	NC-101-1	0	0.03	0	0.03	0.03
	NC-8-1	0	0.09	0	0.09	0.09
	RENO-101-1	0	0	0.17	0.17	0
	RENO-6-1	0	0	0.09	0.09	0
	RENO-8-1	0	0	1.39	1.39	0
Sugar Rush	29-11-7.0	0	0	2.94	2.94	0.11
	29-12-23.1	0.22	0	0	0.22	0.22
	29-12-24.0	0	0	3.38	3.38	0
	NC-102-1	0	0.07	0	0.07	0.07
	NC-102-2	0	0.03	0	0.03	0.03
	NC-102-3	0	0.13	0	0.13	0
	NC-36-1	0	0.08	0	0.08	0.08
	RENO-102-1	0.78	0	0	0.78	.42
The Belieus	29-10-19.0	0.26	0	0.35	0.61	0
	29-11-23.0	0	0	1.69	1.69	0

Timber Sale	EA Road Number	Improvements (miles)	New Construction (miles)	Renovation (miles)	Totals (miles)	Decommission (miles)
	29-11-25.0	0.28	0	0	0.28	0
	29-11-25.1	0	0	0.14	0.14	0
	29-11-9.2	0	0	5.12	5.12	0
	NC-103-1	0	0.03	0	0.03	0.03
	NC-103-2	0	0.03	0	0.03	0.03
	NC-104-1	0	0.27	0	0.27	0.27
Weekend Falls CT	28-11-29.1	0	0	0.14	0.14	0
	29-11-10.0	0	0	1.72	1.72	0
	29-11-11.0	0	0	0.10	0.10	0
	29-11-15.1	0	0	0.93	0.93	0
	29-11-22.0	0	0	0.88	0.88	0
	29-11-5.0	0	0	1.59	1.59	0
	29-11-5.1	0	0	0.76	0.76	0
	29-11-7.1	0	0	1.65	1.65	0
	29-11-8.0	0	0	0.97	0.97	0
	29-11-9.0	0.55	0	0	0.55	0
	29-11-9.2	0	0	0.38	0.38	0
	29-11-9.4	0	0	0.28	0.28	0
	29-11-9.6	0	0	0.78	0.78	0
	29-12-1.1	0	0	0.89	0.89	0
	NC-23-1	0	0.14	0	0.14	0.14
	NC-24-1	0	0.31	0	0.31	0.31
	RENO-26-1	0	0	0.37	0.37	0
	RENO-27-1	0	0	0.27	0.27	0
Multiple TS	20-10-31.0	0	0	1.98	1.98	0
	28-10-31.0	0	0	3.62	3.62	0
	28-11-29.0	0	0	9.90	9.90	0
	28-11-29.1	0	0	4.49	4.49	0
	29-11-28.0	0	0	0.43	0.43	0
Total		7.65	7.35	132.11	147.12	11.41

Appendix E: Port-Orford-Cedar Risk Key

Port-Orford-Cedar Risk Key: Site-specific analysis to help determine where risk reduction management practices would be applied for BWE EA in the vicinity of ACEC and to the rest of the BWE EA.

1a. Are there uninfected POC within, near (25-50 ft.), or downstream (100-200 ft.) of the activity area whose ecological, Tribal, or product use or function measurably contributes to meeting land and resource management plan objectives?

1b. Are there uninfected POC within, near (25-50 ft.) or downstream (100-200 ft.) of the activity area that, were they to become infected would likely spread infection to trees whose ecological, Tribal, or product use or function measurably contributes to meeting land and resource management plan objectives?

1c. Is the activity within an uninfested 7th field watershed as defined in Attachment 1?

2. Will the proposed project introduce appreciable additional risk of infection to these uninfected POC.

The answer to 1a, 1b, could potentially be “yes” due to the Areas of Critical Environmental Concern (ACECs) being adjacent and downstream. 1c and 2 are “no” because there is infection within the 7th field watershed and within the Big Weekly Elk project boundary. To reduce further infections from developing due to actions under the Big Weekly Elk EA, additional PDFs (see Appendix B) would be used in adjacent properties to the ACECs (See Appendix A: Issues Considered but Not Analyzed in Detail for ACECs).

The rest of BWE: The answers to 1a, 1b, 1c and 2 are “no”. The population of Port-Orford-cedar within the project area does not meet the measurably contributes to~ definition (1a and 1b) or appreciable additional risk meaning (1c). The project area is not within an uninfested watershed (2).

Because the answer to all questions is “no”, then risk is low and no POC management practices are required.

The BWE project area is within the range of Port-Orford-cedar; therefore, all management activities would conform to the guidelines specified in the 2004 Final Supplemental Environmental Impact Statement for Management of Port-Orford-Cedar in Southwest Oregon where applicable (FEIS) (USDI BLM, 2004).

Areas within 50 feet of streams or roads were determined to be at high risk of infection, and those areas greater than 50 feet away from roads and streams were determined to be at low risk of infection by Port-Orford-cedar root disease (Phytophthora lateralis) (USDI BLM, 2004, pp. 3-42). Two Risk Keys were used for the analysis area. One for near where ACECs are located and another for the remainder of the project area. For areas near where ACECs are located, specific BMPs and PDFs would be applied (refer to Kip’s write-up). For the remainder of the project area, the answer to all three questions in the Risk Key provided in the 2004 FSEIS (USDI BLM, 2004, pp. 2-18) which gives direction for assessing risk and controlling spread of P. lateralis, was “no”. Because of this low risk, there is no requirement for additional Port-Orford-cedar management practices.

Appendix F: Sample Tree Falling

Background

The Code of Federal Regulations establishes policy such that “All timber… to be sold… will be appraised to estimate fair market value. Measurement shall be by tree cruise, log scale, weight, or such other form of measurement as may be determined to be in the public interest (43 CFR 5420.0-6, 85 FR 82374, December 18, 2020, https://www.govinfo.gov/content/pkg/FR-2020-12-18/pdf/2020-27580.pdf). The regulations further state, “As the general practice, the Bureau of Land Management (BLM) will estimate volume for a lump-sum sale using a tree cruise basis (43 CFR 5422.1).” The BLM would sell the BWE project timber as lump-sum timber sales. The Coos Bay District, based on the experience of the District timber cruiser appraiser, identifies sample tree falling provides the most accurate appraisals and the Coos Bay District regards sample tree falling in the public interest. In a lump-sum sale, timber cruisers assess the standing timber and give it a specific value. This value becomes the BLM cruise estimate and is the minimum bid for the removal of the timber in the advertised sale. The winning bidder pays the exact amount of the winning bid to the BLM.

Conversely, the Forest Service in Western Oregon normally uses a log-scale sale process. The U.S. Forest Service does provide prospective purchasers an appraisal of the timber; however, purchasers make a bid on the average stumpage. Using the average stumpage bid by the purchaser, the Forest Service assesses and determines a final price of the scaled logs after cutting the trees (Howard and DeMars 1985).

The U.S. Forest Service does not use sample tree falling because they do not need as accurate a cruise before the sale offer. However, the U.S. Forest Service has used validation falling in the past. The BLM needs a more accurate cruise to prepare the best appraisal for the minimum lump-sum bid price, before the sale advertisement, and sample tree falling provides the most accurate cruise and the best economic return to the government and the public.

For lump-sum sales, cruising timber must occur before the final decision to advertise the timber sale. Sample tree falling is an additional tool in timber cruising methods and BLM’s objective in using sample tree falling in timber cruising is to provide a more accurate accounting of the offered volume in each sale.

It is in the public interest that the BLM maintains accurate and reliable timber cruises. The practice of sample tree falling maintains accurate and reliable timber cruises and has been in use by the BLM since 1965 (USDI-BLM 1989b p. 3). Sample tree falling provides statistically reliable data available in no other way. It helps ensure the public receives fair market value for the timber sold as required by Congress through FLPMA.

Other Cruise Methods

The BLM has frequently used visual timber cruises but this technique does not allow the BLM to check the accuracy of the final cruise. The pure ocular cruising method makes many assumptions about the trees undergoing measurement:

- The cruiser selects the correct form class/bark thickness ratio/volume equation.
- The cruiser accurately measures the tree height and diameter at breast height (DBH).
- The form of the tree and merchantable height fit the measured form class/volume equation.
- Tree defect is apparent by visible indicators.
- The cruiser assumes the correct amount of hidden defect and breakage.

Although cruisers can obtain form class and bark thickness by climbing the tree, the other estimated variables are subject to inherent measurement bias.

Accuracy of Sample Tree Falling

Conducting sample tree falling removes the measurement bias inherent in making visual estimates. Through checking measurements directly by felling a sample tree, cruisers can make corrections to their estimates. This is because sample tree falling provides the direct measurement of form class, bark thickness, taper, defect, breakage, volume and value without bias. This is a statistically valid sampling methodology (Bell and Dilworth 2007 revised, Iles 2003, USDI-BLM 1989a); cruisers select a portion of the cruise trees to cut, buck (cut-to-length) and scale. By felling a sample tree and substituting the scale of the tree for the cruise in the volume calculations, it eliminates the measurement bias created through ocular estimation. Cruisers can apply the measurements gained by felling, such as form class, bark thickness, and stump to DBH ratio, to the remaining standing trees and incorporate that information into district databases.

The BLM Manual Supplement Handbook 5310-1 (3P Sample Cruising Probability, Proportion, Prediction) states:

> *3P cruising procedures is one of the most effective and precise means of timber sale cruising for BLM in Oregon and Washington* (USDI-BLM 1989b p. 3).

And, in an Information Memo (IM-0R120-90-33), dated February 14, 1990, the Coos Bay District Manager emphasized the requirement of the Timber Cruising Handbook:

> *In addition to meeting sample error standards, the volume estimates of all western Oregon lump-sum timber sales cruised with 3P and variable plot methods must be checked by felling a portion of sample trees (USDI-BLM 1989a p. IV-1, USDI-BLM 1990 p. 2). The following minimum number of sample trees must be felled, bucked, and scaled to minimize technique error through an on-site check of merchantable tree height, form class/bark thickness, defect deduction, and grade estimation* (USDI-BLM 1989a p. IV-1).

Furthermore, thinning in young stands has 85–99 percent log recovery; therefore, cruisers need to fell only 10 percent of sample trees to minimize sampling variability and maintain a low sampling error (USDI-BLM 1989a p. IV-1).

Because of the statistically valid cruise design, cruisers can reliably extrapolate the sample results to the rest of the unit.

Sample Tree Falling in the BWE Project and Analysis

The BLM includes sample tree falling in the BWE EA as an action common to both action alternatives and includes sample tree falling project design features **(Appendix B)** and thus analysis of the proposed action includes the effects of sample tree felling.

Issuing a decision to conduct sample tree falling does not constitute a decision to offer a timber sale, nor does a future decision to implement sample tree falling require a decision to offer timber for sale to precede it. The BLM authorized the use of sample tree felling in the ROD/RMP (p. 75). The ROD/RMP authorized actions to “provide for the orderly and efficient management of resources” (p. 75) with specific management direction to accomplish this by tree sampling (using the 3P fall, buck, and scale sampling method).

Within the Coos Bay district, a sample tree falling decision was protested in late 2020 on the Catching project and the decision withdrawn in 2021 pending additional NEPA review. The protest claimed sample tree falling was unnecessary and committing resources before a timber sale decision. Furthermore, it was asserted that conducting sample tree falling (an action composed of felling up to one tree per 2.5 acres within the project units) would have significant or cumulative effects by damaging other trees, removing or degrading NSO habitat, increasing competitive interactions with barred owls, cutting down murrelet nest trees, increasing fire danger, increasing landslide risk, or affecting the proposed Pacific Connector Gas Pipeline right-of-way. Sample tree falling is a necessary step to remove bias in visual timber cruise measurements and to ensure the public is assured an accurate appraisal of the value of the timber, as explained above. The assertion that sample tree falling damages other trees is speculative and it is not a potentially significant effect. The Coos Bay BLM's District cruiser appraiser, with 43 years' experience in the timber industry, explains:

> *The BLM cruiser program randomly selects the sample trees. After the sample tree has been selected, we number the tree, hang flagging, and put the location on a map. After we are done with the cruise, we randomly select which sample trees to fell. The BLM hires a professional timber cutter to fell the trees. A BLM cruiser takes the cutter to the sample tree and the first question that the cutter is asked is ["C]an the tree be fell[ed] safely following OHSA rules[?"] If the answer is yes, then the next question is ["C]an the tree be fell[ed] without damaging other trees including snag[s?]" If the answer is again yes, then the tree is fell[ed]. We then buck the tree to gather form class[,] which is the taper of the tree[,] which [a]ffects the volume of the tree. We also measure the diameter of each segment[,] which determines log grades. The lumber mills pay is based on grades and volume. We also can determine defect more accurately after the tree has been bucked* (personal communication, Brian Davis, Coos Bay District BLM Timber Cruiser Appraiser, April 1, 2021).

The other remaining concerns have been addressed in the 2021 EA: T&E (p. 60), fire hazard/risk (p. 60), and landslide risk (p. 98-99).

Appendix G: Wildlife

Issue Question 3.1.7 Table and Figures

Table 29. Summary of BWE area for spotted owl in the nesting area

	Total	Reserved Lands	Non-Reserved Acres	spotted owl NRF[2] Habitat	RF Habitat	Dispersal-only[3]	Unsuitable spotted owl [4]
	Acres	Acres	Acres	Acres	Acres	Acres	Acres
	% Total	% Total	% Total	% Total	% Total	% Total	% Total
OWNERSHIP							
All Ownerships	93,252	32,887	63,124	14,403	4,057	26,920	47,873
	100%	35%	68%	15%	4%	29%	51%
--Non-federal (Private/State)	51839	0	54,597	1,442	824.58	11,125	38,448
	56%	0%	100%	3%	2%	21%	74%
--Federal (USFS/BLM/CIT)	41413	32,887	8,527	12,961	3,232	15,795	9,425
	44%	79%	21%	31%	8%	38%	23%
Federal Land Allocations							
Late-successional reserve	21,778	21,778	0	10,624	2,441	6,038	2,675
	53%	100%	0%	49%	11%	28%	12%
HLB /Other	4,745	0	4,745	243.44	264.08	2,544	1,694
	11%	0%	100%	5%	6%	54%	36%
Riparian Reserve	9,896	9,896	0	309.74	336.73	6,140	3,110
	24%	100%	0%	3%	3%	62%	31%
Administratively Withdrawn and Congressionally Reserved	1,195	1,195	0	622.25	7.56	377.22	187.7
	3%	100%	0%	52%	1%	32%	16%
Other	3,799	0	3,799	1,162	201	695	1,741
	9%	0%	100%	31%	5%	18%	46%
Total Federal	**41,413**	**32,869**	**8,544**	**12,961**	**3,250**	**15,795**	**9,408**
	100%	79%	21%	31%	8%	38%	23%

Table 30. Transportation Management Actions for BWE Alternative 2 by LUAs.

Land Use Allocation	BWE Proposed Actions, ALTERNATIVE 2						
BLM-administered Land	**New Construction Miles**	**Light-Mod. Renovation Miles**	**Heavy Renovation Miles**	**Road Improvement**	**Haul Miles**	**Total Miles**	**Road Decomm**
Project Size All LUA's Combined	0	121.9	1.2	6.2	20.4	149.7	5.5
Harvest Land Bases	0	0.1	0.0	0.3	0.0	**0.4**	0.0
HLB LITA	0	0.0	0.0	0.0	0.0	**0.0**	0.0
HLB MITA	0	0.2	0.1	0.2	0.0	**0.5**	0.0
Late Successional Reserve	0	51.4	0.3	3.0	7.3	**61.9**	3.8
Riparian Reserve	0	21.6	0.2	0.4	2.9	**25.1**	0.4
District Defined Reserve	0	9.8	0.2	0.8	0.1	**11.0**	0.4
TPCC-DDR	0	0.0	0.0	0.0	0.0	**0.0**	0.0
ACEC-DDR	0	0.4	0.0	0.0	0.1	**0.6**	0.4
ROAD-DDR	0	9.4	0.2	0.8	0.0	**10.4**	0.0
Other Landowner	0.00	39.1	0.5	1.6	10.1	**51.3**	0.9

Table 31. Transportation Management Actions for BWE Alternative 3 by LUA.

Land Use Allocation	BWE Proposed Actions, Alternative 3						
	New Construction Miles	Light-Mod. Renovation Miles	Heavy Renovation Miles	Road Improvement	Haul Miles	Total Miles	Road Decomm
Project Size All LUA's Combined	7.3	79.4	0.5	7.6	20.4	**115.2**	9.4
Harvest Land Bases	1.8	0.1	0.0	0.3	0.0	**2.3**	1.0
HLB LITA	0.8	0.0	0.0	0.0	0.0	**0.8**	0.1
HLB MITA	1.1	0.1	0.0	0.3	0.0	**1.5**	1.0
Late Successional Reserve	3.5	30.7	0.0	3.1	7.3	**44.5**	7.2
Riparian Reserve	1.0	13.8	0.0	0.6	2.9	**18.4**	1.2
District Defined Reserve	0.2	9.9	0.0	0.8	0.1	**11.1**	
TPCC-DDR	0.1	0.0	0.0	0.0	0.0	**0.1**	0.1
ACEC-DDR	0.0	0.4	0.0	0.0	0.1	**0.6**	0.0
ROAD-DDR	0.0	9.5	0.0	0.8	0.0	**10.4**	0.6
Other Landowner	0.7	24.9	0.5	2.8	10.1	**39.0**	1.5

Table 32. Each Wildlife Action area and Baseline Estimate of Roads Before Proposed Action.

Wildlife Action Areas	Action area total Acres	Miles of Road	Estimated Acres of Roads*	Estimated % Acres of roads in AA
Owl nesting AA	93,252 acres	706 miles	3,166 acres	3%
Owl Dispersal	922,473 acres	6,962 miles	31,223 acres	3%

*Acres of roads are based on an average of 37 feet.

POCA Analysis

One management direction under the RMP directs the BLM to "manage for large blocks of northern spotted owl nesting-roosting habitat that support clusters of reproducing spotted owls, are distributed across the variety of ecological conditions, and are spaced to facilitate the movement and survival of spotted owls dispersing between and through the blocks" (USDI-BLM 2016b, p.64). Spotted owl home range size relates to the primary prey in the area, with a 1.5-mile radius home range in the Oregon Coast physiographic province, where spotted owls predominately prey on flying squirrels (Zabel et al. 1995, Forsman et al. 2004, USDI-USFWS 2011). Based on this home range size, we used a 1.5-mile buffer on the proposed units to evaluate effects on the ability of spotted owls to reproduce. Spotted owl reproduction is more successful with increasing amounts of older forest near the nest or primary roost location (Bart and Forsman 1992, Dugger et al. 2005). The USFWS concluded that spotted owl reproduction was more successful with greater than 50 percent nesting habitat within the 500-acre core area (summarized in USDI-USFWS 2009, USDI-USFWS 2011).

In evaluating how the proposed actions will affect spotted owl sites and high value spotted owl habitat, the BLM considered the amount of available and potential habitat at the 500-acre core scale and within known home ranges that overlap with proposed harvest. The BLM considered 500 acres to be a meaningful scale to spotted owls because the amount of habitat at this scale is related to survival and reproductive success (Olson et al. 2004, Dugger et al. 2005). The BLM evaluated how the proposed actions would affect potential and existing spotted owl habitat by evaluating habitat in 500-acre blocks using the RA10 analysis developed by the Coos Bay BLM (USDI-BLM and USDI-USFWS 2017).

POCA analysis was conducted on the owl nesting action area. The POCA is a moving window analysis to identify 500-acre core areas with greater than 50 percent NRF habitat based on GNN data. The output are polygons that represent possible owl core areas and can be viewed in the BA (USDI-BLM 2020). Table 5 displays POCA data within a 500-acre moving window. More than 50 percent NRF is based on local & GNN habitat data and forestry models for BWE within the owl nesting action area. The data is based on modeling out 40 years.

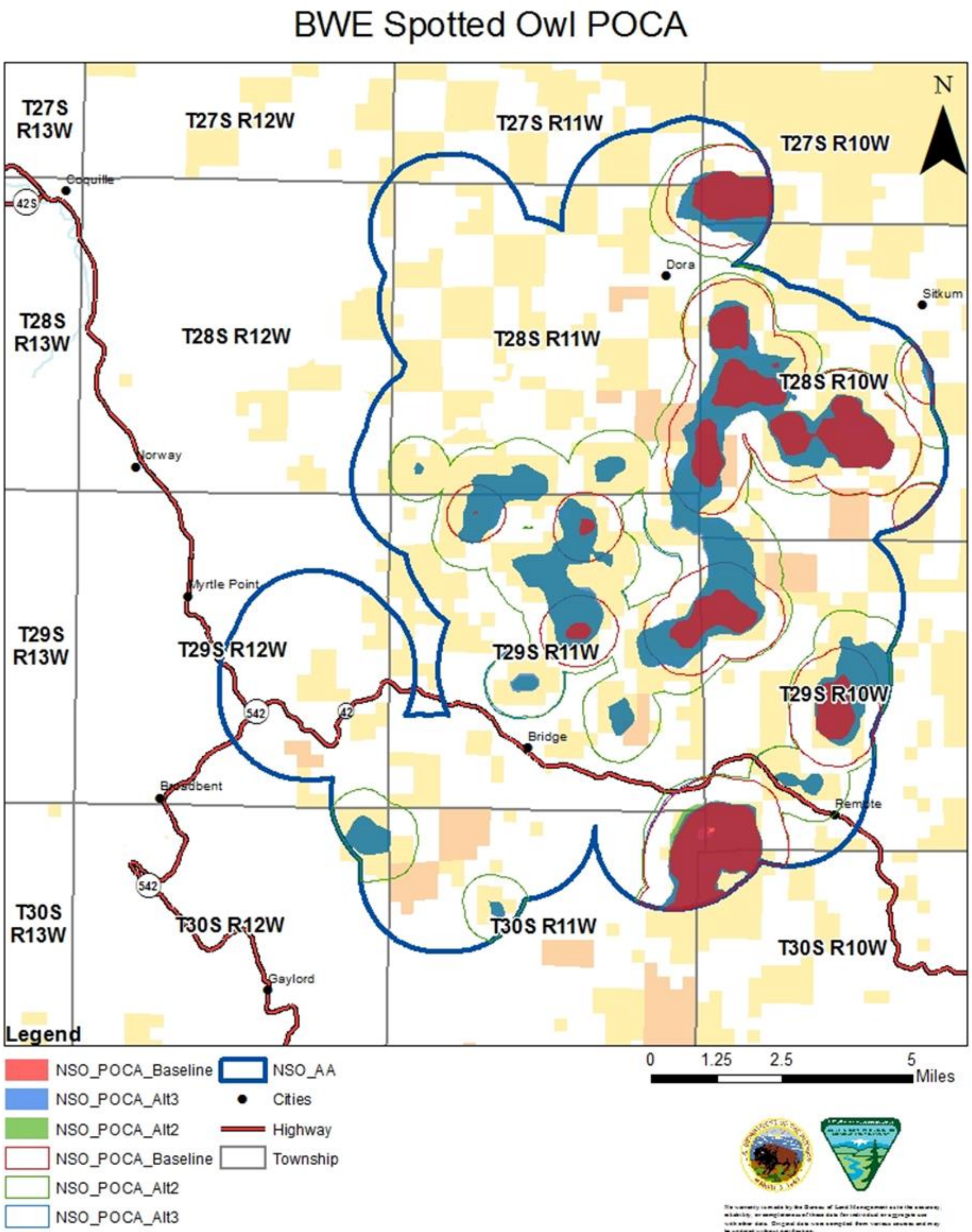
For BWE the BLM used the forestry treatment prescriptions and models (see Issue Question 3.1.4) to make the assumption that in 40 years all planned commercial units in HLB would no longer be habitat, all planned commercial units in LSR would become NRF habitat; in addition, all current RF and NRF habitat outside of units on BLM land in a protected category (LSR, RR) is modeled as NRF in 40 years.

The owl nesting action area has a total of approximately 93,252 acres. There are approximately 21,551 acres of POCA, about 23% of the baseline action area (Table 33). Compared to if the proposed actions in the LSR are completed, in 40 years, the proposed action area will have almost 50% more POCA (39,599 acres) then if the project did not proceed. The commercial treatments will result in stands that will develop into higher quality habitat for spotted owls due to the wider spacing and reduced competition within the stand which will contribute to overall larger patches of available habitat. The POCA does not show that commercial treatments will result in higher quality NRF habitat with fewer treatment entries (Issue 3.1.4) which means that alternative 3 will result in more acres of commercial treatment over the other alternatives.

Table 33. POCA acres modeled out 40 years.

	POCA acres, % of action area	POCA buffer acres, % of action area
Baseline POCA (No action)	6,032 (6.5%)	21,551 (23%)
Alternative 2	13,841 (14.8%)	39,599 (42.5%)
Alternative 3 (preferred)	13,790 (14.8%)	39,596 (42.5%)

Figure 7. POCA Analysis Map for All Alternatives



Issue Question 3.1.8 Tables and Figures

Spotted Owl Known Home Ranges

Spotted owls are considered central place foragers, with a home range in which a pair's activities' center around the nest site (Rosenberg and McKelvey 1999). Spotted owls' use of an area is inversely related to the distance from the nest site (Rosenberg and McKelvey 1999). The BLM generally considers that spotted owls primarily occupy a 503-acre (0.5-mile buffer) core area around the nest tree. Their home range size is related to the primary prey in the area, with a larger, 1.5-mile diameter home range in the Coast Region, where spotted owls rely on flying squirrels, compared with a 1.3-mile diameter home range in the Klamath Region, where wood rats are the primary prey (Zabel et al. 1995, Forsman et al. 2004, USDI-FWS 2011). The proposed project area is primarily in the Coast Region, with a small portion of proposed sales in the Klamath Region. These circular areas are commonly used for a simple measure of habitat availability at multiple, ecologically relevant scales. However, we acknowledge that spotted owls' habitat use is more complex, with owls using a combination of older seral habitat and younger forest types (Franklin et al. 2000, Olson et al. 2004, Dugger et al. 2005).

RMP Appendix A

To balance the requirements of the HLB and spotted owl management directions, the BLM developed a guidance document as Appendix A in the RMP (USDI BLM, 2016b, pp. 103-113). Appendix A includes suggestions in designing the timing of HLB harvest within known spotted owl sites and is intended to avoid or delay, to the "extent consistent with the management objectives and management direction for the Harvest Land Base, near-term negative effects to known sites as northern spotted owl habitat continues to develop in the reserved land use allocations".

Table 34.. Spotted owl Home Ranges Within spotted owl Analysis Area that would be impacted by the Proposed Project.

The spotted owl Home Range 1.5-mile analysis area and spotted owl home ranges that overlap it. No work is proposed in the McKinley Road Home Range under Alternative 2.

IDNO	Site Name	Physiographic Providence	Previous Known Occupancy	Previous Last Occupied Status	Acres of BLM, (%) Patch	Acres of BLM, (%) Core	Acres of BLM, (%) Home Range
2117O	McKinley Road	Coast	2014	Resident Single *	5 (7%)	75 (15%)	1,633 (36%)
2180A	Bear Pen	Coast	1993	Pair	70 (100%)	396 (79%)	2,281 (50%)
2182O	Elk Loop	Coast	1989	Pair	70 (100%)	400 (80%)	2,028 (45%)
2317A	Brewster Valley	Coast	2013	Resident Single	70 (100%)	338 (67%)	2,701 (60%)
2318O	Brownson Headwaters	Coast	1992	Resident Single	70 (100%)	450 (90%)	3,293 (73%)
2347O	Steel Creek	Coast	1994	Resident Single	64 (92%)	348 (69%)	2,175 (48%)
3167O	Kincheloe Quarry	Klamath	1995	Pair	37 (52%)	223 (44%)	1,129 (33%)
3169O	Remote	Coast	2017	Resident Single	63 (91%)	313 (62%)	1,996 (44%)

*The McKinley Road site was established in 2014 with three sightings of a male spotted owl. A hybrid female was also observed in the site in 2014 and surveyors observed the male feeding her a mouse. Because she was a hybrid, we did not consider this site to be occupied by a spotted owl pair.

Figure 8. The spotted owl Home Range 1.5-miles Analysis Area and spotted owl Home Ranges

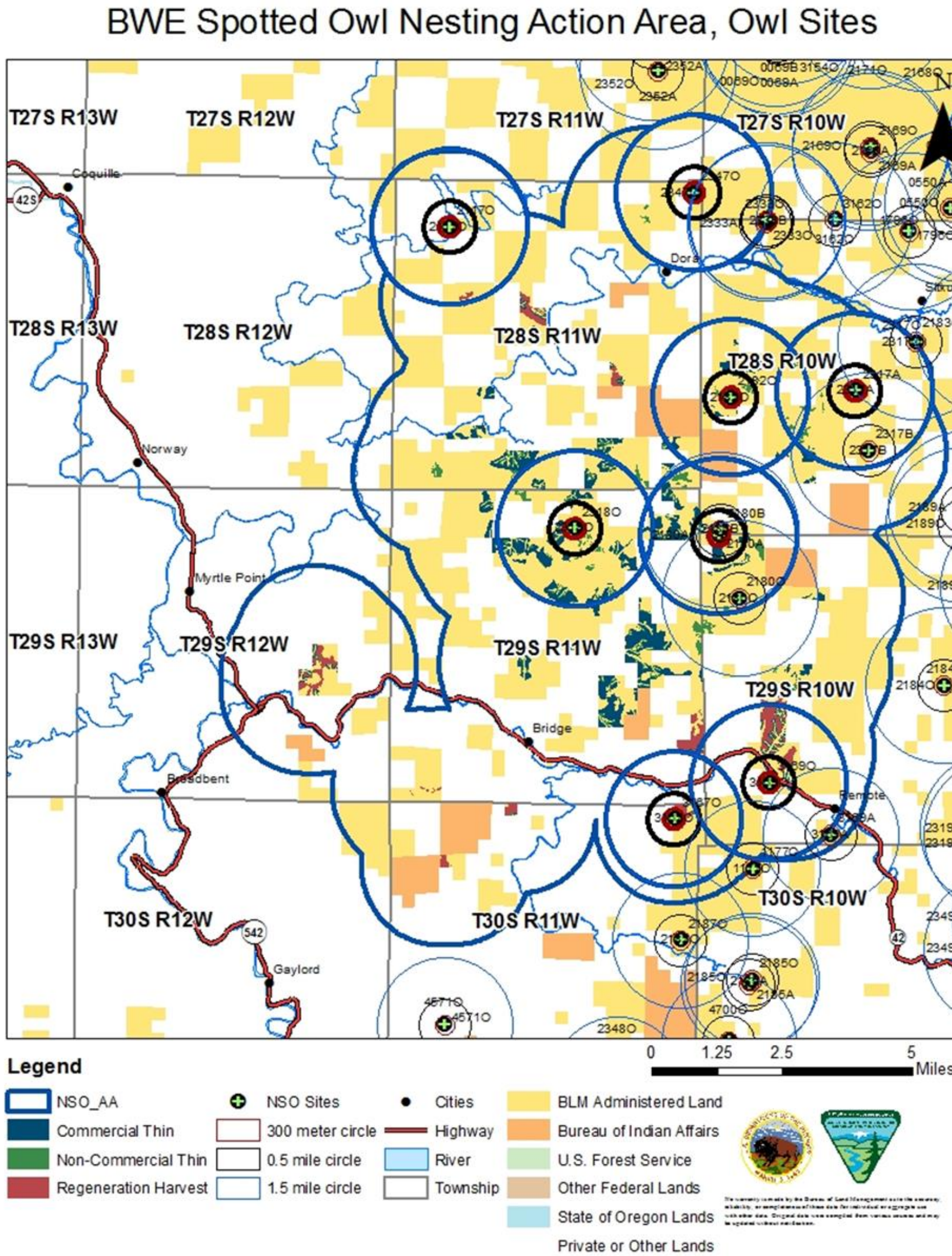


Figure 8 shows the spotted owl Home Range 1.5-mile analysis area and spotted owl home ranges that overlap it. Bolded home ranges are the ones most recently documented as occupied. Alternative 3 timber sales are shown since this would be the biggest impact. No timber sales are proposed in the McKinley Road Home Range under Alternative 2.

Table 35. Acres of Proposed Treatment Units within each spotted owl Home Range for Both Alternatives.

				Acres Treated under Alternative 2 and 3						Percent Change under Alternative 2 and 3 in 40 years					
				Alternative 2			Alternative 3			Alternative 2			Alternative 3		
Home Range Name (IDNO)	Thinning/Regen & New Road	Habitat Type	Treatment	Nest Patch	Core	Home Range	Nest Patch	Core	Home Range	Nest Patch	Core	Home Range	Nest Patch	Core	Home Range
McKinely Road (2117O)	Regen & New Road	NRF	Commercial	0	0	0	0	0	-16	0%	0%	0%	0%	0%	0%
Bear Pen (2180A)	Thinning	Dispersal	Commercial	13	82	300	13	82	320	19%	16%	7%	19%	16%	7%
			Non-Commercial	2	7	115	2	7	107	2%	1%	3%	2%	1%	2%
		RF	Commercial	0	0	1	0	0	1	0%	0%	0%	0%	0%	0%
			Non-Commercial	0	0	0	0	0	0	0%	0%	0%	0%	0%	0%
Elk Loop (2182O)	Thinning	Dispersal	Commercial	7	16	101	7	19	126	11%	3%	2%	11%	4%	3%
			Non-Commercial	0	31	93	0	25	57	0%	6%	2%	0%	5%	1%
		RF	Commercial	0	8	12	0	9	14	0%	2%	0%	0%	2%	0%
			Non-Commercial	0	1	2	0	0	0	0%	0%	0%	0%	0%	0%
Brewster Valley (2317A)	Thinning	Dispersal	Commercial	0	0	10	0	0	10	0%	0%	0%	0%	0%	0%
			Non-Commercial	0	0	45	0	0	45	0%	0%	1%	0%	0%	1%
		RF	Non-Commercial	0	0	13	0	0	0	0%	0%	0%	0%	0%	0%
Brownson Headwaters (2318O)	Thinning	Dispersal	Commercial	8	59	442	8	58	527	11%	12%	10%	11%	11%	12%
			Non-Commercial	4	43	257	4	35	181	6%	9%	6%	6%	7%	4%
Steel Creek (2347O)	Thinning	Dispersal	Non-Commercial	0	0	11	0	0	11	0%	0%	0%	0%	0%	0%
Kincheloe Quarry (3167O)	Thinning	Dispersal	Commercial	0	0	0	0	1	1	0%	0%	0%	0%	0%	0%
			Non-Commercial	0	0	0	0	0	0	0%	0%	0%	0%	0%	0%
	Regen & New Road	Dispersal	Commercial	0	0	0	1	13	15	0%	0%	0%	-2%	-3%	0%
		RF		0	0	0	-24	-45	-45	0%	0%	0%	-34%	-9%	-1%
	Thinning	Dispersal	Commercial	0	0	33	0	7	52	0%	0%	1%	0%	1%	1%

				Acres Treated under Alternative 2 and 3						Percent Change under Alternative 2 and 3 in 40 years					
Remote (3169O)			Non-Commercial	0	12	58	0	5	40	0%	2%	1%	0%	1%	1%
	Regen & New Road	Dispersal	Commercial	0	-14	-166	0	-14	-203	0%	-3%	-4%	0%	-3%	-4%

Acres proposed to be treated by proposed treatment, habitat type, and treatment proposed in spotted owl home ranges for Alternative 2 and Alternative 3. The numbers are given independently for each scale. For example, the number presented under an alternative for nest patch is also included in the core and home range. Additionally, the acres are shown by home range. Since some treatments overlap more than one home range, those acres are shown twice.

Table 36. Spotted owl home ranges and percent of NRF/RF habitat currently in each nest patch (Patch), core use area (Core), and home range.

IDNO	Site Name	Current Conditions								
		%NRF Patch	%RF Patch	% NRF/RF Combined Patch	%NRF Core	%RF Core	%NRF/RF Combined Core	%NRF Home Range	%RF Home Range	% NRF/RF Combined Home Range
2117O	McKinley Road	11%	0%	**11%**	2%	1%	**2%**	6%	0%	**6%**
2180A	Bear Pen	72%	0%	**72%**	30%	13%	**43%**	23%	6%	**29%**
2182O	Elk Loop	71%	2%	**73%**	43%	20%	**63%**	32%	9%	**40%**
2317A	Brewster Valley	81%	0%	**81%**	32%	1%	**33%**	30%	2%	**32%**
2318O	Brownston Headwaters	71%	0%	**71%**	37%	0%	**37%**	22%	3%	**25%**
2333O	Steel Creek	72%	19%	**92%**	48%	16%	**64%**	19%	7%	**26%**
3167O	Kincheloe Quarry	7%	42%	**49%**	29%	12%	**41%**	29%	3%	**32%**
3169O	Remote	83%	1%	**84%**	34%	1%	**36%**	22%	7%	**29%**

Table 36 shows the amount of NRF and RF in each nest patch, core, and home range currently. Current conditions in each owl home range are described below. In evaluating each home range, we combine habitat mapped as NRF and RF to determine whether there was currently sufficient habitat to support a reproductively successful spotted owl pair.

Spotted owl activity site center baseline or affected environment.

McKinley Road (2117O)

The BLM manages approximately 36 percent of the McKinley Road home range. Approximately two percent of the core and six percent of the home range are currently in NRF/RF habitat (Table 36), leaving the home range far below what best available information suggests as the minimum amount of NRF considered necessary for supporting a reproductive spotted owl pair at both scales (summarized in USDI-USFWS 2009, USDI-USFWS 2011).

The McKinley Road site was first identified in 2014 through a resident male that appeared to be attempting to pair with a hybrid female. There were no detections in 2015, and there have been no spotted owl detections in 2019 or 2020 to date.

Bear Pen (2180A)

The BLM manages 79 percent of the Bear Pen core area and 50 percent of the home range. Forty-three percent of the core and 29 percent of the home range are currently in NRF/RF habitat (Table 36). The home range is below the minimum amount of NRF that the best available information suggests as the amount of NRF considered necessary for supporting a reproductive spotted owl pair at both scales (summarized in USDI-USFWS 2009, USDI-USFWS 2011).

The Bear Pen site was surveyed as unoccupied in 2019 and to date in 2020; it was last documented to be occupied in 1993.

Elk Loop (2182O)

The BLM manages 80 percent of the Elk Loop core area and 45 percent of the home range. Sixty-three percent of the core and 40 percent of the home range are currently in NRF/RF habitat (Table 36). This is approximately at the minimum amount of NRF that the best available information suggests as the amount of NRF considered necessary for supporting a reproductive spotted owl pair at both scales (summarized in USDI-USFWS 2009, USDI-USFWS 2011).

The Elk Loop site was surveyed as unoccupied in 2019 and to date in 2020; it was last documented to be occupied in 1989.

Brewster Valley (2317A)

The BLM manages 67 percent of the Brewster Valley core area and 60 percent of the home range (Table 31). Thirty-three percent of the core and 32 percent of the home range are currently in NRF habitat (Table 39), leaving the home range below what the best available information suggests as the amount of NRF considered necessary to support a reproductive spotted owl pair at the core area scale (summarized in USDI-USFWS 2009, USDI-USFWS 2011). However, 67 percent of the core area and 68 percent of the home range are in LSR and RR, and thus likely to provide NRF into the future.

The Brewster Valley site was surveyed as unoccupied in 2019 and to date in 2020. It was last documented to be occupied in 2013.

Brownson Headwaters (2318O)

The BLM manages 90 percent of the Elk Loop core area and 73 percent of the home range (Table 31). Thirty-seven percent of the core and 25 percent of the home range are currently in NRF/RF habitat (Table 39). These are below the minimum amount of NRF that the best available information suggests as the amount of NRF considered necessary for supporting a reproductive spotted owl pair at both scales (summarized in USDI-USFWS 2009, USDI-USFWS 2011).

The Brownson Headwaters site was surveyed as unoccupied in 2019 and to date in 2020; it was last documented to be occupied in 1992.

Steel Creek (2347O)

The BLM manages 69 percent of the Steel Creek core area and 48 percent of the home range. Sixty-four percent of the core area and 26 percent of the home range are currently in NRF/RF habitat, above the minimum that the best available information suggests as the amount of NRF considered necessary to support a reproductive spotted owl pair at the core area scale, but below at the home range scale (summarized in USDI-USFWS 2009, USDI-USFWS 2011).

The Steel Creek site was surveyed as unoccupied in 2019 and to date in 2020; it was last documented to be occupied in 1994.

Kincheloe Quarry (3167O)

The BLM manages 44 percent of the Kincheloe Quarry core area and 33 percent of the home range (Table 31). Forty-one percent of the core and 32 percent of the home range are currently in NRF/RF habitat (Table 39). These are below the minimum amount of NRF that the best available information suggests as the amount of NRF considered necessary for supporting a reproductive spotted owl pair at both scales (summarized in USDI-USFWS 2009, USDI-USFWS 2011).

The Kincheloe Quarry site was surveyed as unoccupied in 2019 and to date in 2020; it was last documented to be occupied in 1995.

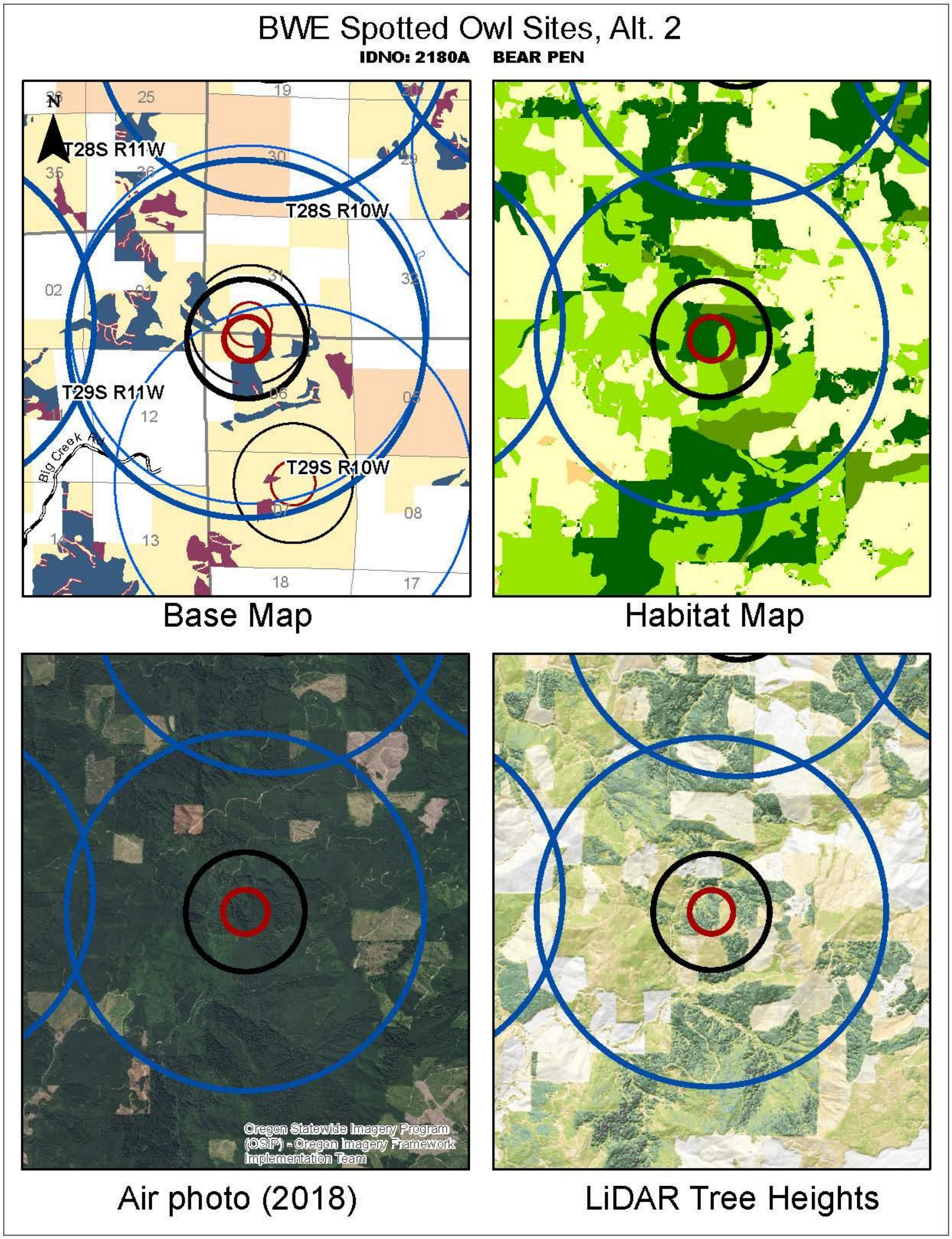
Remote (3169O)

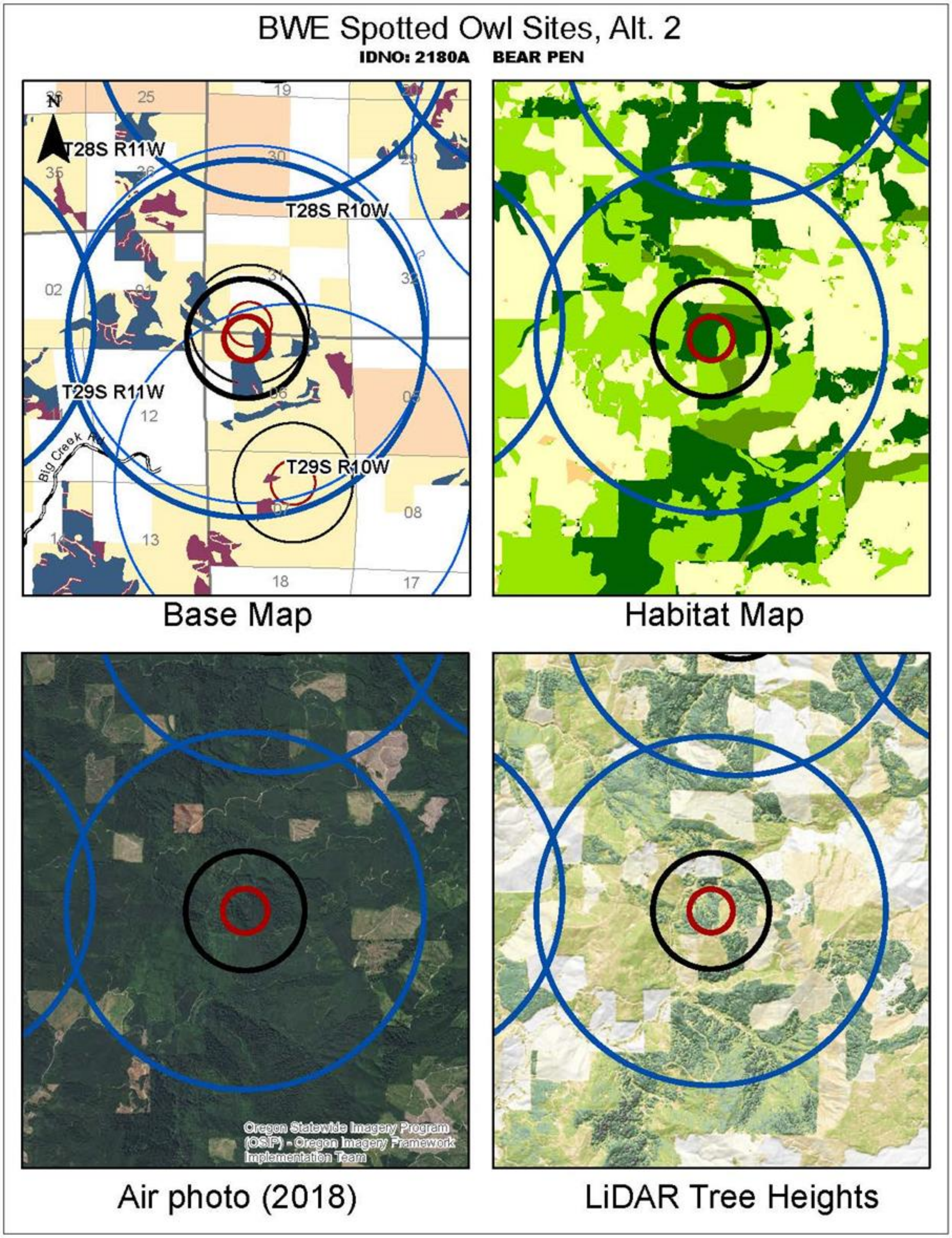
The BLM manages 62 percent of the Remote core area and 44 percent of the home range (Table 31). Thirty-six percent of the core and 29 percent of the home range are currently in NRF/RF habitat (Table 38) These are below the minimum amount of NRF that the best available information suggests as the amount of NRF considered necessary for supporting a reproductive spotted owl pair at both scales (summarized in USDI-USFWS 2009, USDI-USFWS 2011).

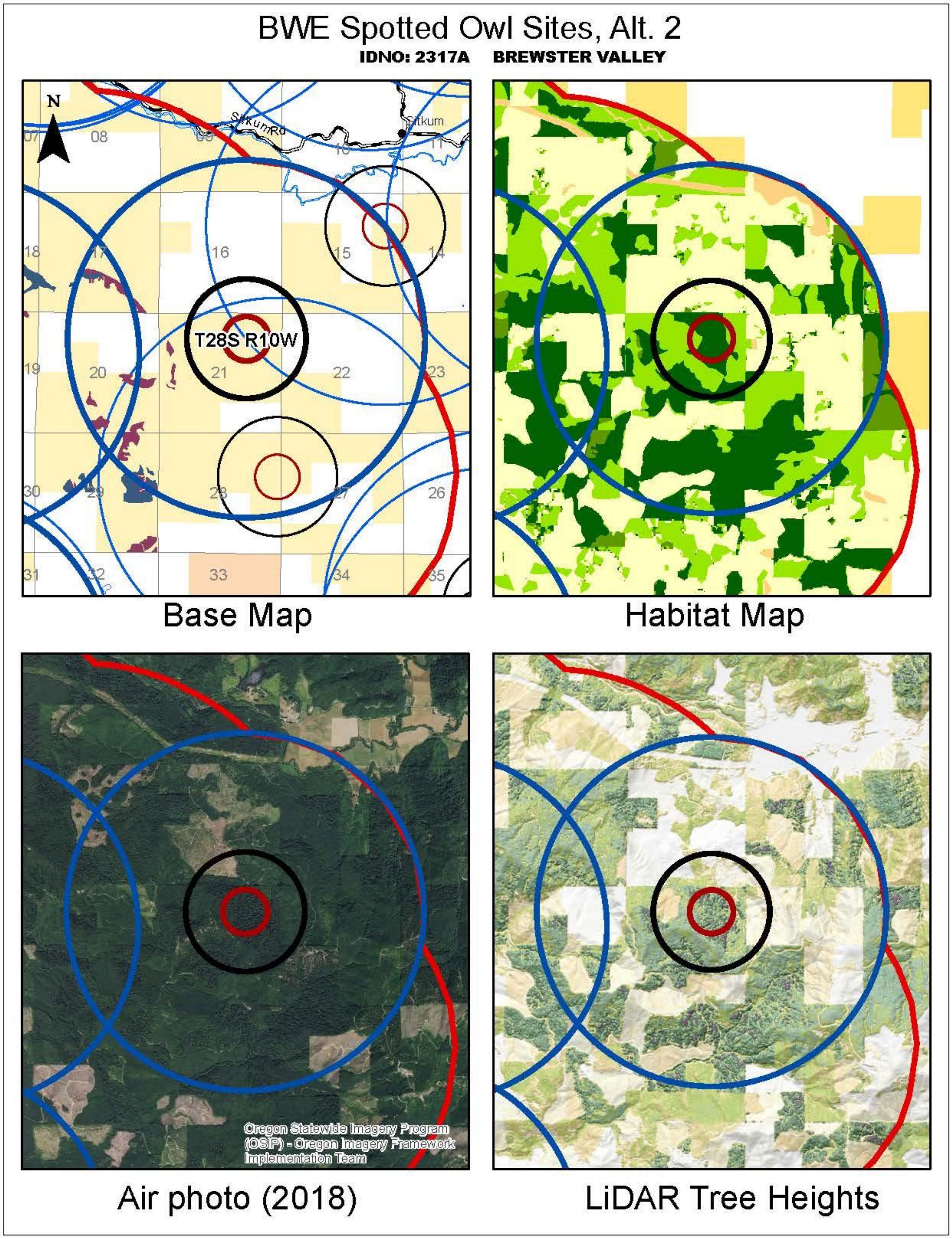
The Remote site was surveyed as unoccupied in 2019 and to date in 2020; it was last documented to be occupied in 2017.

Spotted Owl Site Maps:

Alternative 2: Spotted owl activity center maps. Top left base map with units, top right habitat map, bottom left air photos, and bottom right LiDAR images.

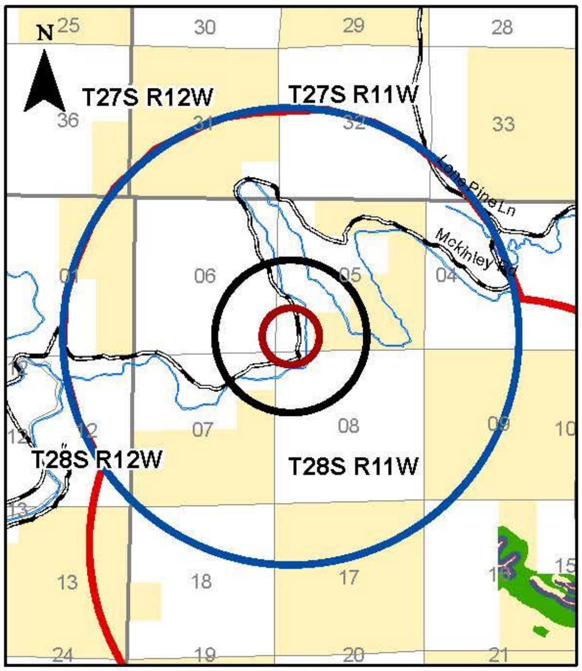



BWE Spotted Owl Sites, Alt. 2
IDNO: 2180A BEAR PEN
N
T28S R11W
T28S R10W
T29S R11W
T29S R10W
Big Creek Rd
25
19
30
29
35
36
02
01
31
32
12
06
05
07
08
13
18
17
Base Map
Habitat Map
Oregon Statewide Imagery Program (OSIP) - Oregon Imagery Framework Implementation Team
Air photo (2018)
LiDAR Tree Heights

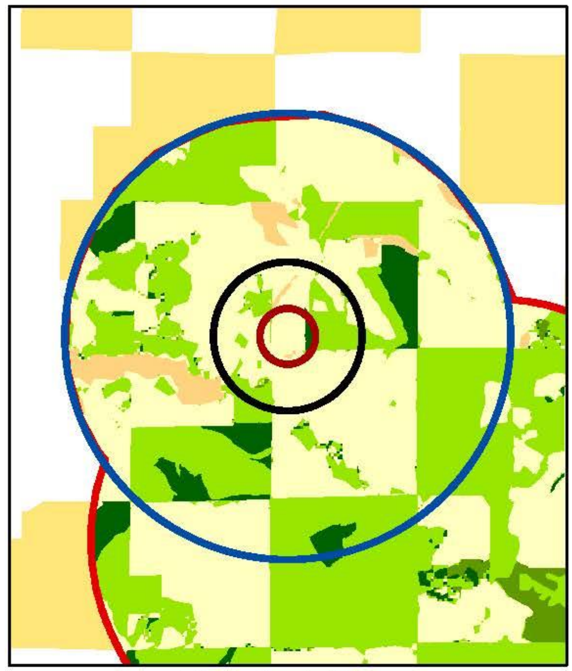

BWE Spotted Owl Sites, Alt. 2
IDNO: 2317A BREWSTER VALLEY
N
Sitkum Rd
Sitkum
07
08
09
10
11
18
17
16
15
14
T28S R10W
19
20
21
22
23
30
29
28
27
26
31
32
33
34
35
Base Map
Habitat Map
Oregon Statewide Imagery Program (OSIP) - Oregon Imagery Framework Implementation Team
Air photo (2018)
LiDAR Tree Heights

BWE Spotted Owl Sites, Alt. 2

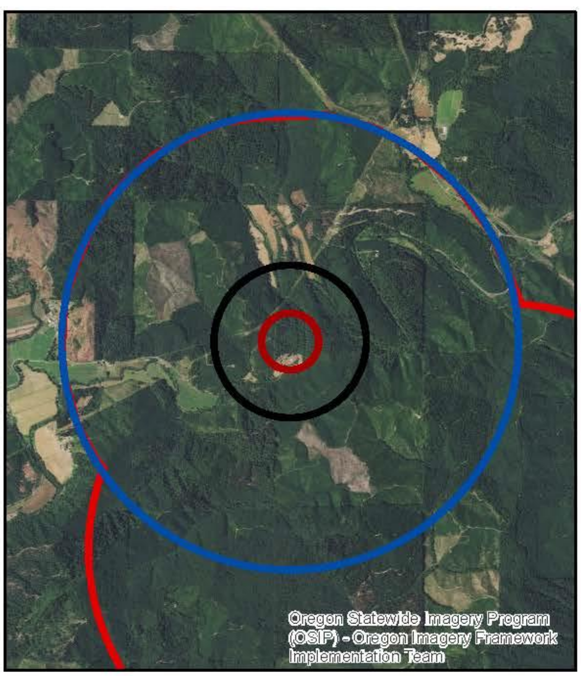
IDNO: 2117O MCKINELY ROAD



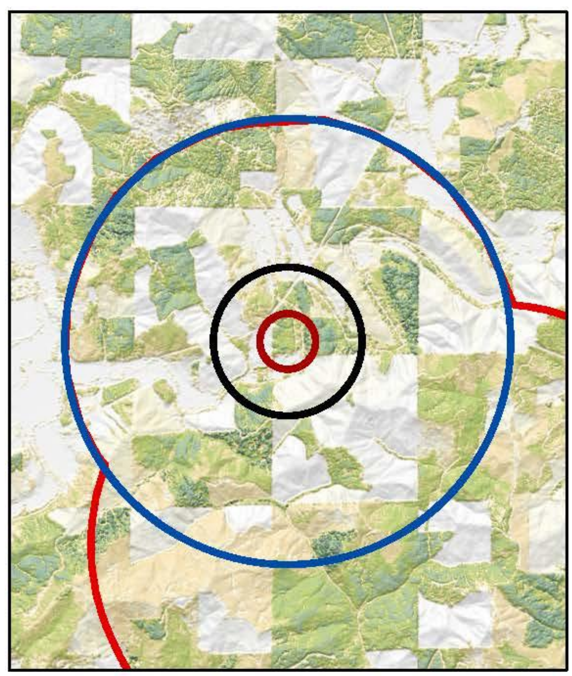
Base Map



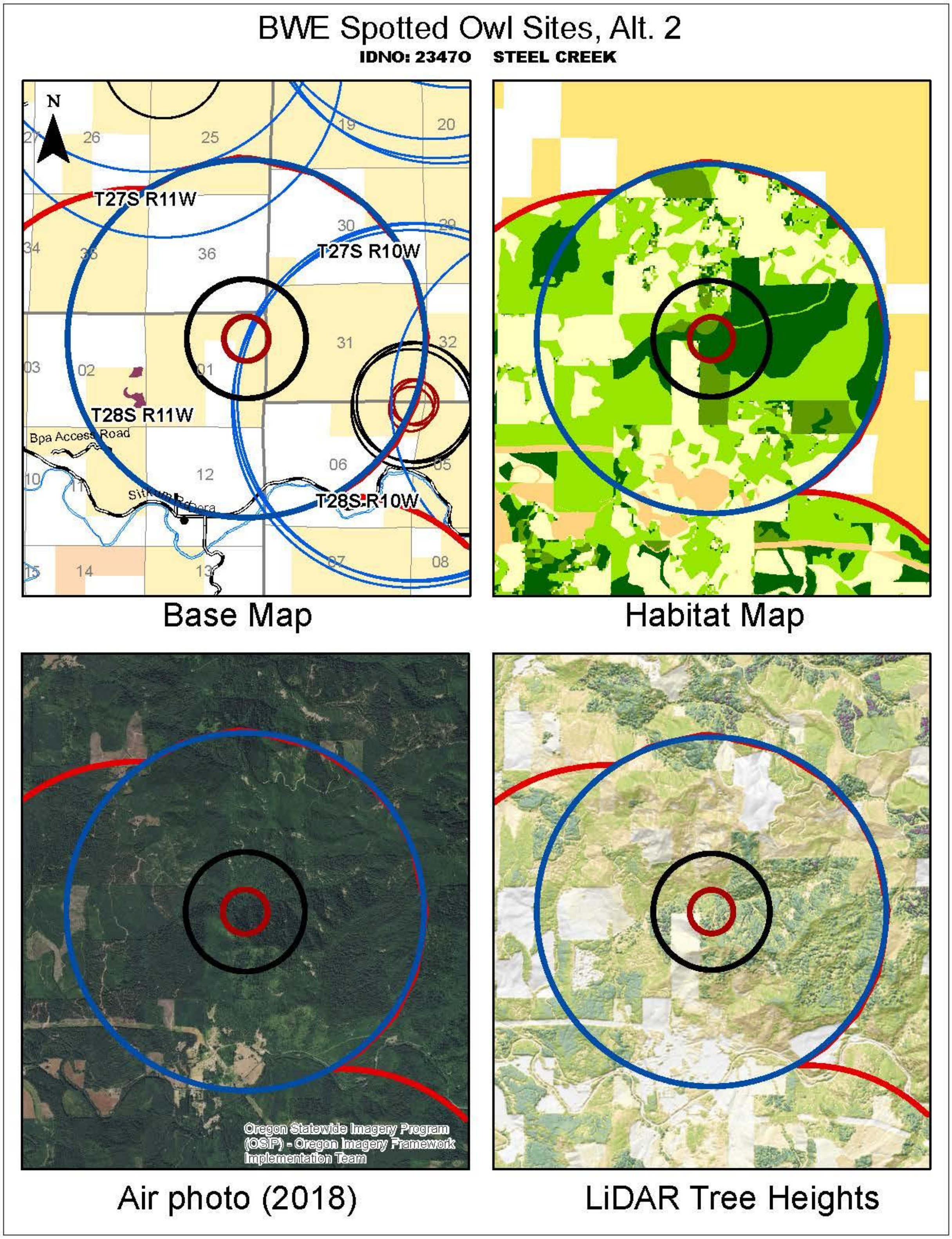
Habitat Map



Air photo (2018)

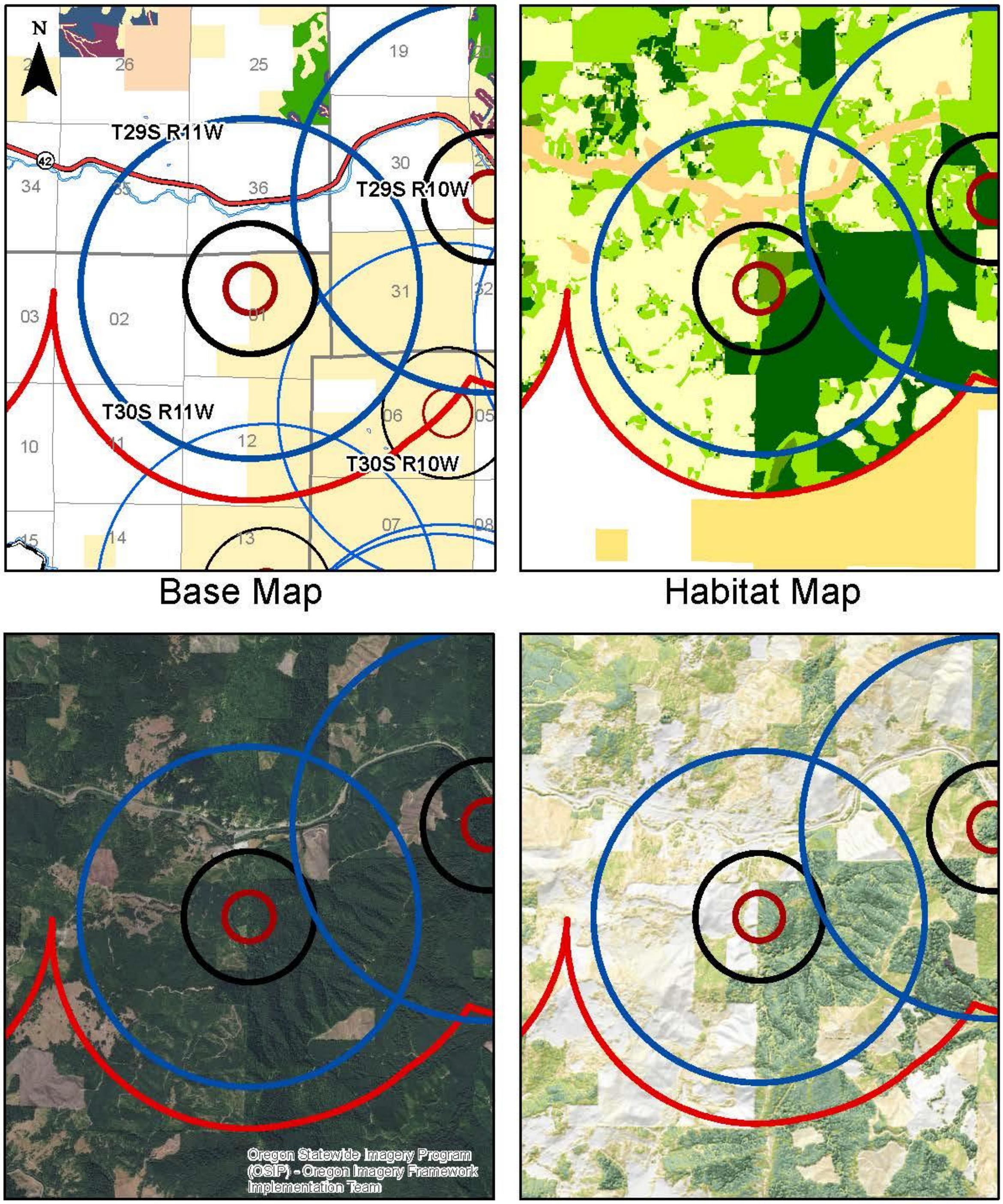


LiDAR Tree Heights

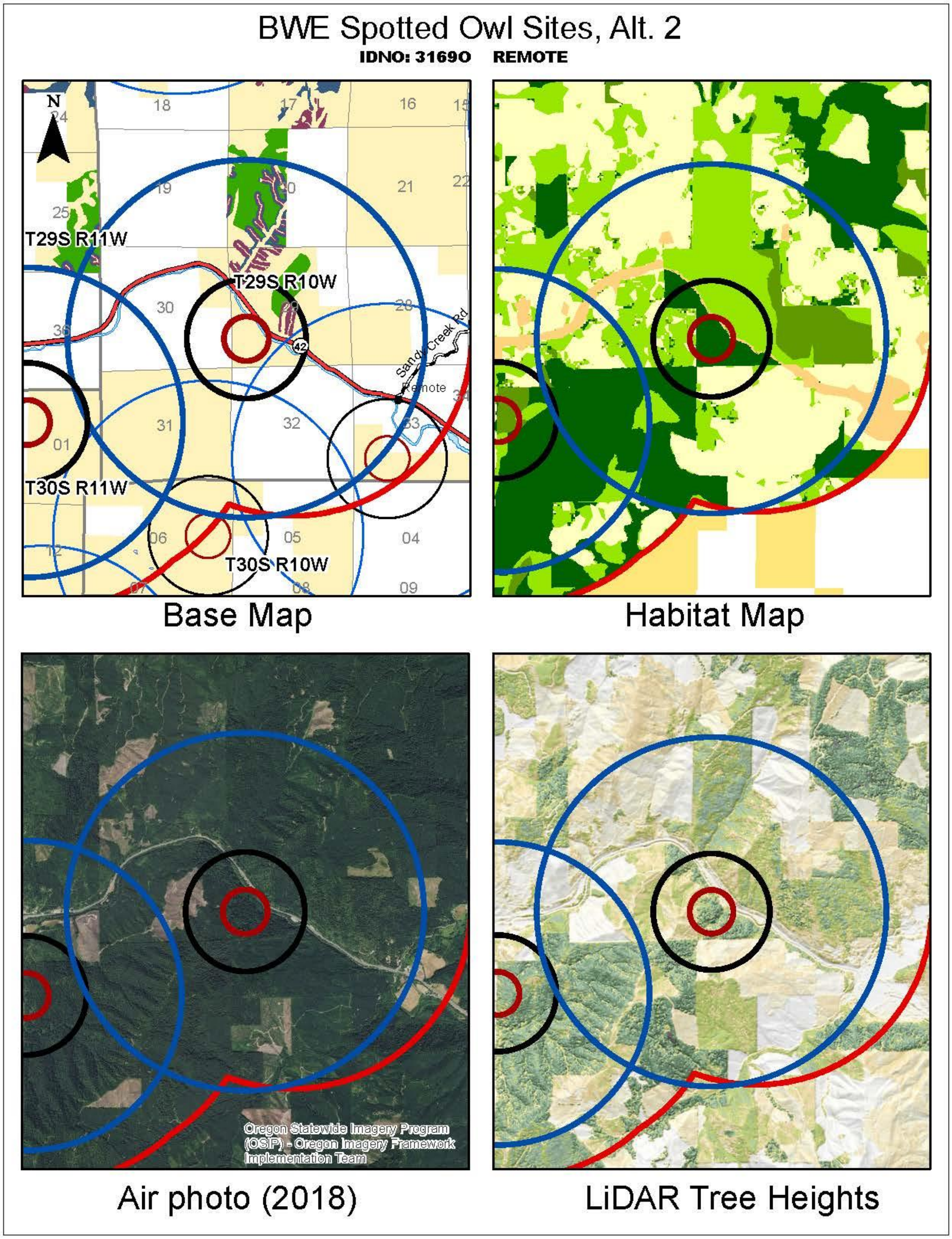

BWE Spotted Owl Sites, Alt. 2
IDNO: 23470 STEEL CREEK
N
T27S R11W
T27S R10W
T28S R11W
T28S R10W
Bpa Access Road
Base Map
Habitat Map
Oregon Statewide Imagery Program (OSIP) - Oregon Imagery Framework Implementation Team
Air photo (2018)
LiDAR Tree Heights

BWE Spotted Owl Sites, Alt. 2

IDNO: 3167O KINCHELOE QUARRY

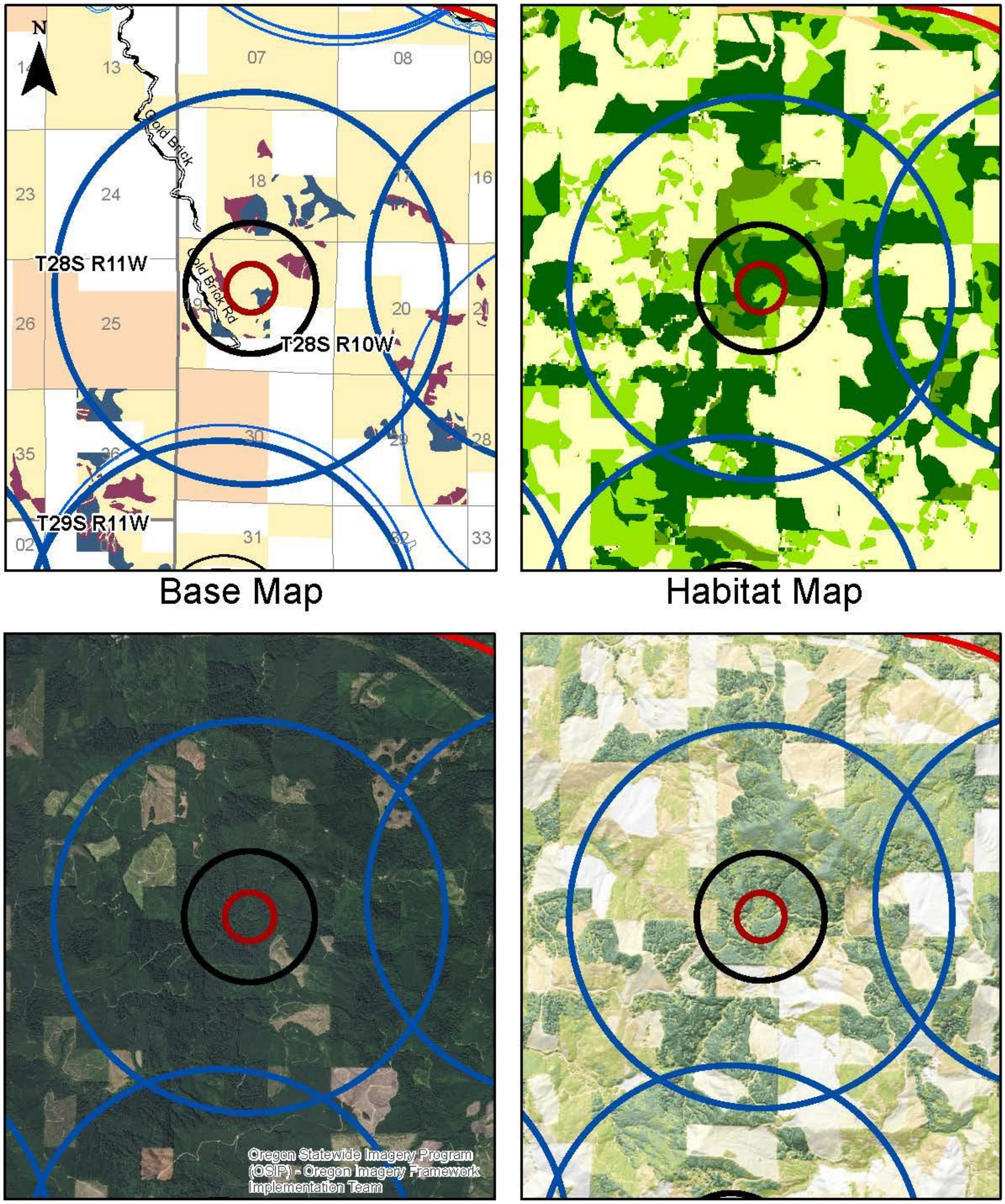


Base Map | Habitat Map | Air photo (2018) | LiDAR Tree Heights


BWE Spotted Owl Sites, Alt. 2
IDNO: 3169O REMOTE
N
T29S R11W
T29S R10W
T30S R11W
T30S R10W
Sandy Creek Rd
Remote
42
Base Map
Habitat Map
Oregon Statewide Imagery Program (OSIP) - Oregon Imagery Framework Implementation Team
Air photo (2018)
LiDAR Tree Heights

BWE Spotted Owl Sites, Alt. 2

IDNO: 21820 ELK LOOP

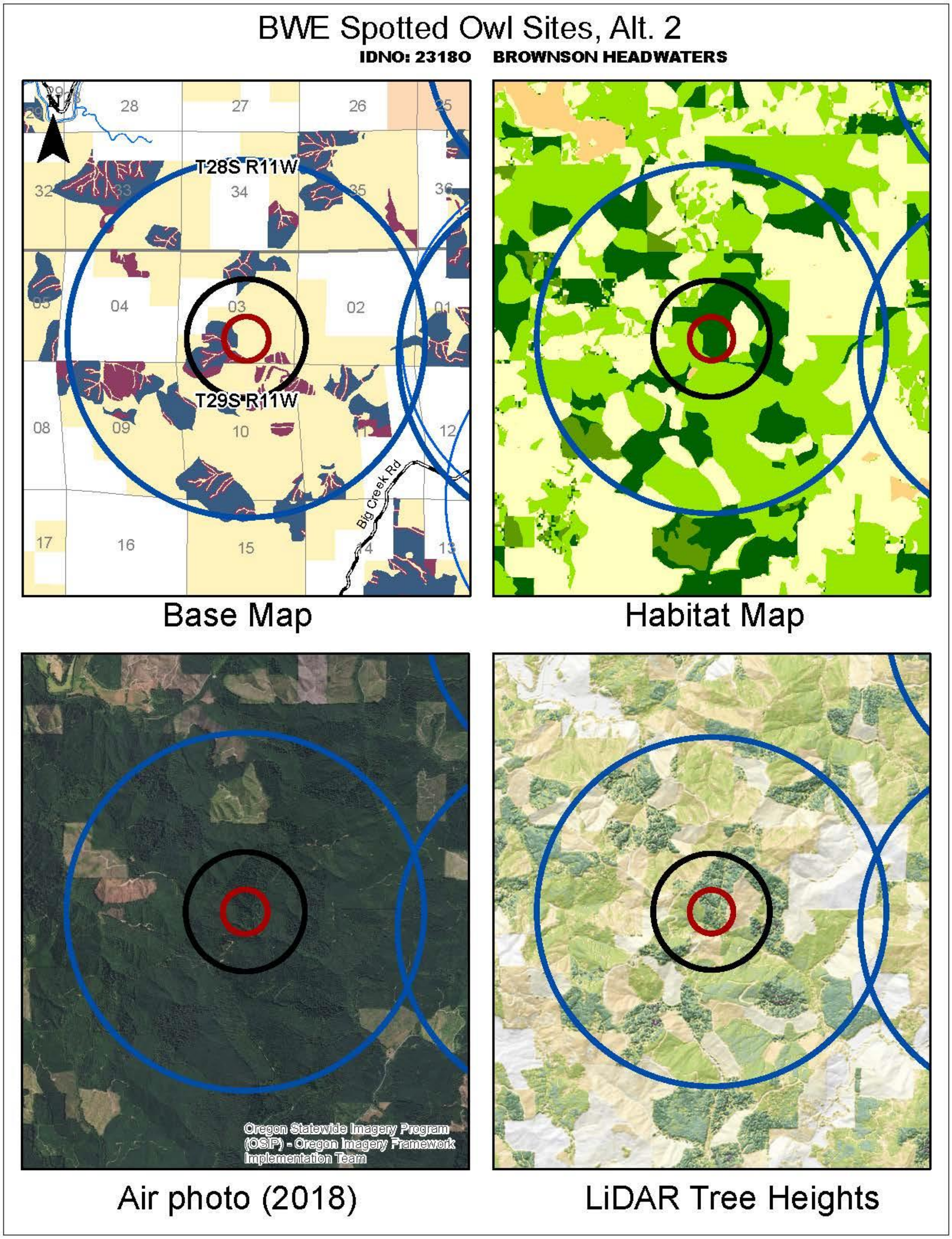


Base Map

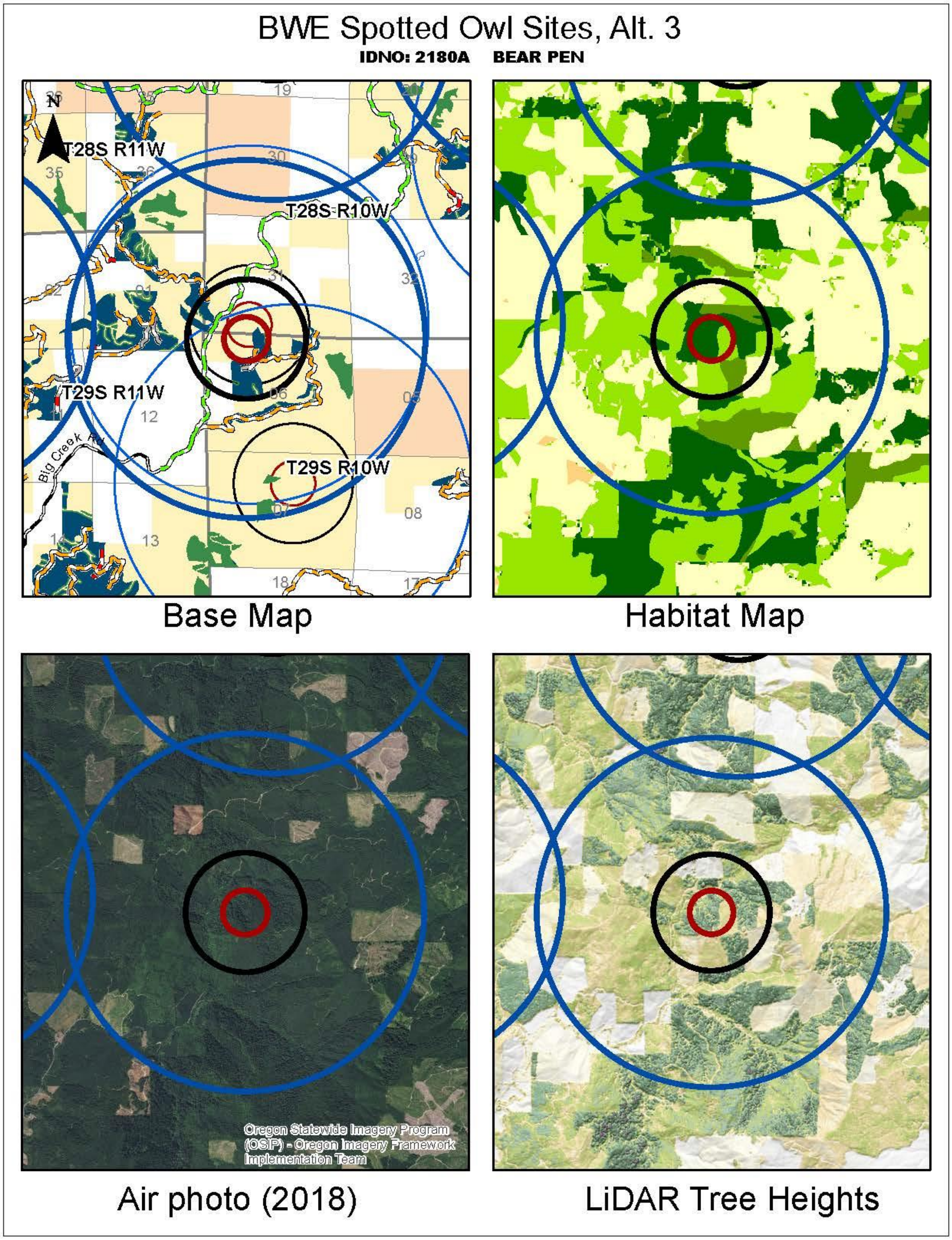
Habitat Map

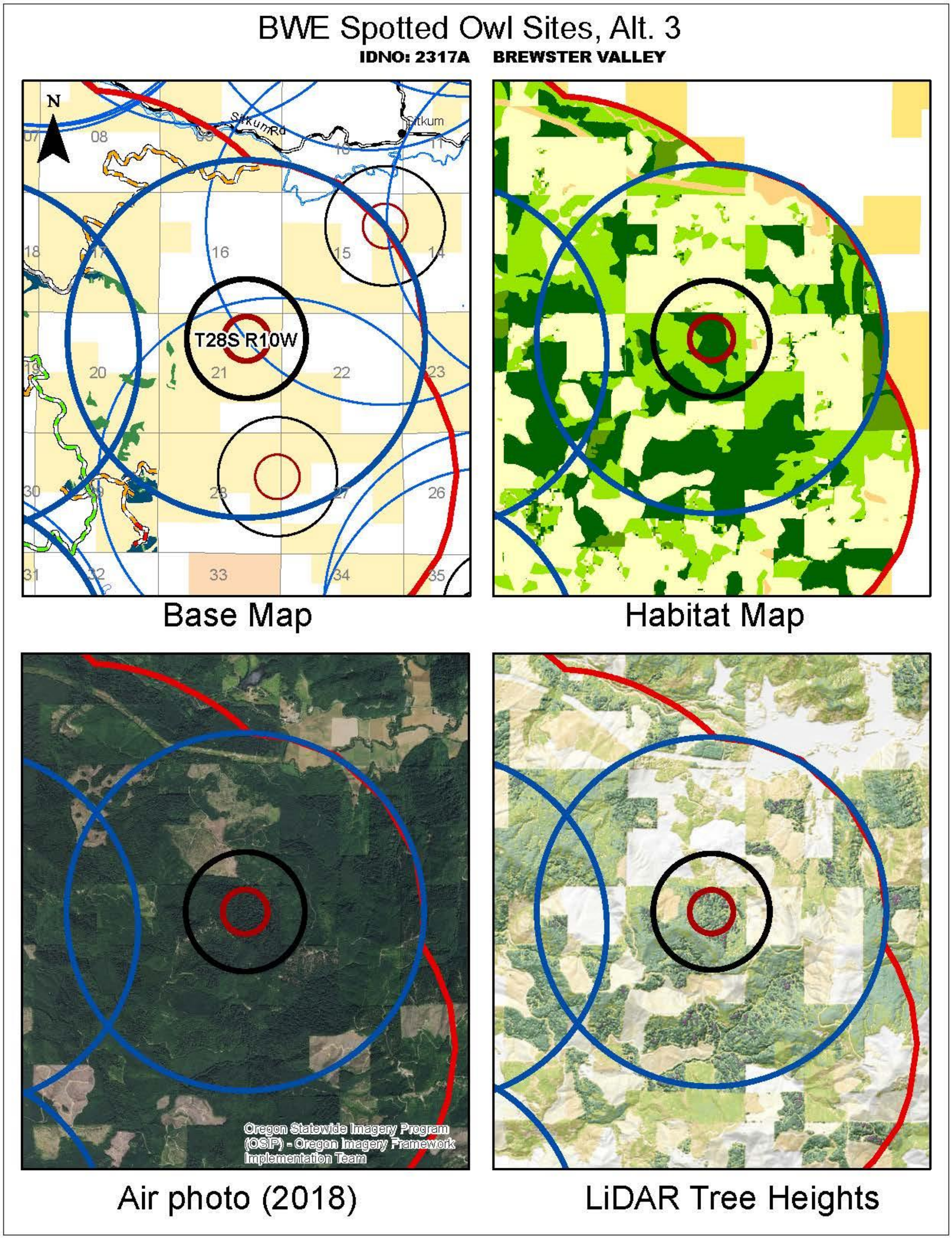
Air photo (2018)

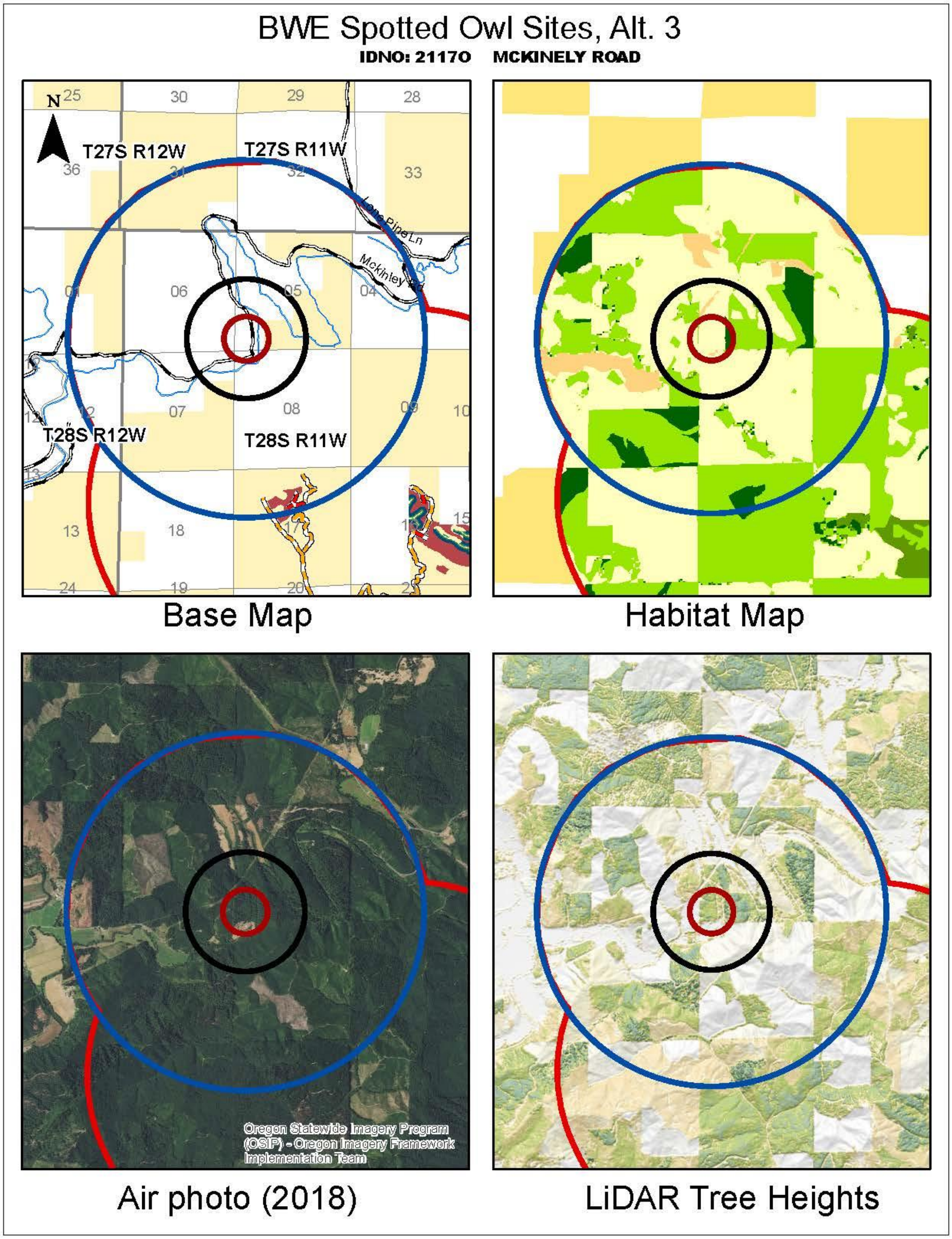
LiDAR Tree Heights


BWE Spotted Owl Sites, Alt. 2
IDNO: 2318O BROWNSON HEADWATERS
T28S R11W
T29S R11W
Big Creek Rd
Base Map
Habitat Map
Oregon Statewide Imagery Program (OSIP) - Oregon Imagery Framework Implementation Team
Air photo (2018)
LiDAR Tree Heights

Alternative 3:Spotted owl activity center maps, Top left base map with units, top right habitat map, bottom left air photos, and bottom right LiDAR images.

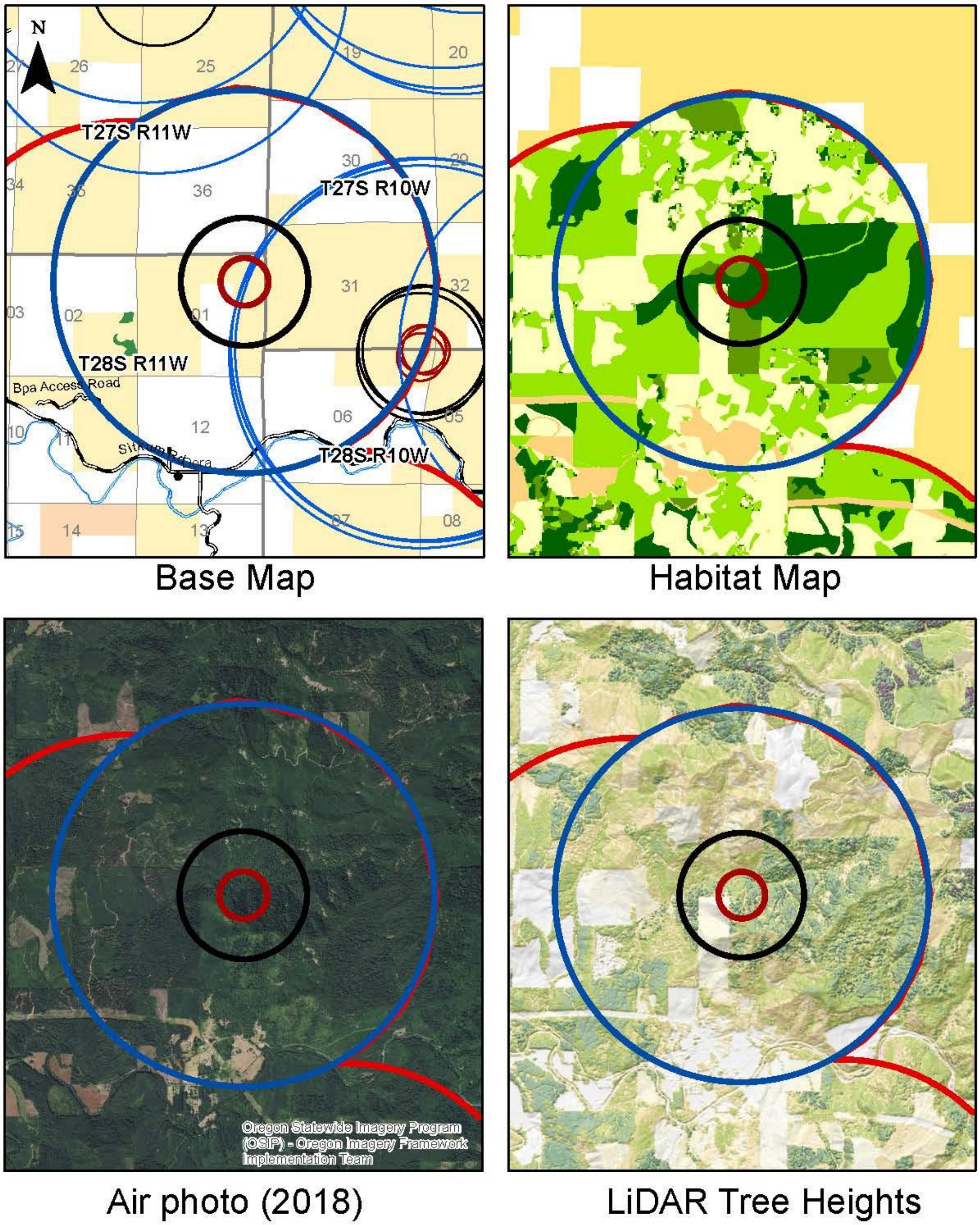



BWE Spotted Owl Sites, Alt. 3
IDNO: 2317A BREWSTER VALLEY
N
Sitkum Rd
Sitkum
T28S R10W
07
08
09
10
11
18
17
16
15
14
19
20
21
22
23
30
29
28
27
26
31
32
33
34
35
Base Map
Habitat Map
Oregon Statewide Imagery Program (OSIP) - Oregon Imagery Framework Implementation Team
Air photo (2018)
LiDAR Tree Heights


BWE Spotted Owl Sites, Alt. 3
IDNO: 2117O MCKINELY ROAD
N
T27S R12W
T27S R11W
T28S R12W
T28S R11W
Lone Pine Ln
Mckinley Rd
Base Map
Habitat Map
Oregon Statewide Imagery Program (OSIP) - Oregon Imagery Framework Implementation Team
Air photo (2018)
LiDAR Tree Heights

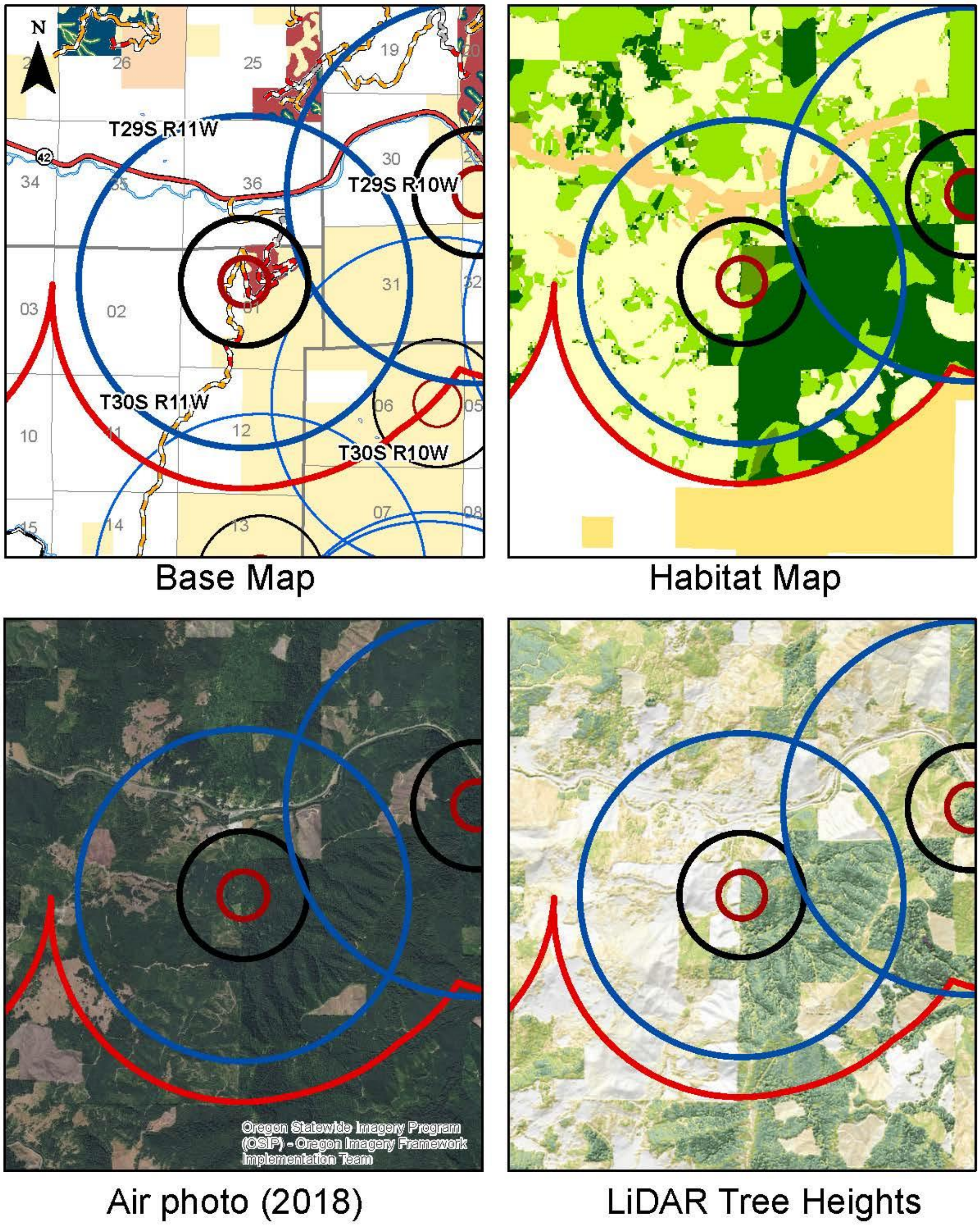
BWE Spotted Owl Sites, Alt. 3

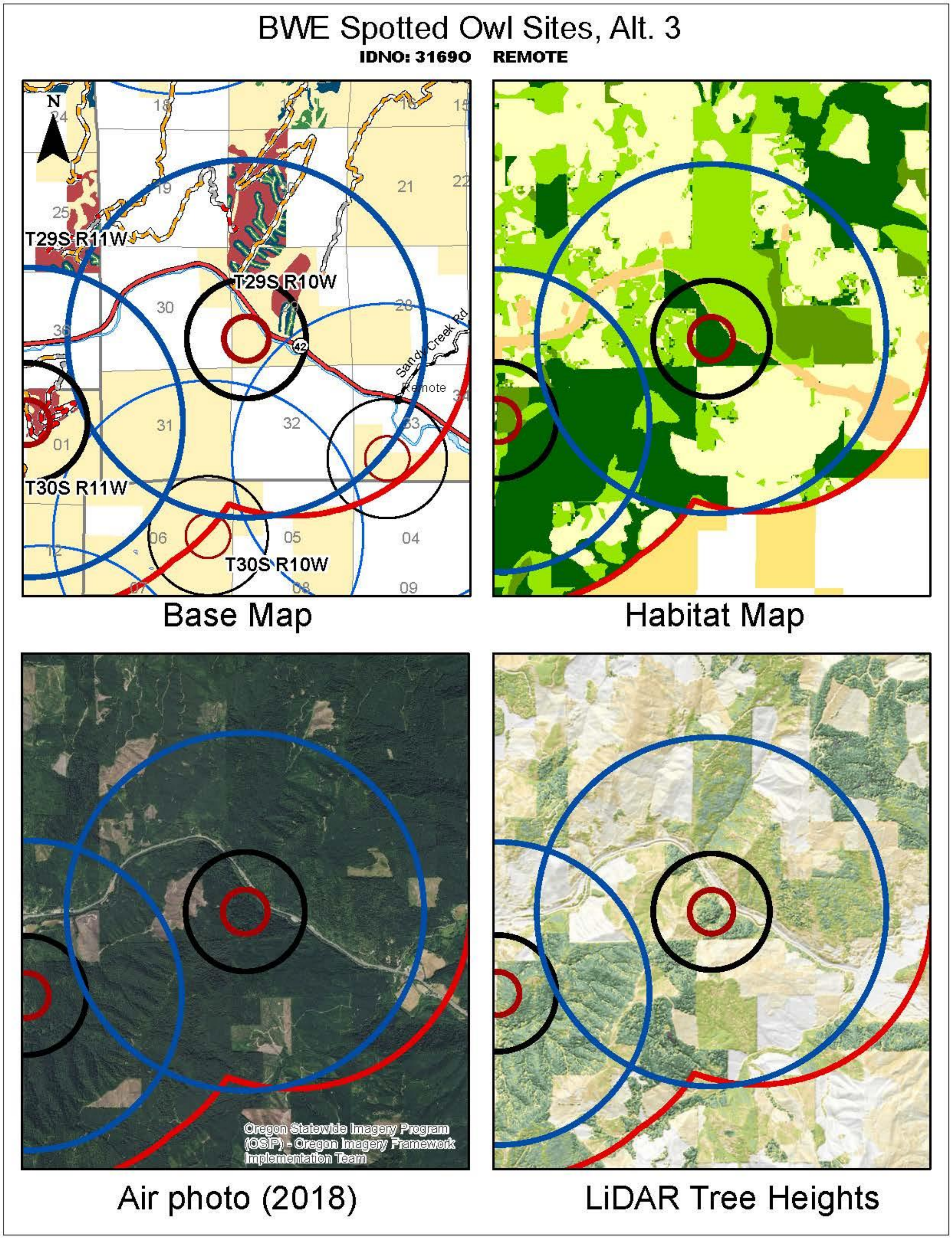
IDNO: 2347O STEEL CREEK



BWE Spotted Owl Sites, Alt. 3

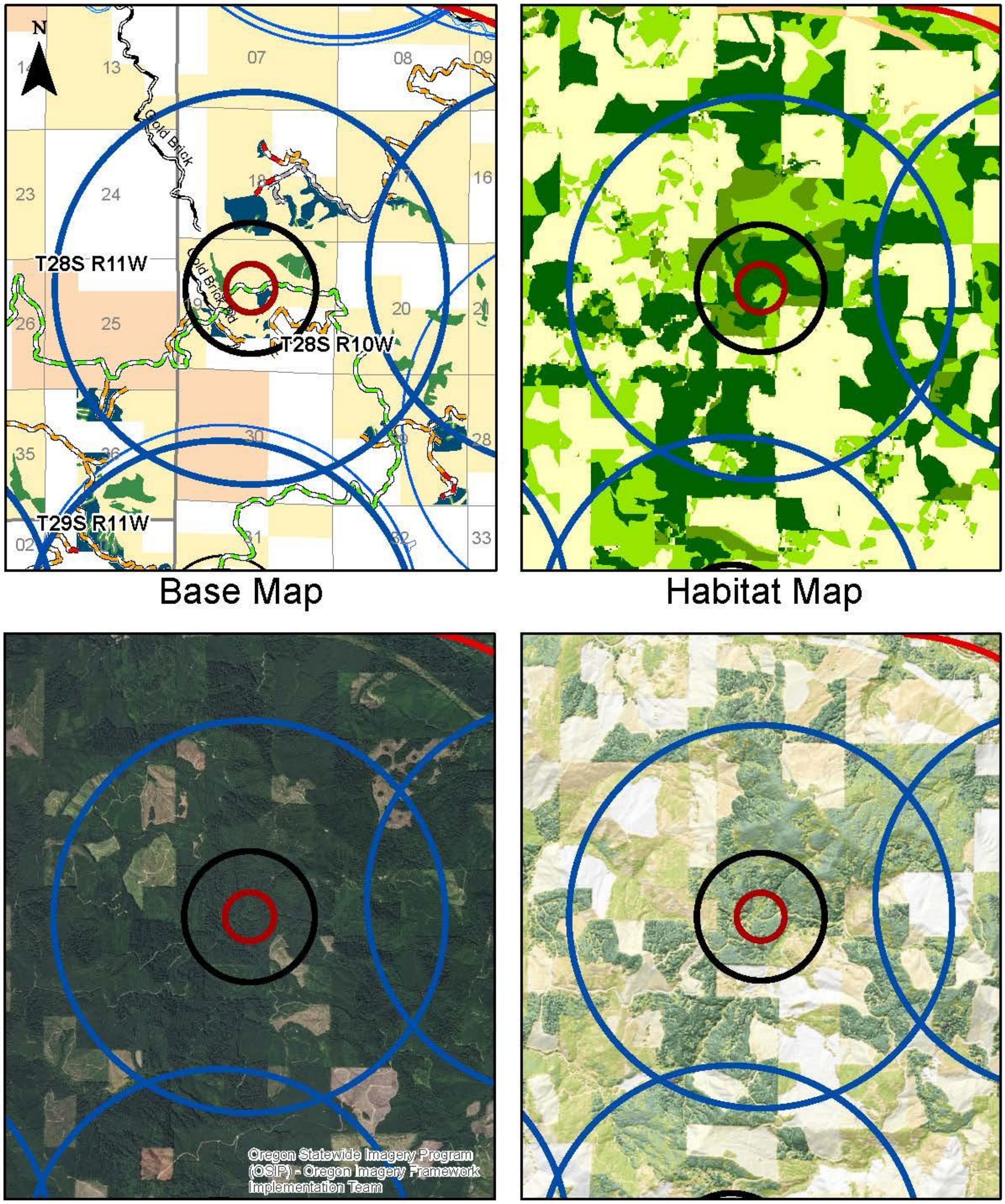
IDNO: 31670 KINCHELOE QUARRY




BWE Spotted Owl Sites, Alt. 3
IDNO: 3169O REMOTE
N
T29S R11W
T29S R10W
T30S R11W
T30S R10W
Sandy Creek Rd
Remote
42
Base Map
Habitat Map
Oregon Statewide Imagery Program (OSIP) - Oregon Imagery Framework Implementation Team
Air photo (2018)
LiDAR Tree Heights

BWE Spotted Owl Sites, Alt. 3

IDNO: 21820 ELK LOOP

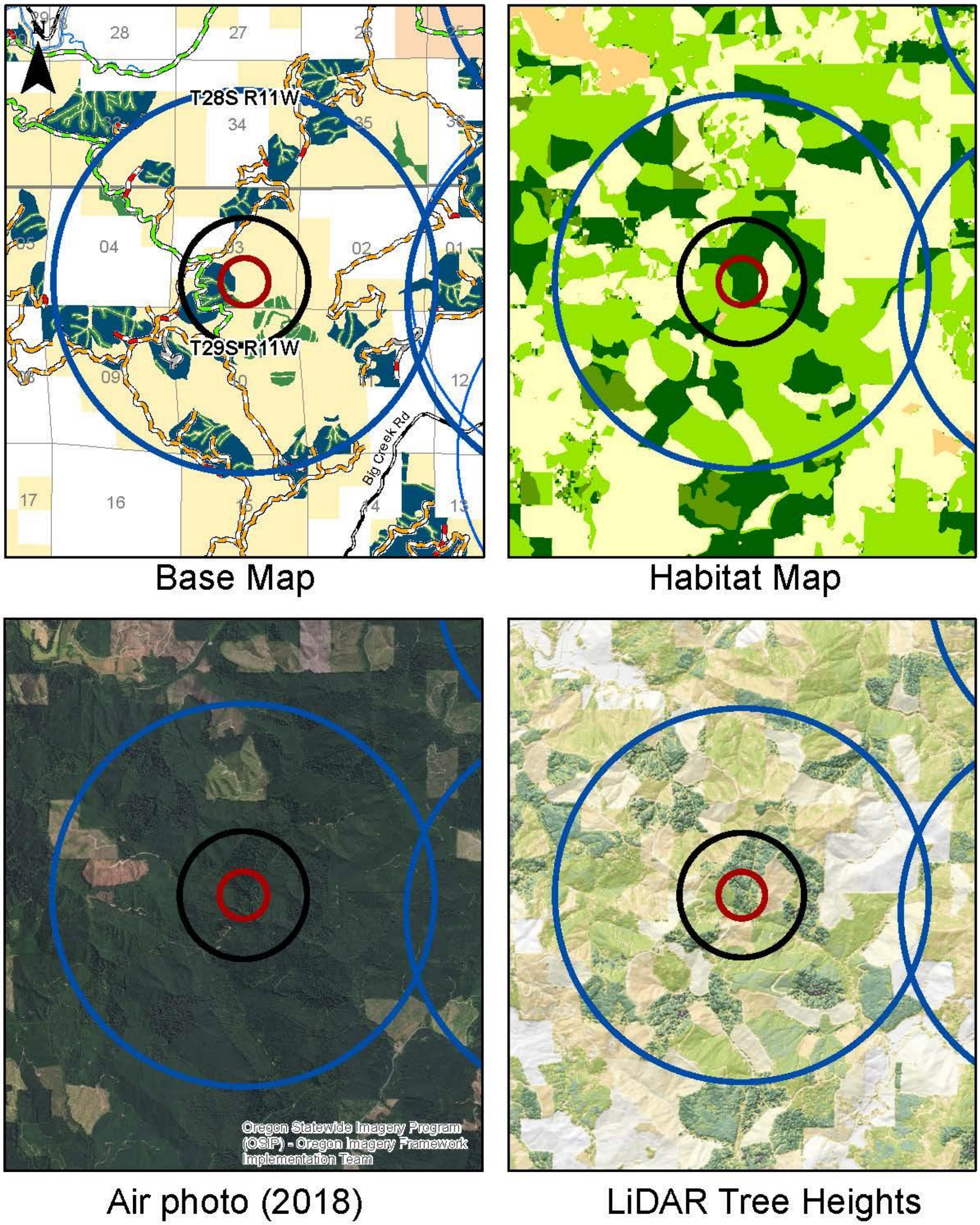


Base Map | Habitat Map

Air photo (2018) | LiDAR Tree Heights

BWE Spotted Owl Sites, Alt. 3

IDNO: 2318O BROWNSON HEADWATERS



Spotted Owl Tables

Baseline

Table 37. Known spotted owl sites by name and IDNO, previous known occupancy and status, BLM ownership by acres for patch, core and home range per site.

IDNO	Site Name	Physiographic Providence	2019 Status	Previous Known Occupancy	Previous Last Occupied Status	Acres of BLM, % BLM acres in Patch	Acres of BLM, % BLM acres in Core	Acres of BLM, % BLM acres in Home Range
2117O	McKinley Road	Coast	NR	2014	Resident Single	5	75	1633
						7%	*15%*	*36%*
2180A	Bear Pen	Coast	NR	1993	Pair	70	396	2281
						100%	*79%*	*50%*
2182O	Elk Loop	Coast	NR	1989	Pair	70	400	2028
						100%	*80%*	*45%*
2317A	Brewster Valley	Coast	NR	2013	Resident Single	70	338	2701
						100%	*68%*	*60%*
2318O	Brownson Headwaters	Coast	NR	1992	Resident Single	70	450	3293
						100%	*90%*	*73%*
2347O	Steel Creek	Coast	No Survey	1994	Resident Single	64	348	2175
						91%	*70%*	*48%*
3167O	Kincheloe Quarry	Klamath	one day visit	1995	Pair	37	223	1129
						53%	*45%*	*33%*
3169O	Remote	Coast	NR	2017	Resident single	63	313	1996
						90%	*63%*	*44%*

Alternative 2

Table 38. Habitat impacts due to treatment of project footprint to owl habitat, by LUA for alternative 2.

Land Use Allocation	NRF	RF	Disp.	Other	Total Acres	CHU
Project Size All LUA's Combined	**40**	**112**	**3,194**	**13**	**3,360**	**2,047**
Commercial	40	84	2,174	5	2,303	1,240
Non-Commercial	0	28	1,021	8	1,056	807
New Road Construction	**0**	**0**	**0**	**0**	**0**	**0**
Harvest Land Base Total Acres	**40**	**71**	**408**	**1**	**520**	**203**
Regeneration LITA	0	0	193	0	193	192
Regeneration MITA	40	71	203	1	315	0
Commercial Thin LITA	0	0	11	0	11	11
Commercial Thin MITA	0	0	2	0	2	0
Late Successional Reserve Total Acres	**0**	**33**	**1782**	**11**	**1826**	**1242**
LSR Commercial Thin	0	13	1312	3	1328	967
LSR Non-Commercial Thin	0	20	470	8	498	275
Riparian Reserve Total Acres	**0**	**8**	**1005**	**0**	**1013**	**611**
RR Commercial Thin	0	0	454	0	455	263
RR Non-Commercial Thin	0	4	539	0	544	339
Tree Tipping Total Acres	0	3	12	0	15	9

Table 39. Effects to owl habitat within the owl nesting action area, by land allocation for all BWE units, for alternative 2.

Land Allocation	**Total Acres Treated**	**NRF T/M**	**NRF Down-grade**	**NRF Removed**	**RF T/M**	**RF Down-grade**	**RF Removed**	**Dispersal T/M**	**Dispersal Removed**	**Non-Habitat**
HLB	520	0	0	40	0	0	71	0	408	1
LSR	1,826	0	0	0	20	13	0	1,782	0	11
RR	1,013	0	0	0	8	0	0	1,005	0	0
Roads- New Construction	0	0	0	0	0	0	0	0	0	0
Total Acres	3,359	0	0	40	28	13	71	2,787	408	12

Table 40. Summary of effects to spotted owl habitats within the portion of the ORC-06-02 critical habitat subunit that overlaps the owl nesting Action Area1 and overlapping units for alternative 2.

CHU ORC-06-02									
Owl nesting AA Total CHU Acres: 16, 171	6,511 acres NRF			1,424 acres RF			5,396 acres Dispersal only		
CHU acres overlap units total: 2,602	0 acres NRF			12 acres RF			2,028 acres Dispersal		
Habitat Effects	NRF Removed	NRF Downgrade	NRF T&M	RF Removed	RF Downgrade	RF T&M	Dispersal-Only Removed	Dispersal-Only T&M	Total Habitat Acres Treated on CHU
	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	
HLB (LITA only)	0	0	0	0	0	0	192	11	203
LSR	0	0	0	0	10	1	0	1231	1242
RR	0	0	0	0	0	0	0	602	603
DDR									
New Construction Roads	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	10	2	192	1843	2047
% Change to ORC-06*	0.00%	0.00%	0.00%	0.00%	-0.01%	0.00%	-0.24%	-2.25%	2.50%

Alternative 3

Table 41. Habitat impacts due to treatment of project footprint to owl habitat, by LUA, for alternative 3.

Land Use Allocation	**NRF**	**RF**	**Disp.**	**Other**	**Total Acres**	**CHU**
Project Size All LUA's Combined	**72**	**157**	**3366**	**13**	**3,608**	**2,155**
Commercial	72	139	2602	6	2,820	1,693
Non-Commercial	0	18	763	7	788	462
New Road Construction	**3**	**2**	**5**	**4**	**14**	**6**
Harvest Land Base Total Acres	**72**	**116**	**538**	**1**	**728**	**298**

Land Use Allocation	NRF	RF	Disp.	Other	Total Acres	CHU
Regeneration LITA	0	45	242	0	287	287
Regeneration MITA	72	71	283	1	427	0
Commercial Thin LITA	0	0	11	0	11	11
Commercial Thin MITA	0	0	2	0	2	0
Late Successional Reserve Total Acres	**0**	**33**	**1782**	**12**	**1,827**	**1,242**
LSR Commercial Thin	0	21	1537	5	1,562	1,096
LSR Non-Commercial Thin	0	13	245	7	265	146
Riparian Reserve Total Acres	**0**	**8**	**1046**	**0**	**1,054**	**616**
RR Commercial Thin	0	3	528	0	532	299
RR Non-Commercial Thin	0	2	506	0	508	307
Tree Tipping Total Acres	0	3	12	0	15	9

Table 42. Effects to owl habitat within the owl nesting action area, by land allocation for all BWE units, for alternative 3.

Land Allocation	Total Acres Treated	NRF T/M	NRF Down-grade	NRF Removed	RF T/M	RF Down-grade	RF Removed	Dispersal T/M	Dispersal Removed	Non-Habitat
HLB	727	0	0	72	0	0	116	0	538	1
LSR	1828	0	0	0	13	21	0	1782	0	12
RR	1054	0	0	0	5	3	0	1046	0	0
Roads- New Construction	14	0	0	3	0	0	2	0	5	4
Total Acres	3623	0	0	75	18	24	118	2828	543	17

Table 43. Summary of effects to spotted owl habitats within the portion of the ORC-06-02 critical habitat subunit that overlaps the owl nesting Action Area1 and overlapping units for alternative 3.

CHU ORC-06-02									
Owl nesting AA Total CHU Acres: 16, 171	6,511 acres NRF			1,424 acres RF			5,396 acres Dispersal only		
CHU acres overlap units total: 2,698	0 acres NRF			56 acres RF			2098 acres Dispersal		
Habitat Effects	**NRF Removed**	**NRF Downgrade**	**NRF T&M**	**RF Removed**	**RF Downgrade**	**RF T&M**	**Dispersal-Only Removed**	**Dispersal-Only T&M**	**Total Habitat Acres Treated on CHU**
	(acres)	**(acres)**	**(acres)**	**(acres)**	**(acres)**	**(acres)**	**(acres)**	**(acres)**	
HLB (LITA only)	0	0	0	45	0	0	253	0	**298**
LSR	0	0	0	0	12	0	0	1,223	**1235**
RR	0	0	0	0	0	0	0	616	**616**
DDR									
New Construction Roads	3	0	0	1	0	0	2	0	**6**
Total	**3**	**0**	**0**	**46**	**12**	**0**	**255**	**1839**	**2155**
% Change to ORC-06*	**0.00%**	**0.00%**	**0.00%**	**-0.06%**	**-0.01%**	**0.00%**	**-0.31%**	**-2.25%**	**3%**

Marbled Murrelet Tables

Alternative 2

Table 44. Habitat impacts due to treatment of project footprint to murrelet habitat, by LUA for alternative 2.

Land Use Allocation	Surveyed Unoccupied and Unsurveyed Suitable Habitat	Designated Occupied Habitat that is Suitable	Designated Occupied Habitat that is not Suitable	Non-habitat	Total Acres	CHU
Project Size All LUA's Combined	**166**	**0**	**0**	**3,192**	**3,359**	**0**
Commercial	155	0	0	2,147	2,302	0
Non-Commercial	11	0	0	1,045	1,056	0
New Road Construction (outside units)	0	0	0	0	0	0
Harvest Land Base Total Acres	**143**	**0**	**0**	**377**	**520**	**0**
Regeneration Harvest LITA	33	0	0	159	193	0
Regeneration Harvest MITA	110	0	0	205	315	0
Commercial Thin LITA	0	0	0	11	11	0
Commercial Thin MITA	0	0	0	2	2	0
Late Successional Reserve Total Acres	**0**	**0**	**0**	**1,825**	**1,826**	**0**
LSR Commercial Thin	0	0	0	1,328	1,328	0
LSR Non-Commercial Thin	0	0	0	498	498	0
Riparian Reserve Total Acres	**23**	**0**	**0**	**989**	**1,013**	**0**
RR Commercial Thin	12	0	0	442	454	0
RR Non-Commercial Thin	11	0	0	533	544	0
Tree Tipping	0	0	0	15	15	0

Table 45. Habitat impacts due to proposed action by LUA for the murrelet, alt. 2.

LUA	Suitable*			Occupied (not habitat)			Suitable Occupied		
	T/M	Downgrade	Removed	T/M	Downgrade	Removed	T/M	Downgrade	Removed
HLB	0	0	143	0	0	0	0	0	0
LSR	0	0	0	0	0	0	0	0	0
RR	11	12	0	0	0	0	0	0	0
NC roads	0	0	0	0	0	0	0	0	0
Total	11	12	143	0	0	0	0	0	0

Alternative 3

Table 46. Habitat impacts due to treatment of project footprint to murrelet habitat, by LUA for alternative 3.

Land Use Allocation	Surveyed Unoccupied and Unsurveyed Suitable Habitat	Designated Occupied Habitat that is Suitable	Designated Occupied Habitat that is not Suitable	Non-habitat	Total Acres	CHU
Project Size All LUA's Combined	**255**	**1**	**1**	**3,362**	**3,619**	**59**
Commercial	242	0	0	2,536	**2,778**	56
Non-Commercial	12	0	0	816	**828**	2
New Road Construction (outside units)	1	1	1	9	**12**	1
Harvest Land Base Total Acres	**229**	**0**	**0**	**499**	**728**	**55**
Regeneration Harvest LITA	74	0	0	214	**287**	55
Regeneration Harvest MITA	155	0	0	272	**427**	0
Commercial Thin LITA	0	0	0	11	**11**	0
Commercial Thin MITA	0	0	0	2	**2**	0
Late Successional Reserve Total Acres	**0**	**0**	**0**	**1,825**	**1,826**	**0**
LSR Commercial Thin	0	0	0	1,525	**1,525**	0
LSR Non-Commercial Thin	0	0	0	300	**300**	0
Riparian Reserve Total Acres	**25**	**0**	**0**	**1,029**	**1,054**	**2**
RR Commercial Thin	13	0	0	513	**526**	1
RR Non-Commercial Thin	12	0	0	501	**513**	1
Tree Tipping	0	0	0	15	**15**	0

Table 47. Habitat impacts due to proposed action by LUA for the murrelet, alt. 3.

LUA	Suitable*			Occupied (not habitat)			Suitable-Occupied		
	T/M	Downgrade	Removed	T/M	Downgrade	Removed	T/M	Downgrade	Removed
HLB	0	0	229	0	0	0	0	0	0
LSR	0	0	0	0	0	0	0	0	0
RR	12	13	0	0	0	0	0	0	0
NC roads	0	0	1	0	0	1	0	0	1
Total	**12**	**13**	**230**	**0**	**0**	**1**	**0**	**0**	**1**

Special Status Species

Table 48. Special Status Species Within BWE.

Common Name	*Scientific Name*	Documented (D) or Suspected (S)	Key Habitats—Species Notes—Species Range
Amphibians			
Foothill yellow-legged frog	*Rana boylii*	D	Primarily found in larger order streams and rivers (4th through 6th order), but also documented from 1st through 8th orders
Birds			
Purple martin	*Progne subis*	D	Known on District; nests over water or in the uplands in snags in open areas; will occur in the project area, particularly near ponds
Bald Eagle	*Haliaeetus leucocephalus*	S	
Invertebrates			
Broadwhorl tightcoil	*Pristiloma johnsoni*	S	Found in moist and diverse forest sites with abundant ground cover
Pacific walker	*Pomatiopsis californica*	S	Central- Southern OR, coastal fog belt. Riparian associate, semi-aquatic snail. Wet leaf litter and vegetation, beside flowing or standing water in shaded situations (Springs and seeps in forested habitats)
Western bumblebee	*Bombus occidentalis*	S	Generalist foragers, they do not depend on any one flower type; important pollinators of wild flowering plants and crops, not documented on Coos Bay District
Mammals			
Fringed myotis	*Myotis thysanodes*	D	Forest dwelling species roosting in snags, rock crevices, caves, mines, buildings, bridges, and green trees
Townsend's big-eared bat	*Spermophilus townsendii*	D	Forest and grassland habitats, roosting in caves and mines, buildings, bridges, and basal hollows of trees
Reptiles			
Western pond turtle	*Actinemys marmorata*	D	Most common in lentic water (ponds, slow sections of rivers), but also use streams and rivers, generally in low velocity sections and deep pools; nests in open areas adjacent to water; can overwinter in forest habitat

Appendix H: Forest Information and Stand Modeling Projections

Table 49. Numbers of Acres in the HLB the Proposed Treatment would Affect in Each Sixth Field Watershed.

Sixth Field Watershed	6th Field Watershed		Proposed Treatments	
	Acres	HLB (ac)	Alt.2 (ac)	Alt. 3 (ac)
Belieu Creek-Middle Fork Coquille River	11,352	1,166	289	413
Big Creek	16,693	140	12	12
Dement Creek-South Fork Coquille River	27,642	477	17	17
Elk Creek	9,692	91	27	27
Indian Creek-Middle Fork Coquille River	15,424	1,011	91	141
Myrtle Creek	19,988	578	5	19
Yankee Run-East Fork Coquille River	16,432	1,354	79	98
Total	**117,222**	**4,817**	**520**	**727**

Table 50. Alternative 2 Direct Effects at Project and SYU Scale.

Age Class	Alternative 2 Regeneration Harvests (acres)	Current SYU Acres in the HLB	Post-Harvest Age Class (SYU) (acres)	Percent Change at the SYU Scale in the HLB	Post-Harvest Percent of total SYU in the HLB
10	+508	1,766	2,274	+29%	7%
20	0	2,677	2,677	0%	8%
30	0	6,465	6,465	0%	19%
40	0	3,339	3,339	0%	10%
50	-57	3,890	3,833	-1%	11%
60	-262	2,765	2,503	-9%	7%
70	-56	3,102	3,046	-2%	9%
80	-6	3,103	3,097	0%	9%

Age Class	Alternative 2 Regeneration Harvests (acres)	Current SYU Acres in the HLB	Post-Harvest Age Class (SYU) (acres)	Percent Change at the SYU Scale in the HLB	Post-Harvest Percent of total SYU in the HLB
90	-43	2,214	2,171	-2%	6%
100	0	615	615	0%	2%
110	0	982	982	0%	3%
120	0	426	426	0%	1%
130	-35	385	350	-9%	1%
140	-9	397	388	-2%	1%
150	0	400	400	0%	1%
160	-40	555	515	-7%	1%
170	0	473	473	0%	1%
190+	0	1,381	1,381	0%	4%
Total		34,935	34,935		100%

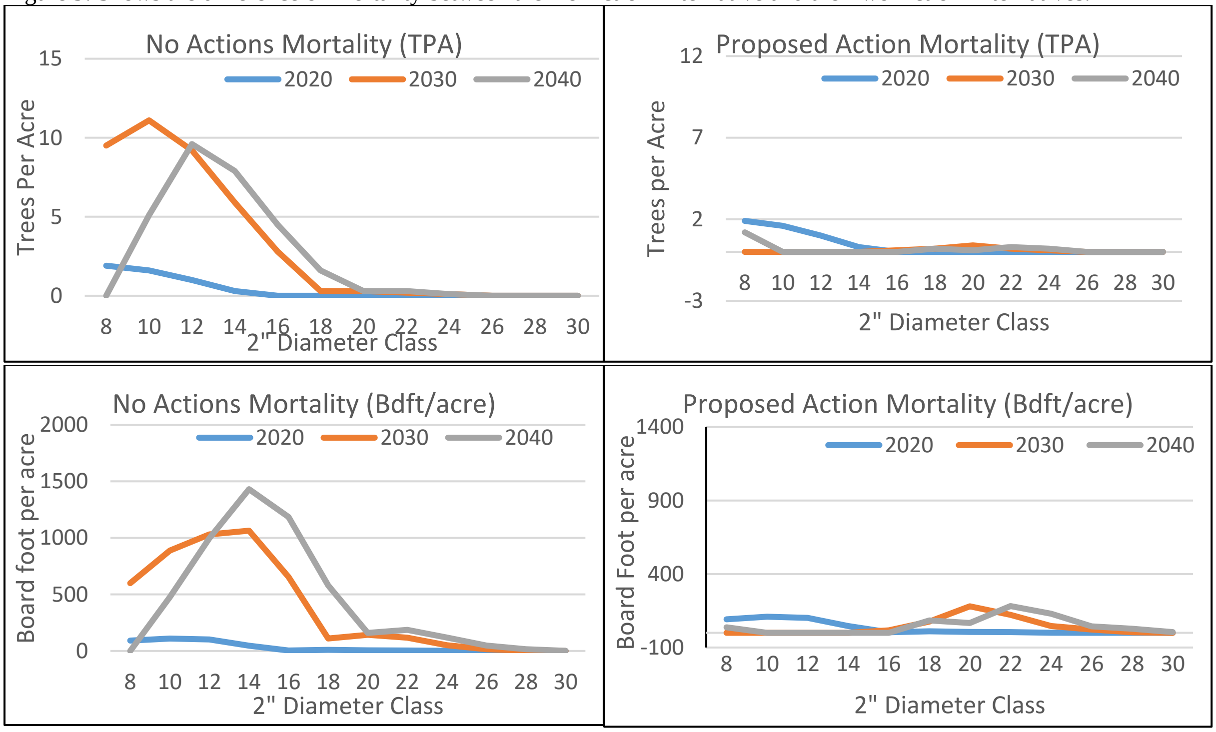
Table 51. Alternative 3 - Direct Effects at the SYU Scale.

Age Class	Alternative 3 Regeneration Harvests (acres)	Current SYU Acres in the HLB	Post-Harvest Age Class (SYU) (acres)	Percent Change at the SYU Scale in the HLB	Post-Harvest Percent of total SYU in the HLB
10	+715	1,766	2,481	+39%	7%
20	0	2,677	2,677	0%	8%
30	0	6,465	6,465	0%	19%
40	0	3,339	3,339	0%	10%
50	-57	3,890	3,833	-1%	11%
60	-329	2,765	2,436	-12%	7%
70	-118	3,102	2,984	-4%	9%
80	-6	3,103	3,097	0%	9%
90	-43	2,214	2,171	-2%	6%
100	-45	615	570	-7%	2%
110	0	982	982	0%	3%
120	0	426	426	0%	1%
130	-35	385	350	-9%	1%
140	-9	397	388	-2%	1%
150	0	400	400	0%	1%
160	-40	555	515	-7%	1%
170	-13	473	460	-3%	1%
190+	-20	1,381	1,361	-1%	4%
Total		34,935	34,902		100%

Table 52. Stand Data for Commercial Thinning Unit (2020 Stand Exam Data).

EA Unit	Age	Basal Area (square feet)	Trees Per Acre	Quadratic Mean Diameter (inches)	Height (feet)	Volume (Mbf/ac)	Percent Canopy Cover	Relative Density
106	41	253	294	14	137	57	84	69

Figure 9. Shows the difference of Mortality between the No Action Alternative and the Two Action Alternatives.



This capture of volume is shown in TPA and Bdft/ac.

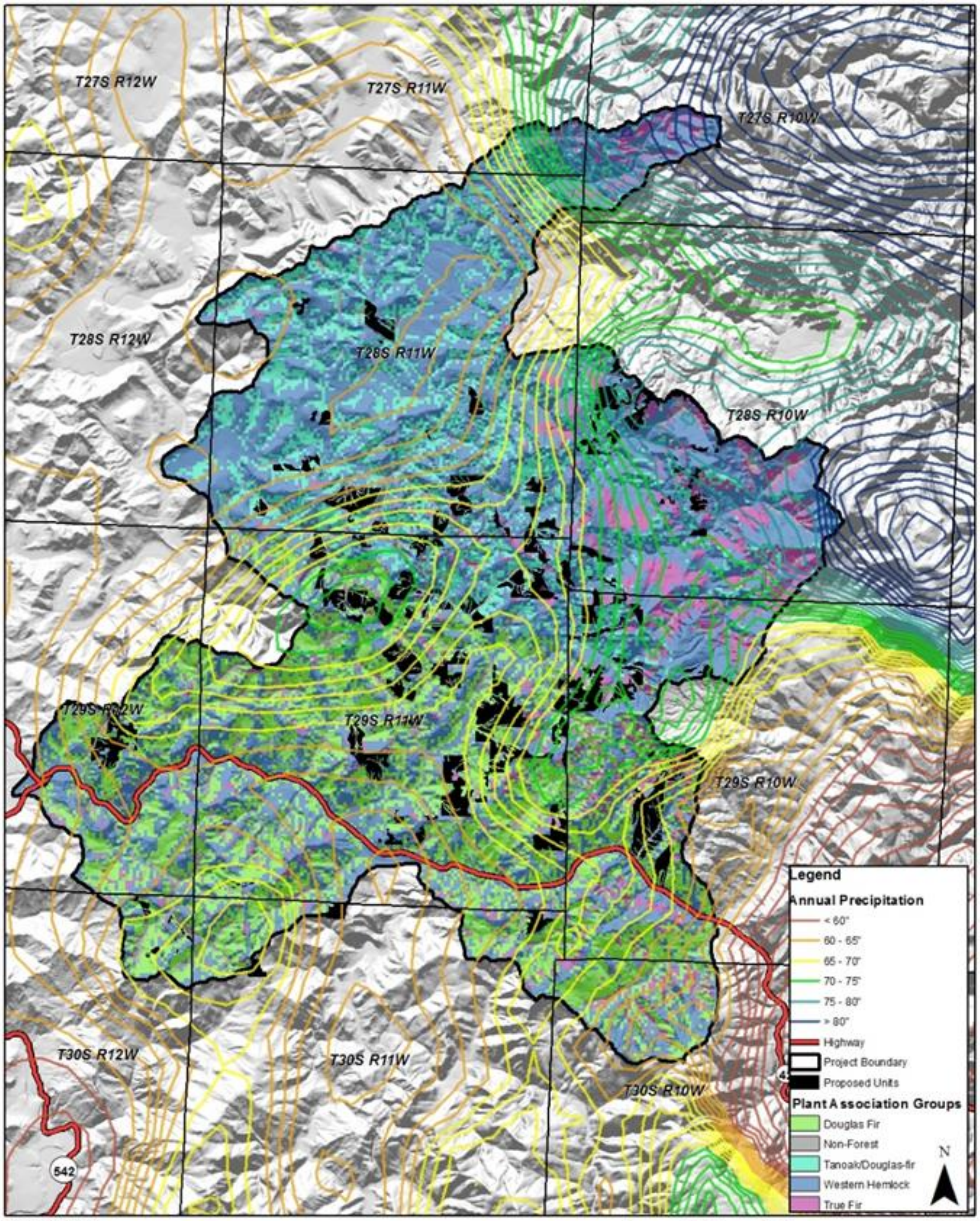
Table 53. Plant Association Groups within Proposed Harvest Units[17]

Plant Association Group	Description	Approx. Acres in Proposed Harvest Units
Western Hemlock	These forest types occur on sites that are wet and warm during the winter months, and humid during the summer. Soils are moderately deep and well drained loams with rock fragments, generally derived from sandstone. The overstory is dominated by Douglas fir, with western hemlock and occasionally grand fir or western redcedar. Port-Orford cedar is frequent, though at low covers. Big-leaf maple, tanoak, California-laurel and Port-Orford-cedar are frequent in the understory. Vine maple may be dense, along with huckleberry, Oregongrape, and salmonberry in the shrub layer. Western sword-fern is common.	45%
Douglas Fir Moist	This warm, moist forest type can be variable; however, salmonberry, and Tanoak are frequently present in addition to overstory Douglas-fir and red alder. Understory species include Douglas-fir, western redcedar and tanoak, Port-Orford-cedar is also found occasionally. While salmonberry is usually dominant in the shrub layer, huckleberry, ocean-spray, salal, and elderberry are also common. Western sword-fern is the dominant herb species.	30%
Tanoak/ Douglas-fir Moist	On lower slopes, bottomlands and northern aspects stands transition into a Tanoak/Douglas fir type. Soils are generally sandstone derived sandy loams. The overstory Tanoak and Douglas fir is accompanied by golden chinquapin and Pacific madrone. Typically, tanoak dominates the regeneration layer. Wet site indicators such as western hemlock, western redcedar, Pacific yew, and red alder may be present at low cover. Salal and Pacific rhododendron dominate the shrub layers. Poison oak and beargrass characterize drier sites, while sword-fern characterizes the wetter sites.	15%
True Fir	Grand fir forest types occur at higher elevations and upper slope positions in the project area with high amounts of precipitation on soils derived from a mix of granite, sandstone and others. In addition to Douglas-fir and grand fir, golden chinquapin and Pacific madrone are frequent. Other hardwoods include vine maple, big-leaf maple, red alder,	10%

17 From Atzet et al. 1996, "Field Guide to the Forested Plant Associations of Southwestern Oregon"

Plant Association Group	Description	Approx. Acres in Proposed Harvest Units
	Pacific dogwood, tanoak, and canyon live oak. In the shrub layer, Oregongrape, snowberry, salal, hairy honeysuckle, baldhip rose, and Pacific blackberry are frequent.	

Figure 10. Plant Associated Groups and Precipitation in BWE.



Creation Date: July 2020

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.

0 1.25 2.5 5 Miles

Figure 11. Most private forest lands in and around the BWE project area are intensively managed even aged Douglas fir plantations. The proposed thinning prescriptions are designed to "Manage for large blocks of spotted owl nesting-roosting habitat that support clusters of reproducing spotted owls, are distributed across the variety of ecological conditions, and are spaced to facilitate the movement and survival of spotted owls dispersing between and through the blocks." (RMP/ROD 2016b, pg. 64) In order to accomplish this, [i]n stands that are not spotted owl nesting-roosting habitat, apply silvicultural treatments to speed the development of spotted owl nesting-roosting habitat or improve the quality of spotted owl nesting-roosting habitat in the stand or in the adjacent stand in the long term (RMP/ROD 2016b, pg. 66).

Table 54. Acres of Previous Commercial Silvicultural Harvests in BWE Planning Area

	Silvicultural Management			
Decade	**Clearcut/ Regeneration**[18]	**Selective Cut**[19]	**Thinning**[20]	**Total by Decade**
Prior to 1960	1,424	15	--	
1960-1969	56	59	--	115
1970-1979	3,793	--	--	3,793
1980-1989	4,951	--	--	4,951
1990-1999	1,657	--	35	1,692
2000-2009	283	--	488	771
2010- Present	3	--	2,385	2,388
Total by Type	***12,167***	***74***	***2,908***	***13,710***

[18] Clearcut refers to the removal of all trees on a site, and is followed up by planting a new cohort, leading to an even aged stand. Regeneration also refers to a timber harvest resulting in a new cohort of trees, often overstory trees are left on site to act as a seed source and provide shade as the new stand develops. These overstory trees may or may not be removed once a new cohort is established leading to an even aged or two aged stand.
[19] Selective cut refers to the removal of only some trees, generally the largest in a stand or the dead and dying to redistribute resources and stimulate growth in the remaining trees
[20] Thinning refers to the partial harvest of a stand, intending to redistribute resources to residual trees.

Table 55. Comparison of Stand Stages by Stand Age as references by Oliver (1996) and Franlin, et al. (2002).Figure 3. Comparison of stand stages by stand age as referenced by Oliver (1996) and Franklin, et al. (2002).

<table>
<tr><th>Typical stand age* (years)</th><th>Oliver and Larson (1996) Stand Development Stages</th><th>Franklin et al. (2002) Structural Stage</th></tr>
<tr><td>0</td><td colspan="2">Disturbance and legacy creation</td></tr>
<tr><td rowspan="2">20</td><td rowspan="2">Stand Initiation</td><td>Cohort establishment</td></tr>
<tr><td rowspan="2">Canopy closure</td></tr>
<tr><td>30</td><td rowspan="2">Stem Exclusion</td></tr>
<tr><td>50</td><td rowspan="2">Biomass accumulation/ competitive exclusion</td></tr>
<tr><td rowspan="2">80</td><td rowspan="2">Understory Reinitiation</td></tr>
<tr><td rowspan="2">Maturation</td></tr>
<tr><td rowspan="2">150</td><td rowspan="5">Old Growth</td></tr>
<tr><td rowspan="2">Vertical diversification</td></tr>
<tr><td rowspan="2">300</td></tr>
<tr><td>Horizontal diversification</td></tr>
<tr><td>800-1200</td><td>Pioneer cohort loss</td></tr>
<tr><td colspan="3">* Stand ages provided as references. However, stands can achieve structural classes at different stand ages depending on disturbance and site conditions.</td></tr>
</table>

Figure 12. Timber Harvest Practices, 1955-Present in the BWE Project Area.

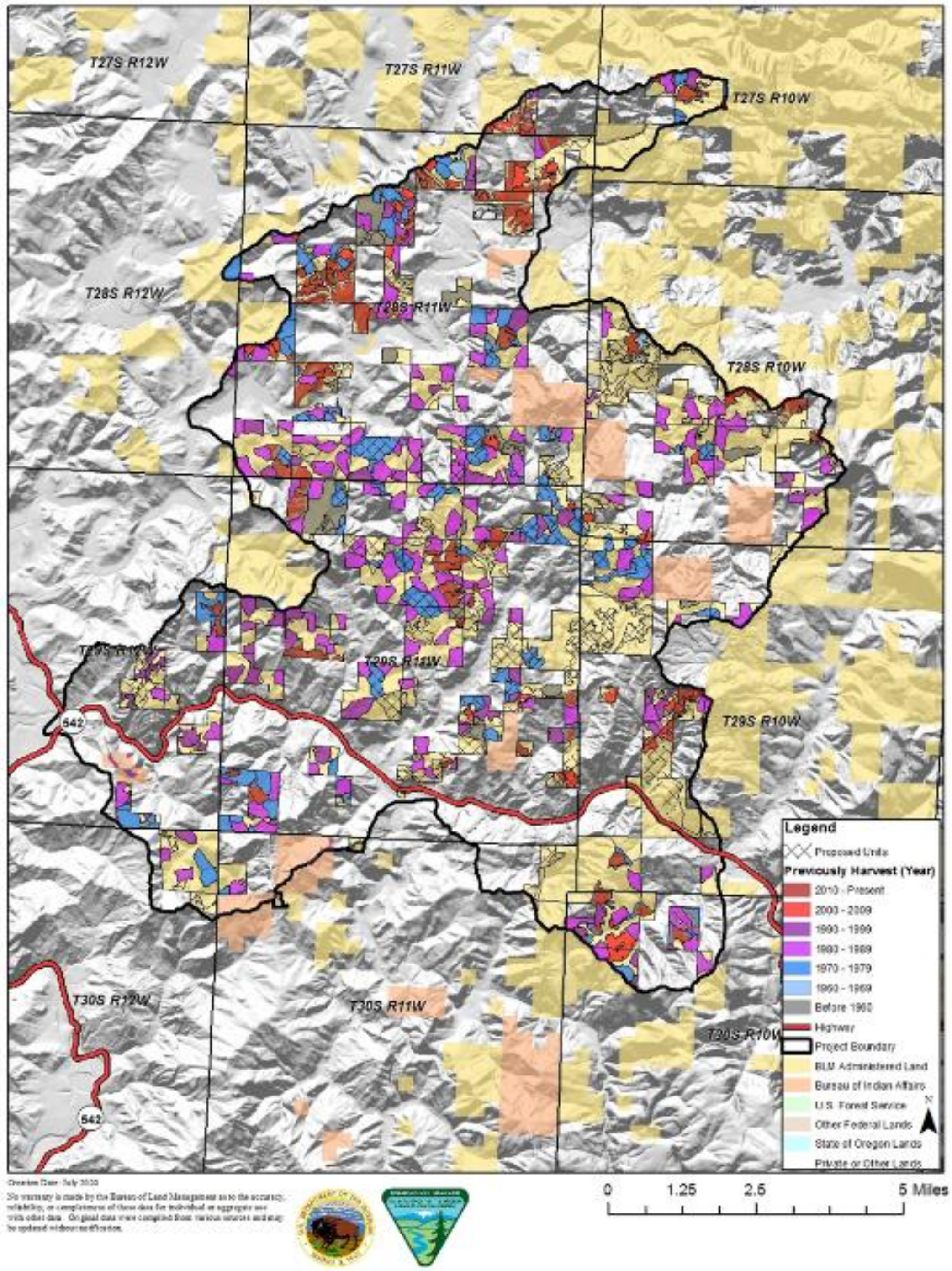
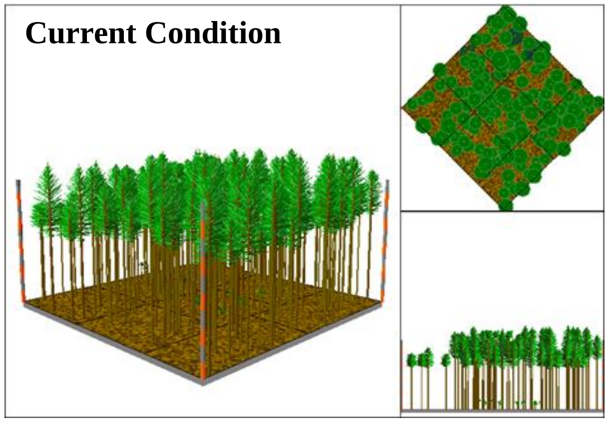


Figure 13. Example 40-year-old stand: Current Conditions (top) The same 40-year-old stand after 60 years (total age 100), on the bottom left with no action and on the right under the proposed action. Thinning the stand to lower relative densities early allowed the stand to develop a second cohort. The residual trees develop higher live crown ratios, and larger diameters relative to their heights when compared to No Action.



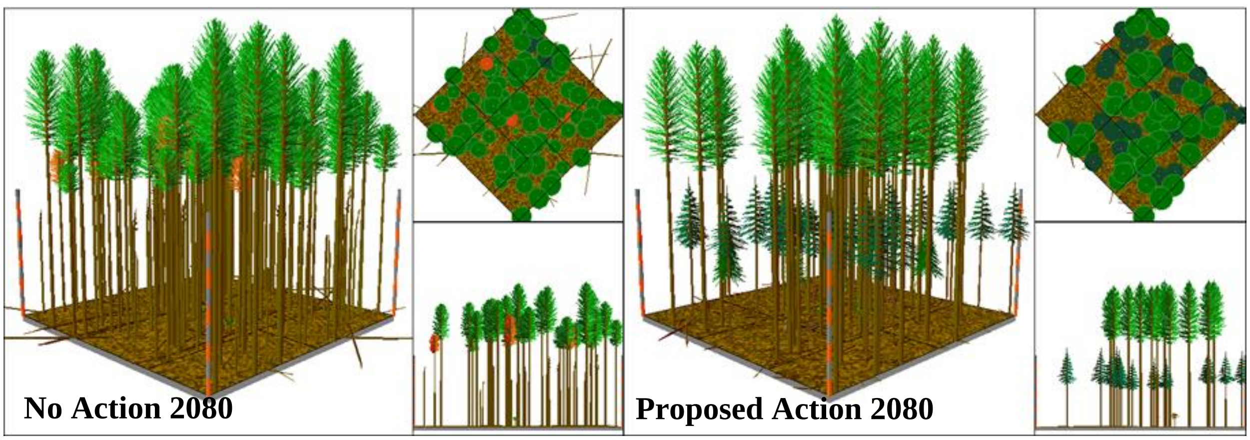


Figure 14. Stand Visualization System overhead images of the No Action Alternative and the Proposed Action post treatment and in 60 years. The image depicts approximately 10 acres of forest, which underdoes a variable density thin and group selection harvest as described in the Proposed Action.

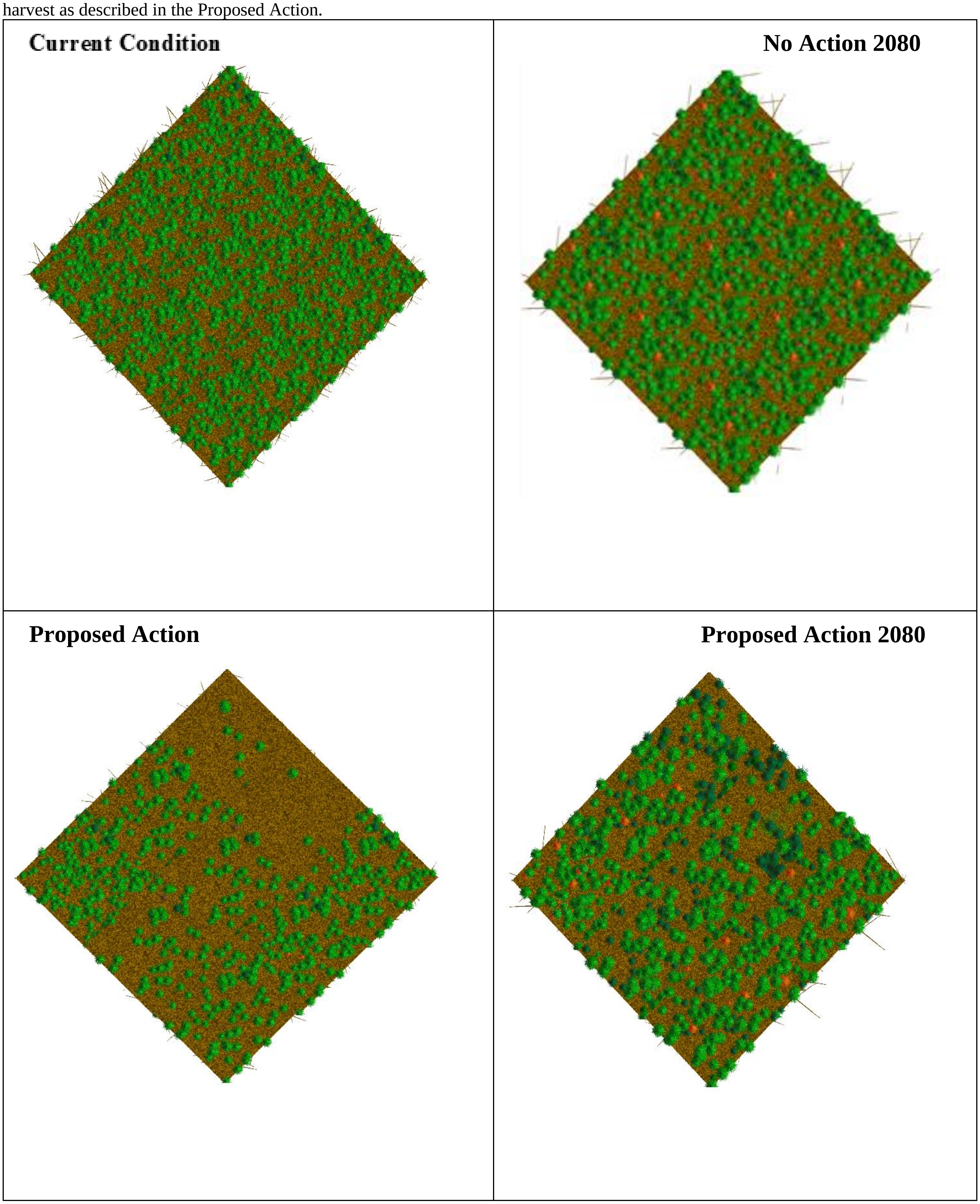


Table 56. Stand Metrics: No Action

Stand Metric	Basal Area (ft^2/ac)					Quadratic Mean Diameter (inches)					Relative Density (RD)					Canopy Cover (%)				
Age	**Current**	**Post - Treat**	**Year 20**	**Year 40**	**Year 60**	**Current**	**Post - Treat**	**Year 20**	**Year 40**	**Year 60**	**Current**	**Post - Treat**	**Year 20**	**Year 40**	**Year 60**	**Current**	**Post - Treat**	**Year 20**	**Year 40**	**Year 60**
40	200 (±40)	N/A	290 (±30)	340 (±40)	380 (±50)	12 (±3)	N/A	18 (±4)	22 (±5)	26 (±6)	60 (± 10)	N/A	70 (±10)	75 (±10)	75 (±10)	75 (±10)	N/A	75 (±10)	75 (±10)	75 (±10)
50	220 (±40)	N/A	285 (±30)	330 (±40)	370 (±50)	14 (±3)	N/A	18 (±4)	22 (±5)	26 (±6)	60 (± 10)	N/A	65 (±10)	70 (±10)	75 (±10)	75 (±10)	N/A	75 (±10)	75 (±10)	75 (±10)
60	260 (±40)	N/A	330 (±30)	370 (±40)	400 (±50)	12 (±3)	N/A	16 (±4)	20 (±5)	24 (±6)	80 (± 10)	N/A	80 (±10)	80 (±10)	80 (±10)	80 (±10)	N/A	80 (±10)	80 (±10)	80 (±10)
70 - 90	260 (±40)	N/A	300 (±30)	340 (±40)	370 (±50)	15 (±3)	N/A	19 (±4)	23 (±5)	27 (±6)	70 (±10)	N/A	70 (±10)	70 (±10)	70 (±10)	80 (±10)	N/A	80 (±10)	80 (±10)	80 (±10)

Table 57. Stand Metrics Following Thinning to 20-30 RDI (Heavy Thinning)

Stand Metric	Basal Area (ft^2/ac)					Quadratic Mean Diameter (inches)					Relative Density (RD)					Canopy Cover (%)					Estimated MBF/ac
Age	**Current**	**Post - Treat**	**Year 20**	**Year 40**	**Year 60**	**Current**	**Post - Treat**	**Year 20**	**Year 40**	**Year 60**	**Current**	**Post - Treat**	**Year 20**	**Year 40**	**Year 60**	**Current**	**Post - Treat**	**Year 20**	**Year 40**	**Year 60**	
40	200 (±40)	100 (±20)	175 (±30)	260 (±40)	330 (±50)	12 (±3)	17 (±3)	16 (±4)	21 (±5)	26 (±6)	60 (± 10)	25 (±5)	40 (±10)	60 (±10)	70 (±10)	75 (±10)	50 (±10)	55 (±10)	70 (±10)	80 (±10)	15
50	220 (±40)	100 (±20)	160 (±30)	240 (±40)	310 (±50)	14 (±3)	15 (±3)	15 (±4)	20 (±5)	24 (±6)	60 (± 10)	25 (±5)	40 (±10)	55 (±10)	65(±10)	75 (±10)	45 (±10)	65 (±10)	75 (±10)	80 (±10)	20
60	260 (±40)	90 (±20)	130 (±30)	210 (±40)	280 (±50)	12 (±3)	13 (±3)	11 (±4)	15 (±5)	19 (±6)	80 (± 10)	25 (±5)	40 (±10)	55 (±10)	65 (±10)	80 (±10)	50 (±10)	65 (±10)	75 (±10)	80 (±10)	36
70 - 90	260 (±40)	85 (±20)	130 (±30)	190 (±40)	250 (±50)	15 (±3)	16 (±3)	13 (±4)	18 (±5)	22 (±6)	70 (±10)	25 (±5)	35 (±10)	45 (±10)	55 (±10)	80 (±10)	40 (±10)	55 (±10)	65 (±10)	70 (±10)	36

Table 58. Stand Metrics Thinning to 30-40 RDI (Light Thinning)

Stand Metric	Basal Area (ft^2/ac)					Quadratic Mean Diameter (inches)					Relative Density (RD)					Canopy Cover (%)					Estimated MBF/ac
Age	**Current**	**Post - Treat**	**Year 20**	**Year 40**	**Year 60**	**Current**	**Post - Treat**	**Year 20**	**Year 40**	**Year 60**	**Current**	**Post - Treat**	**Year 20**	**Year 40**	**Year 60**	**Current**	**Post - Treat**	**Year 20**	**Year 40**	**Year 60**	
40	200 (±40)	140 (±20)	200 (±30)	290 (±40)	350 (±50)	12 (±3)	16 (±3)	17 (±4)	22 (±5)	26 (±6)	60 (± 10)	35 (±5)	55 (±10)	70 (±10)	75 (±10)	75 (±10)	65 (±10)	70 (±10)	75 (±10)	80 (±10)	9
50	220 (±40)	140 (±20)	200 (±30)	280 (±40)	350 (±50)	14 (±3)	16 (±3)	17 (±4)	21 (±5)	25 (±6)	60 (± 10)	35 (±5)	50 (±10)	60 (±10)	70 (±10)	75 (±10)	65 (±10)	70 (±10)	75 (±10)	80 (±10)	12
60	260 (±40)	110 (±20)	170 (±30)	250 (±40)	320 (±50)	12 (±3)	13 (±3)	12 (±4)	16 (±5)	20 (±6)	80 (± 10)	35 (±5)	50 (±10)	60 (±10)	70 (±10)	80 (±10)	60 (±10)	65 (±10)	75 (±10)	80 (±10)	30
70 - 90	260 (±40)	120 (±20)	170 (±30)	230 (±40)	290 (±50)	15 (±3)	15	14	19	23	70 (±10)	35 (±5)	45 (±10)	55 (±10)	60 (±10)	80 (±10)	55 (±10)	60 (±10)	70 (±10)	75 (±10)	28

Table 59. These tables present the key nesting habitat metrics for spotted owls at 20-year intervals at three thinning intensities compared to no action. The bold, underlined values in each table indicate the year and thinning intensity that best attains the desired values for each stand age.

40-Year-Old Stands	Year 20		Year 40		Year 60	
Desired Stand Component:	Mid Story Conifer 21-32" DBH (8-22TPA Target)	Overstory Conifers 32-48" DBH (8-13 TPA Target)	Mid Story Conifer 21-32" DBH (8-22TPA Target)	Overstory Conifers 32-48" DBH (8-13 TPA Target)	Mid Story Conifer 21-32" DBH (8-22TPA Target)	Overstory Conifers 32-48" DBH (8-13 TPA Target)
20 RD	38	< 1	**<u>37</u>**	**<u>9</u>**	21	24
30 RD	39	< 1	63	6	50	19
40 RD	38	< 1	70	4	68	15
No Action	36	< 1	64	3	68	11

50-Year-Old Stands	Year 20		Year 40		Year 60	
Desired Stand Component:	Mid Story Conifer 21-32" DBH (8-22TPA Target)	Overstory Conifers 32-48" DBH (8-13 TPA Target)	Mid Story Conifer 21-32" DBH (8-22TPA Target)	Overstory Conifers 32-48" DBH (8-13 TPA Target)	Mid Story Conifer 21-32" DBH (8-22TPA Target)	Overstory Conifers 32-48" DBH (8-13 TPA Target)
20 RD	25	1	**<u>19</u>**	**<u>10</u>**	18	22
30 RD	42	1	41	8	32	22
40 RD	46	1	60	6	51	19
No Action	44	< 1	62	4	59	15

60-Year-Old Stands	Year 20		Year 40		Year 60	
Desired Stand Component:	Mid Story Conifer 21-32" DBH (8-22TPA Target)	Overstory Conifers 32-48" DBH (8-13 TPA Target)	Mid Story Conifer 21-32" DBH (8-22TPA Target)	Overstory Conifers 32-48" DBH (8-13 TPA Target)	Mid Story Conifer 21-32" DBH (8-22TPA Target)	Overstory Conifers 32-48" DBH (8-13 TPA Target)
20 RD	13	3	16	7	19	11
30 RD	19	3	**<u>23</u>**	**<u>8</u>**	25	15
40 RD	24	4	30	9	32	17
No Action	47	5	54	12	51	20

70-90-Year-Old Stands	Year 20		Year 40		Year 60	
Desired Stand Component:	Mid Story Conifer 21-32" DBH (8-22TPA Target)	Overstory Conifers 32-48" DBH (8-13 TPA Target)	Mid Story Conifer 21-32" DBH (8-22TPA Target)	Overstory Conifers 32-48" DBH (8-13 TPA Target)	Mid Story Conifer 21-32" DBH (8-22TPA Target)	Overstory Conifers 32-48" DBH (8-13 TPA Target)
20 RD	9	5	12	8	18	10
30 RD	15	5	**<u>19</u>**	**<u>10</u>**	22	13
40 RD	21	6	25	12	24	16
No Action	41	7	40	15	38	22

Table 60. These tables present the total volume of wood in cubic feet available for recruitment to streams from the outer zone of the RR from trees greater than 20” DBH and 30” DBH. They are presented at 20-year intervals under a thinning and no action scenario. The percentages shown in the CU Ft over 30” shows how much of the wood greater than 20” is available in trees over 30” DBH.

40-Year-Old Stands	**No Action**		**Thinning (30 RD, Mid-Range)**	
	CU Ft over 20”	CU Ft over 30”	CU Ft over 20”	CU Ft over 30”
Year 0	900	200 (22%)	900	200 (22%)
Year 20	6200	400 (6%)	6800	400 (6%)
Year 40	13100	2100 (16%)	14100	3800 (27%)
Year 60	18400	6800 (37%)	19000	10500 (55%)

50-Year-Old Stands	**No Action**		**Thinning (30 RD, Mid-Range)**	
	CU Ft over 20”	CU Ft over 30”	CU Ft over 20”	CU Ft over 30”
Year 0	2300	0 (0%)	2300	0 (0%)
Year 20	7700	400 (5%)	7300	600 (8%)
Year 40	13300	3000 (23%)	11700	5000 (43%)
Year 60	18000	7700 (43%)	17000	11700 (69%)

60-Year-Old Stands	**No Action**		**Thinning (30 RD, Mid-Range)**	
	CU Ft over 20”	CU Ft over 30”	CU Ft over 20”	CU Ft over 30”
Year 0	4800	800 (17%)	2300	800 (17%)
Year 20	10300	2700 (26%)	4800	1900 (40%)
Year 40	15700	6300 (40%)	8200	4400 (54%)
Year 60	19800	11500 (58%)	12500	8600 (69%)

70–90-Year-Old Stands	**No Action**		**Thinning (30 RD, Mid-Range)**	
	CU Ft over 20”	CU Ft over 30”	CU Ft over 20”	CU Ft over 30”
Year 0	6000	1100 (18%)	6000	1100 (18%)
Year 20	10100	3900 (39%)	5000	2600 (52%)
Year 40	14200	7500 (53%)	8000	5200 (65%)
Year 60	17700	11800 (67%)	11600	8000 (69%)

Appendix J: Fisheries and Hydrology

Figure 15. Decision Tree for Thinning and Tree Tipping.

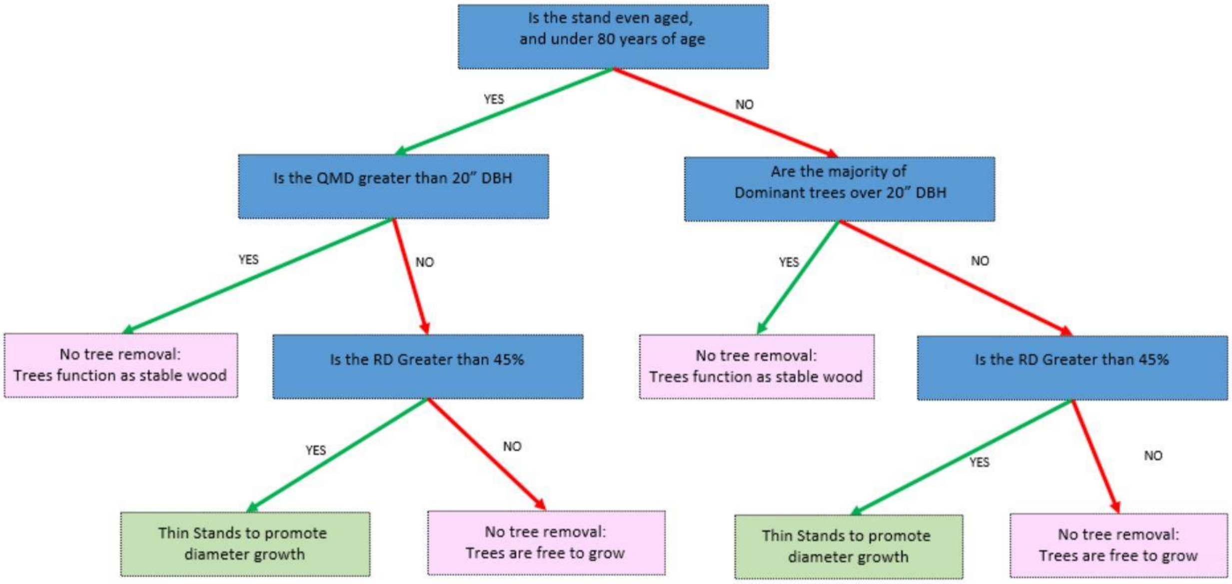


Table 61. Summary of Past, Present, and Reasonably Foreseeable Actions for all alternatives.

Agency	Past	Present	Reasonably Foreseeable
Private Timberlands	Continued harvest on a 40 to 60-year rotation. Approximately 60-65 percent of private lands would be in stand establishment stage of forest development at any time. Privately-management lands account for 36,407 acres in the analysis area, or approximately 52.4 percent of the total acreage.		
PCGP	N/A	N/A	Clearing of forest vegetation to facilitate construction of 36-inch high-pressure natural gas pipeline. Approximately 13 acres of RR would be cleared initially, and approximately 4 acres would be kept cleared perpetually as part of the permanent easement.
Coquille Tribe timberlands	Removal of trees that would be stable wood in streams.	The Coquille Tribe is planning on conducting commercial logging operations within the East Fork, Middle Fork and South Fork Coquille 5th fields. Actions include approximately 216 acres of regeneration and modified regeneration harvest; approximately 42 acres of commercial thinning; 7.3 miles of roads treatments; approximately 50 acres of outer riparian zone group selections; and approximately 5.6 acres of inner riparian zone single tree harvest. Inner zone treatments may result in up to 28 individual trees removed from riparian areas.	
BLM-administered Lands	Past management in the RR created even aged stands that have removed potential of large wood in nearby streams	Stands within the RR would continue to compete with each other suppressing the amount potential for trees to grow to 20"+ Dbh. Trees would continue to suffer from suppression mortality slowing opportunity for large trees to become large wood in streams.	

Figure 16. Example of BLM Variable Retention Regeneration Harvest (Regeneration) Versus a Private Clearcut Outside Roseburg, Oregon.

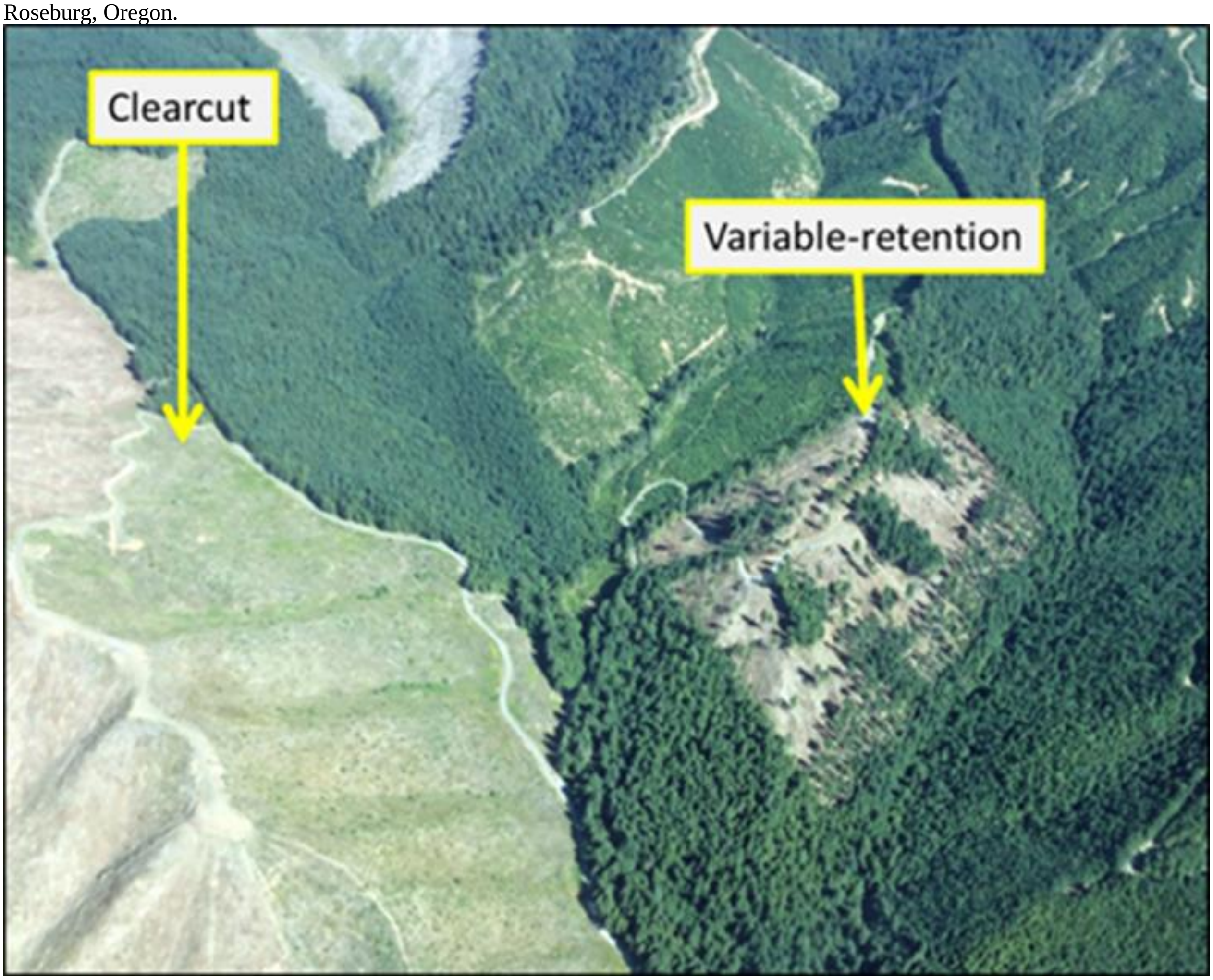


Table 62. Summer Flow Deficit for Different Experimental Harvest Treatments.

Experimental Treatment	Forest Age (Years) (R=reference stand, T=treatment stand)	Summer Flow Deficit (Percent)	Notes
H.J. Andrews and Coyote Creek—Clearcutting five 25–237-acre catchments, plantations < 50 years old	R 100–500 T 100–500	40–75	
Alsea—Clearcutting one 185-acre drainage, plantation 40–53 years old	R 90–170 T 70–110	50	
H.J. Andrews—One larger-opening patch cut—250-acre catchment, patches 13, 20, and 28 acres	R 450–500 T 450–500	21	One patch overlapped the main stem, and one patch overlapped headwater streams
Alsea—One larger-opening patch cut—768-acre drainage, three 61-acre patches with plantations 40–53 years old	R 90–170 T 50–110	14	50–100-foot buffers on perennial streams, intermittent streams not buffered
Coyote Creek—One smaller-opening patch cut—169-acre catchment, 30 percent cut, patches < eight acres	R 100–300 T 100–300+	None	Some patches adjacent to streams and overlapping streams

Sources: Perry and Jones (2016), Segura *et al.* (2020), Harr and Krygier (1972), Rothacher (1964)

Table 63. 2019 BLM forest by Land Use Allocation, Age, and Subwatershed.

Subwatershed (6th field)	0 Year	10 Year	20 Year	30 Year	40 Year	50 Year	60 Year	70 Year	80 Year	90 Year	100 Year	110 Year	120 Year	130+ Year	Totals
Belieu Creek-Middle Fork Coquille River (approx. 11359 acres, 4310 acres BLM, 38% BLM, proposed harvest in HLB is 457 acres, 4.1%)															
Harvest Land Base	4	—	132	249	207	77	346	79	3	3	40	—	—	60	1,200
Reserve	4	—	96	269	155	155	343	23	45	2	15	—	17	1,990	3,114
Big Creek (approx. 16704 acres, 8955 acres BLM, 54% BLM, proposed harvest in HLB is 12.3 acres, 0.1%)															
Harvest Land Base	1	—	30	88	23	0.5	0.1	5	—	—	—	—	—	14.2	162
Reserve	9.5	63	11	1,597	662	677	971	489	315	276	95	—	81	3,551	8,798
Elk Creek (approx. 9698 acres, 4524 acres BLM, 47% BLM, proposed harvest in HLB is 12.3 acres, 0.13%)															
Harvest Land Base	0.1	—	—	64	9	70	—	—	—	—	—	—	—	16	159
Reserve	6	3	42	859	338	538	6.5	0.1	413	86	41	0.1	50	1,999	4,382
Indian Creek-Middle Fork Coquille River (approx. 15434 acres, 4426 acres BLM, 29% BLM, proposed harvest in HLB is 138.5 acres, 1%)															
Harvest Land Base	1	—	134	403	114	263	83	51	1	2	0.1	0.1	0.5	40	1,093
Reserve	8	7	38	651	176	398	209	76	31	70	81	53	18	1515	3,331
Yankee Run-East Fork Coquille River (approx. 16442 acres, 7520 acres BLM, 46% BLM, proposed harvest in HLB is 98 acres, 0.6%)															
Harvest Land Base	22	—	17	252	359	424	180	127	5	40	—	—	—	19	1,445

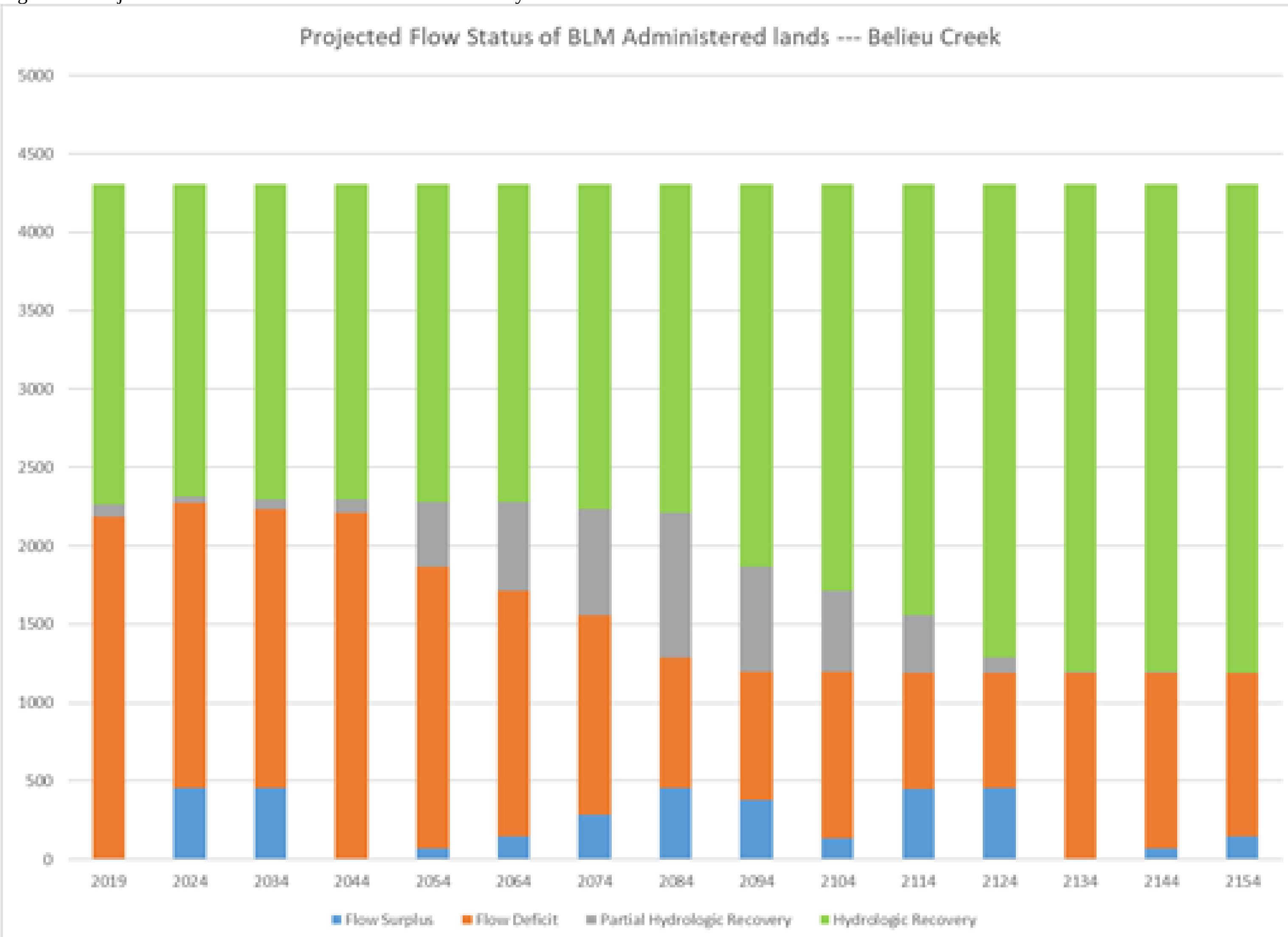
Subwatershed (6th field)	0 Year	10 Year	20 Year	30 Year	40 Year	50 Year	60 Year	70 Year	80 Year	90 Year	100 Year	110 Year	120 Year	130+ Year	Totals
Reserve	33	42	45	835	800	1202	352	359	219	144	116	12	1	1929	6,089
Totals															
Harvest Land Base	28.1	—	313	1,056	712	834.5	609.1	262	9	45	40.1	0.1	0.5	149.2	2,662>4,058.6
Reserve	60.5	115	232	4,211	2131	2970	1,881.5	947.1	1,023	578	348	65.1	167	10,984	25,713.2

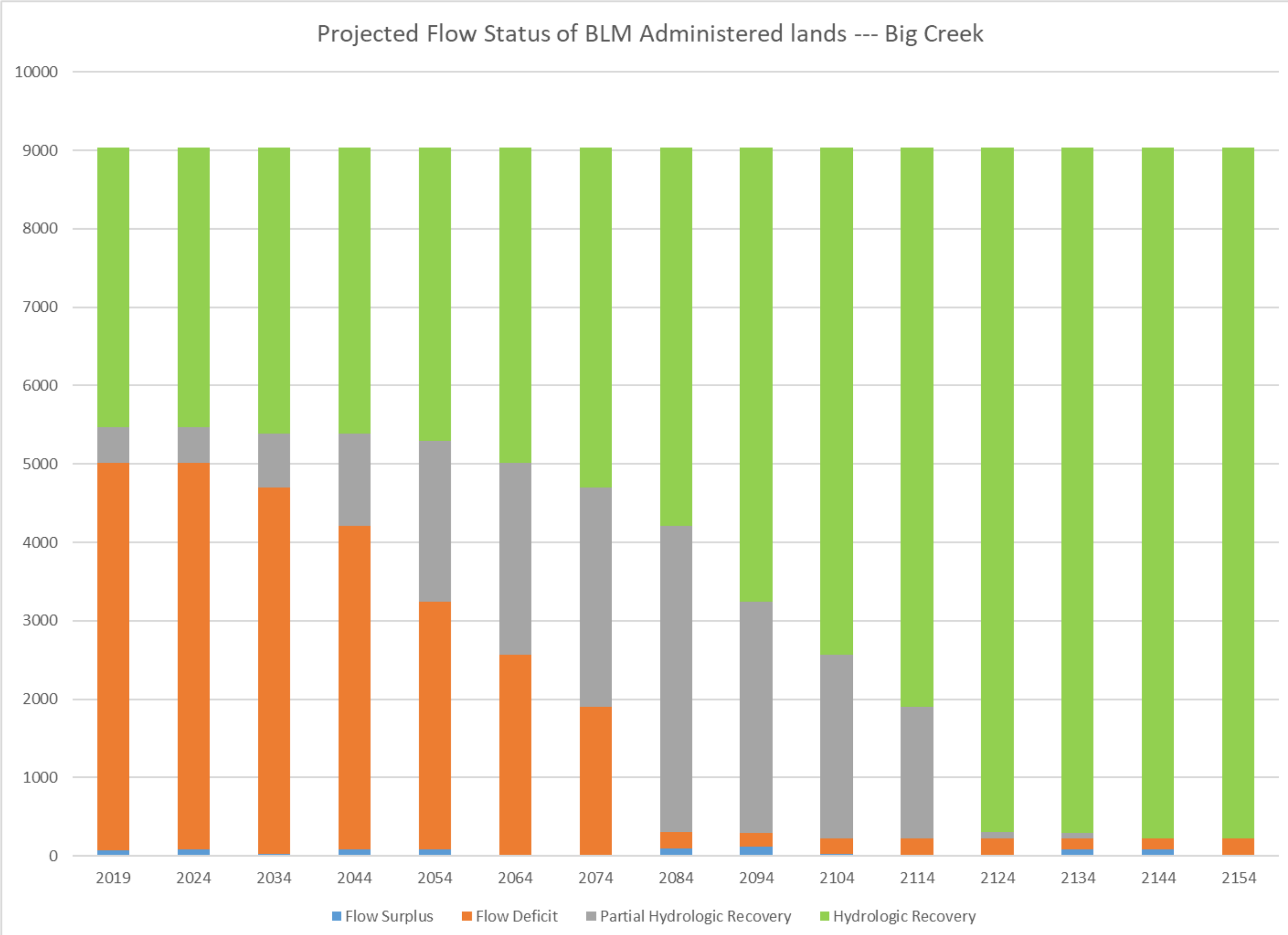
Note: The Reserve category includes BLM forested acres in the District-Designated Reserve – Timber Production Capability Classification, LSR, and RR. The HLB category includes all BLM acres in the MITA and LITA. In Analytical Methods Step 2 the following acres would be binned in the HLB 0 year column to signify regeneration harvest: Belieu: 277 acres from 60 year, 85 acres from 70 year; 45 acres from 100 year, 10 acres from 130 year and 40 acres from 160 year; Big: 12 acres from 40 year; Elk: 12 acres from 50 year; Indian: 83 acres from 60 year, 34 acres from 70 year, 3 acres from 130 year, 9 acres from 140 year, 13 acres from 170 year; Yankee: 30 acres from 50 year, 6 acres from 80 year, 43 acres from 90 year and 20 acres from 240 year. These acres add to 722 and may be slightly different than the 772 acres of regeneration listed in this EA due to rounding.

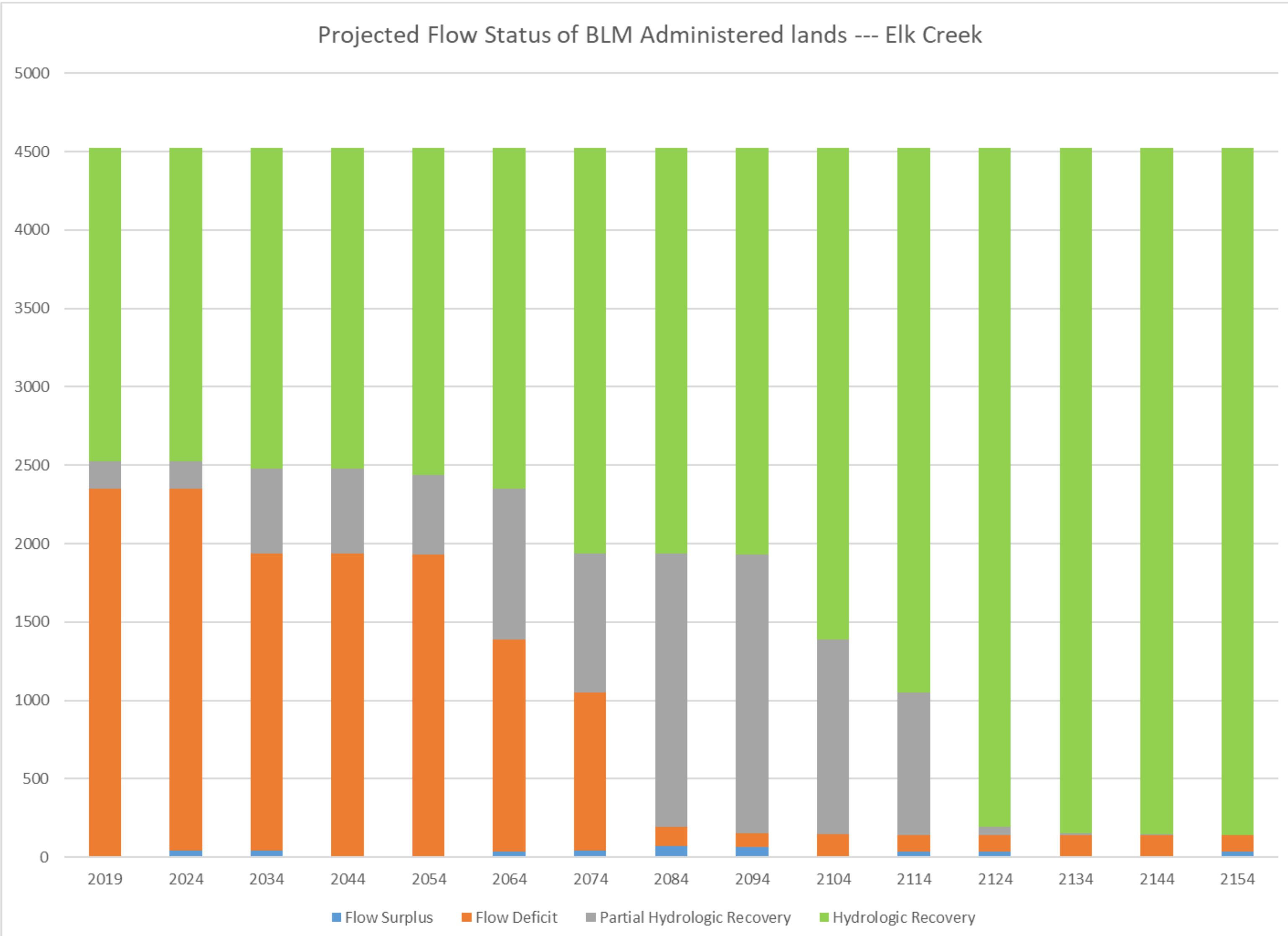
Table 64. 2019 Private Forest Acres by Age and Watershed.

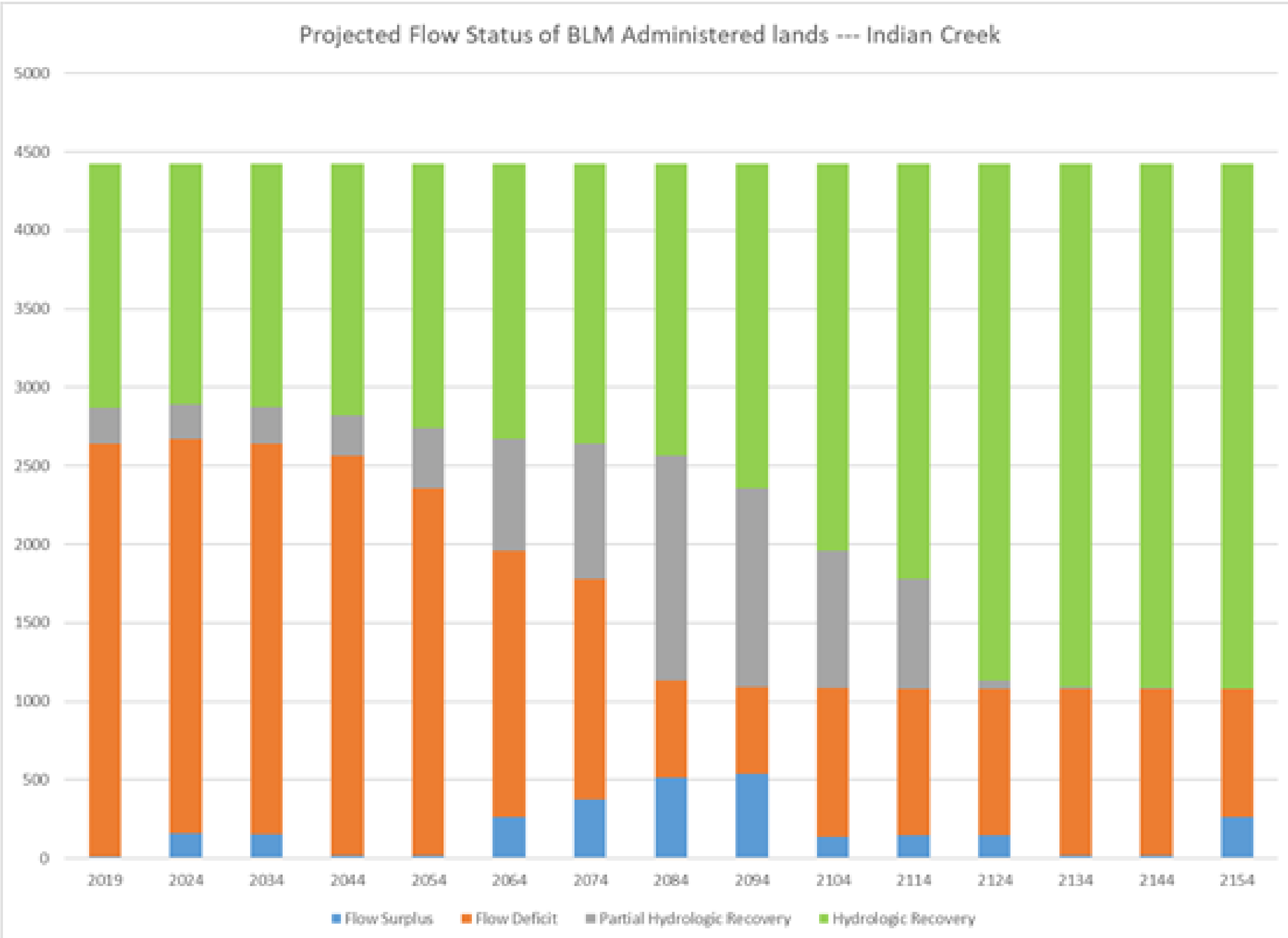
Subwatershed	0–19 Years	20–79 Years	80–129 Years	130+ Years	Totals
Belieu Creek	3395	2291	166	8	5860
Big Creek	4240	2432	200	410	7282
Elk Creek	2716	1412	143	713	4984
Indian Creek	4491	3494	222	178	8385
Yankee Run	3286	1994	630	139	6049
Totals	18,128	11,623	1361	1448	32,560

Figure 17. Projected Flow Status of BLM-administered lands by Subwatershed and Decade.




Projected Flow Status of BLM Administered lands --- Big Creek
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
2019
2024
2034
2044
2054
2064
2074
2084
2094
2104
2114
2124
2134
2144
2154
Flow Surplus
Flow Deficit
Partial Hydrologic Recovery
Hydrologic Recovery


Projected Flow Status of BLM Administered lands --- Elk Creek
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
2019
2024
2034
2044
2054
2064
2074
2084
2094
2104
2114
2124
2134
2144
2154
Flow Surplus
Flow Deficit
Partial Hydrologic Recovery
Hydrologic Recovery



Projected Flow Status of BLM Administered lands --- Indian Creek
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
2019
2024
2034
2044
2054
2064
2074
2084
2094
2104
2114
2124
2134
2144
2154
Flow Surplus
Flow Deficit
Partial Hydrologic Recovery
Hydrologic Recovery

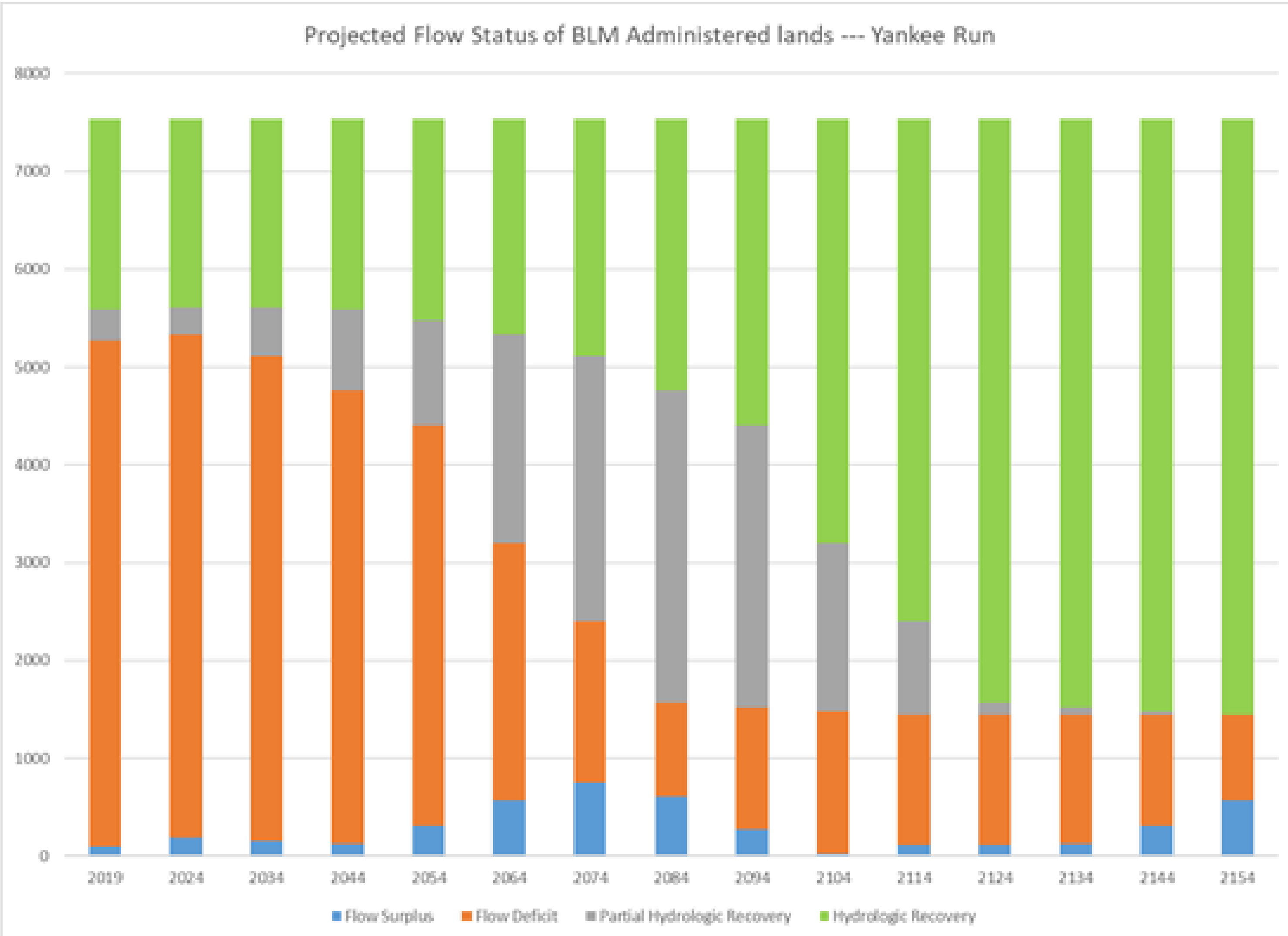

Projected Flow Status of BLM Administered lands --- Yankee Run
8000
7000
6000
5000
4000
3000
2000
1000
0
2019
2024
2034
2044
2054
2064
2074
2084
2094
2104
2114
2124
2134
2144
2154
Flow Surplus
Flow Deficit
Partial Hydrologic Recovery
Hydrologic Recovery

Table 65. Fish Habitat in Feet Within and Closest Downstream from each Proposed Harvest Unit.

EA Unit	Unit Project Name	Length of Fish Habitat Within EA Unit (feet)	Distance to Downstream Fish Habitat (feet)
1	Golden Elk	1,892	180
2	Elk Creek	2,566	120
3	Elk Cr. Ridge	1,217	340
4	Elk Creek Ridge	—	120
6	South Fork Elk	444	670
7	South Fork Elk	652	412
8	South Fork Elk	1,026	120
9	Elk 29	—	622
10	Elk 29	—	1,309
12	Bear Pen Creek	—	488
13	Bear Pen Creek	—	530
14	Bear Pen Creek	—	622
15	Bear Pen Creek	616	295
16	Big Brown	—	185
16	Big Brown	—	247
17	Big Brown	980	120
17	Big Brown	992	120
18	Brownson Falls	—	120
19	Brownson Falls	660	587
20	Brownson Falls	—	120
21	Brownson Falls	—	1,005
22	Brownson Falls	—	1,060
23	Brownson Creek	200	—
24	Week End	936	120
28	Upper Elk Creek	—	1,132
29	Upper Elk Creek	—	969
30	Anderson Mountain	968	360
31	Jones Creek	1,396	120
33	Jones Creek	—	120
34	Upper Axe	—	581
35	Small Sandy	—	1,763
37	Brownson Falls	—	120
38	Bear & Elk CT	589	167
39	Bear Pen Creek	—	243
40	Jones Creek	—	120
41	Elk Creek	—	120
42	Lower Frenchie	—	1,319
43	Sheep Mt	—	294
44	Wacky Gap Thin	—	870
46	Wacky Gap Thin	—	1,833
100	New Yankee	—	250
102	Sugar Rush	—	450
103	The Belieus	1,883	835
105	Lower Frenchie	4,480	150
106	Small Sandy	—	1,135
107	Rock Slide	—	415
108	King Salmon	—	1,212
109	King Salmon	—	1,470
110	King Salmon	—	403
111	New Yankee	—	120

Information from BLM GIS. Distance to Downstream Fish Habitat is the closest any part of the unit comes to fish habitat without having fish habitat within the unit. Where there is a unit with fish habitat and downstream the downstream is the next closest point to fish habitat. Note that the data for fish bearing may not match streamline length as they are two different data sets collected by different specialists with different instruments often from multiple agencies. This table should not be used for quantitative or qualitative inquiries. The table is intended for general reference only.

Appendix I: Unit 111

The RMP/ROD states on (pp. 104-105) that the "The BLM may elect to defer harvest at particular times on particular stands in the Harvest Land Base for reasons described in the management direction and this appendix. However, the BLM will not defer or forego timber harvest of stands in the Harvest Land Base for reasons not described in the management direction or this appendix." The Management Direction for the Harvest Land Base – Moderate Intensity Timber Area (MITA) includes the following provision: "In each regeneration harvest unit, retain 5 -15 percent of the pre-harvest stand basal area in live trees… …Include among retained trees all trees that are both ≥ 40” DBH and that the BLM identifies were established prior to 1850, except where falling is necessary for safety or operational reasons and no alternative harvesting method is economically viable or practically feasible. If such trees need to be cut for safety or operational reasons, retain cut trees in the stand… (page 63).

FOI number 241806 was analyzed as EA Unit 111 in the Big Weekly Elk EA. The BLM conducted stand exams in 2019, analysis of the results shows that approximately 70% of the standing volume is in trees that meet the ROD/RMP definition as both ≥ 40” DBH and were established prior to 1850, this represents approximately 60% of the pre-harvest stand basal area, and they are well distributed throughout the stand. Using Lidar derived tree points and a draft conventional logging plan, the BLM estimates that approximately 139 large old trees would need to be cut and left for operational reasons to access the available volume. Retaining these felled trees in the stand would amount to an addition of 50-100 tons of fuels per acre in the unit at the time of harvest. Additionally, the remaining retained large old trees would still represent approximately 60% of the pre-harvest stand basal area, exceeding the allowable maximum of 15% within the HLB - MITA land use allocation. The BLM has elected to defer this unit because retaining all trees that are both ≥ 40” DBH and were established prior to 1850 per the Management Direction, while cutting all such trees needed for safety or operational reasons is not economically or practically feasible for accessing the 27% of available timber volume in the stand with conventional logging systems at this time, and is not consistent with management direction to retain a maximum of 15% percent of the pre-harvest stand basal area in live trees.

Figure 18. Unit 111 Forest Vegetation Simulator Information

Year: 2020

FOREST VEGETATION SIMULATOR
STAND AND STOCK TABLES
Per-acre values are based on total stand area

Species: ALL Year: 2020 Mgmt Id: NONE Stand: 241806_A

	LIVE TREES						HARVESTED TREES					
DIAM. CLASS	TREES PER ACRE	AVG HT	BASAL AREA	TOTAL CU FT	MERCH CU FT	MERCH BD FT	TREES PER ACRE	AVG HT	BASAL AREA	TOTAL CU FT	MERCH CU FT	MERCH BD FT
10	139.9	18.1	24.2	609.1	591.9	2902.0	139.9	18.1	24.2	609.1	591.9	2902.0
20	32.3	114.5	70.0	3220.0	3127.4	18708.0	32.3	114.5	70.0	3220.0	3127.4	18708.0
30	12.7	138.1	62.2	2880.0	2847.2	18844.8	12.7	138.1	62.2	2880.0	2847.2	18844.8
40	15.9	182.8	140.0	7474.7	7419.7	53542.1	6.2	173.0	46.7	2346.7	2322.5	16434.7
50	11.3	192.0	155.5	8415.4	8366.6	60936.5	0.0	0.0	0.0	0.0	0.0	0.0
60	3.1	205.2	54.4	3049.7	3032.6	22613.7	0.0	0.0	0.0	0.0	0.0	0.0
70	0.3	232.4	7.8	493.2	490.7	3775.3	0.0	0.0	0.0	0.0	0.0	0.0
Total	215.4	63.8	514.2	26142.2	25876.2	181322.3	191.0	47.4	203.1	9055.8	8889.0	56889.6

Figure 19. Unit 111 Frequency Distribution by Age (years)

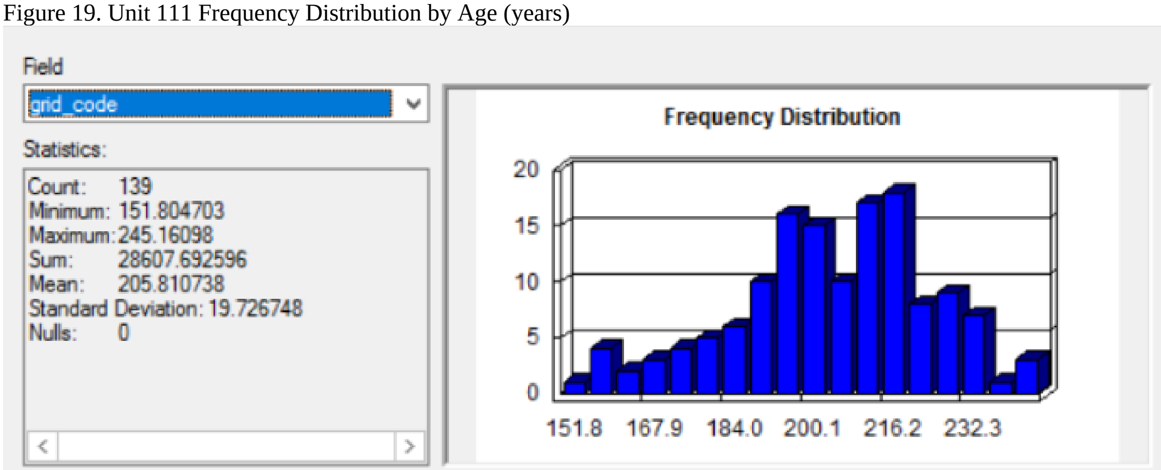
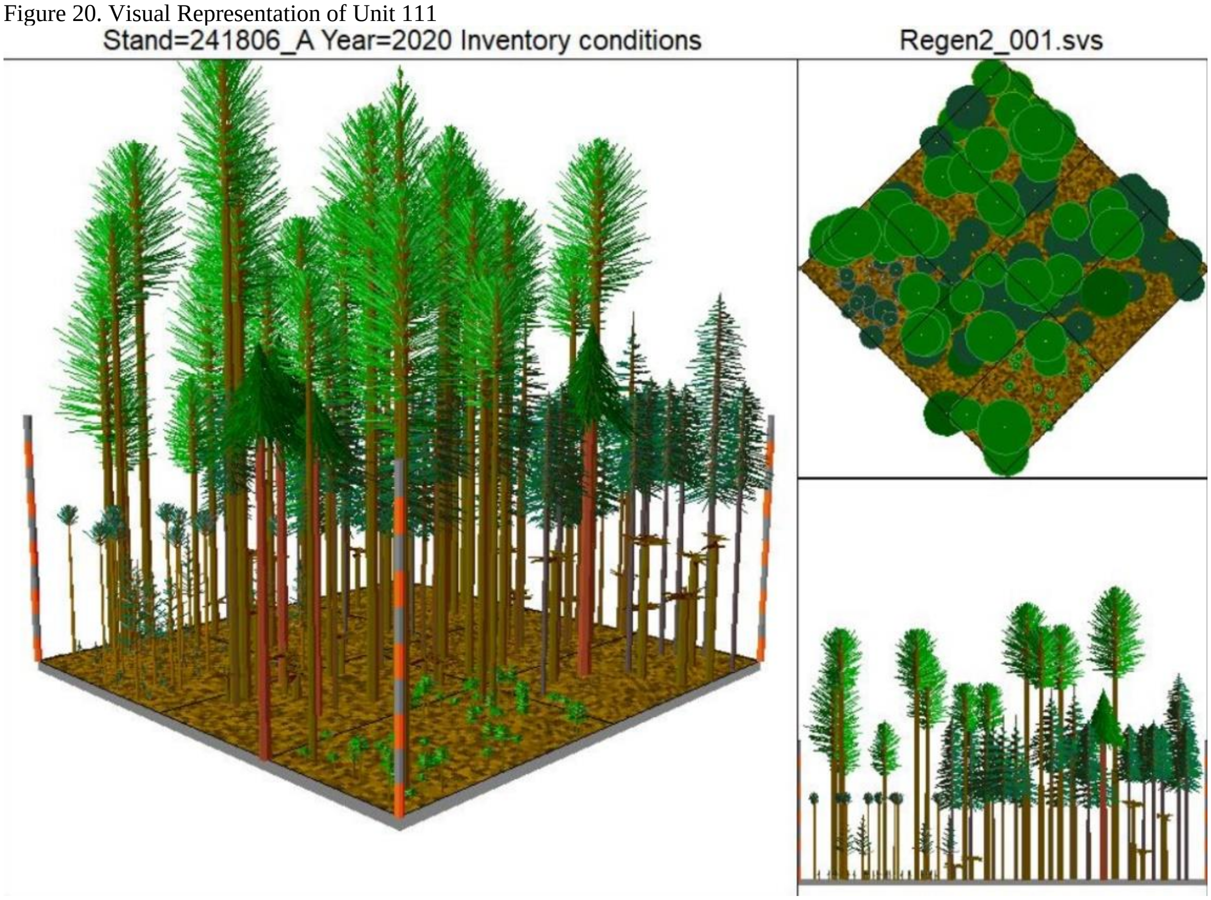


Figure 20. Visual Representation of Unit 111



Works Cited

Aron, C., M. Bailey. (2020). Road maintenance, renovation, construction, and improvement definitions to ensure compliance with Endangered Species Act. Coos Bay District Bureau of Land Management internal document.

Abdelnour, A., M. Stieglitz, F. Pan, R. McKane. (2011). Catchment hydrological responses to forest harvest amount and spatial pattern. *Water Resources Research* Vol. 47.

Anthony, R.G., E.D. Forsman, A.B. Franklin, D.R. Anderson, K.P. Burnham, G.C. White, C.J. Schwarz, J.D. Nichols, J.E. Hines, G.S. Olson, S.H. Ackers, L.S. Andrews, B.L. Biswell, P.C. Carlson, L.V. Diller, K.M. Dugger, K.E. Fehring, T.L. Fleming, R.P. Gerhardt, S.A. Gremel, R.J. Gutierrez, P.J. Happe, D.R. Herter, J.M. Higley, R.B. Horn, L.L. Irwin, P.J. Loschl, J.A. Reid and S.G. Sovern. (2006). Status and trends in demgraphy of northern spotted owls, 1985-2003. Wildlife Monographs. 48 pp.

Anthony, B. (2019). Methodology for Oregon's 2018 water quality report and list of water quality limited waters. Portland, OR: Oregon Department of Environmental Quality, Water Quality Division.

Andrews, L. S., Perkins, J. P., Thrailkill, J. A., Poage, N. J., & Tappeiner II, J. C. (2005). Silvicultural approaches to develop Northern Spotted owl nesting sites, central coast ranges, Oregon. *Western Journal of Applied Forestry* , 13-27.

Atzet, T., White, D. E., McCrimmon, L. A., Martinez, P. A., Fong, P. R., & Randall, V. D. (1996). Field Guide to the forested plant associations of Southwestern Oregon. *PNW Region, Technical Paper*, pp. TP-17-96. Retrieved from http://www.fs.usda.gov/detail/rogue-siskiyou/maps-pubs/?cid=stelprdb5319390

Bateman, D. S., R. E. Gresswell, et al. (2018). Fish response to contemporary timber harvest practices in a second-growth forest from the central Coast Range of Oregon. *Forest Ecology and Management* 411: 142–157.

Bart, J. and E.D. Forsman. 1992. Dependence of northern spotted owls, *Strix occidentalis caurina*, on old-growth forests in the western United States. Biological Conservation. 62(2): p. 95–100.

Beechie, T. and T.H. Sibley, (1997). Relationships between channel characteristics, woody debris and fish habitat in northwestern Washington streams. Transactions of the American Fisheries Society 126, 217-229.

Beechie, T. J., G. Pess, *et al.* (2000). Modeling recovery rates and pathways for woody debris recruitment in northwestern Washington streams. North American Journal of Fisheries Management 20(2), 436-452. ftp://frap.fire.ca.gov/pub/incoming/TAC/ISOR%20references%201-139%20%20KIRSTEN/Beechie%20et%20al.%202000.BMP.

Beggs, L.R. (2004). Vegetation Response Following Thinning in Young Douglas-fir Forests of Western Oregon: Can Thinning Accelerate Development of Late-Successional Structure and Composition? Corvallis, OR: Oregon State University. 95 p. M.S. thesis.

Bell, J. F. and J. R. Dilworth. 2007 revised. *Log scaling and timber cruising*. John Bell & Associates. Corvallis, OR.

Benda, L.E. and T.E. Dunne. (1997a). Stochastic forcing of sediment routing and storage in channel networks. Water Resources Research. 33, 2865–2880.

Benda, L.E. and T. E. Dunne. (1997b). Stochastic forcing of sediment supply to the channel networks from landsliding and debris flows. Water Resources Research. 33, 2849–2863.

Benda, L.E., D.J. Miller, K. Andras, P. Bigelow, G. Reeves, and D. Michael. (2007). NetMap: a new tool in support of watershed science and resource management. Forest Science. 53, 206–219.

Benda, L.E., and P. Bigelow. (2014). On the patterns and processes of wood in northern California streams. Geomorphology 209, 79-97.

Benda, L.E., S.E. Litschert, G. Reeves, and R. Pabst. (2015). Thinning and instream wood recruitment in riparian second growth forests in coastal Oregon and the use of buffers and tree tipping as mitigation. Journal of Forestry Research 27(4), 821-836.

Beschta, R.L.; R.E. Bilby, G.W. Brown, L.B. Holtby, and T.D. Hofstra. (1987). Stream temperature and aquatic habitat: fisheries and forestry interactions. In: Salo, E.O.; Cundy, T.W., eds. Streamside management: forestry and fishery interactions. Seattle, WA: Institute of Forest Resources, University of Washington: 191–232. Chapter 6.

Bigelow, P.E., L.E. Benda, D.J. Miller, and K.M. Burnett, K.M. (2007). On debris flows, river networks, and the spatial structure of channel morphology. For. Sci. 53: 220–238.

Bilby, R.E. 1981. Role of organic debris dams in regulating the export of dissolved and particulate matter from a forested watershed. Ecology 62, 1234-1243.

Bilby, R.E. and G.E. Likens. (1980). Importance of organic debris dams in the structure and function of stream ecosystems. Ecology 61, 1107-1113.

Bilby, R.E. and J.W. Ward. (1989). Changes in characteristics and function of woody debris with increasing size of streams in western Washington. Transactions of the American Fisheries Society 118, 368-378.

Bilby, R.E. and P.A. Bisson. (1998). Function and distribution of large woody debris. In: Naiman, R.J.; Bilby, R.E., eds. River ecology and management. New York, NY: Springer: 324-346.

Bladon, K. D., S. Bywater-Reyes, et al. (2019). Increased streamflow in catchments affected by a forest disease epidemic. *Science of the Total Environment* 691: 112–123.

Bond, B. J., J. A. Jones, et al. (2002). The zone of vegetation influence on baseflow revealed by diel patterns of streamflow and vegetation water use in a headwater basin. *Hydrol. Process*. 16: 1671–1677.

Bosch, J. M. and J. D. Hewlett. (1982). A review of catchment experiments to determine the effect of vegetation changes on water yield and evapotranspiration. *Journal of Hydrology* 55, 3–23. http://coweeta.uga.edu/publications/2117.pdf.

Bottom, D. L., Howell, P. J., and J. D. Rodgers. (1985). The effects of stream alterations on salmon and trout habitat in Oregon. Oregon Department of Fish and Wildlife. Portland, OR.

Boyd M. and D. Sturdevant. (1997). The scientific basis for Oregon's stream temperature standard: common questions and straight answers. Oregon Department of Environmental Quality.

Boyer, K.L, D.R. Berg, and S.V. Gregory. (2003). Riparian Management for Wood in Rivers. Pages 407-420 *in* S.V. Gregory, K.L. Boyer, and A.M. Gurnell, editors. The ecology and management of wood in world rivers. American Fisheries Society, Symposium 37, Bethesda, Maryland.

Bradford, M. J. and J. S. Heinonen. (2008). Low flows, instream flow needs and fish ecology in small streams. *Canadian Water Resources Journal* Vol. 33(2): 165–180.

Bragg, D.C., J.L. Kershner, and D.W. Roberts. (2000). Modeling Large Woody Debris Recruitment for Small Streams of the Central Rocky Mountains. USDA Forest Service General Technical Report RMRS-GTR-55:1-36.

Brake, D., Molnau, and J. SS. (1997). Sediment transport distances and culvert spacings on logging roads within the Oregon Coast mountain range. Annual International Meeting. Minneapolis, MN: ASAE..

Brown, A. E., L. Zhang, et al. (2005). A review of paired catchment studies for determining changes in water yield resulting from alterations in vegetation. *Journal of Hydrology* 310: 28–61.

Buchalski, M.R., J.B. Fontaine, P.A.I. Heady, J.P. Hayes and F.F. Winifred. (2013). Bat response to differing fire severity in mixed-conifer forest California. LPLoS ONE. 8(3): 7 pp.

Burnett, K.M. and D.J. Miller. 2007. Streamside policies for headwater channels: an example considering debris flows in the Oregon Coastal Province. Forest Science. 53(2): 239–253.

Burnett, K.M., G.H. Reeves, D.J. Miller, S. Clarke, K. Vance-Borland, and K. Christiansen. 2007. Distribution of salmon-habitat potential relative to landscape characteristics and implications for conservation. Ecological Applications. 17(1), 66–80.

Carey, A. B., Wilson, T. M., Maguire , C. C., & Biswell, B. L. (1997). Dens of northern flying squirrels in the Pacific Northwest. *The Journal of Wildlife Management. 61(3):* , p. 684-699.

Chadwick, D. O. (1980). Forest development in North America following major disturbances . *Ecology and Management, Vol. 3*, p. 153-168.

Courtney, S.P., J.A. Blakesley, R.E. Bigley, M.L. Cody, J.P. Dumbacher, R.C. Fleischer, A.B. Franklin, J.F. Franklin, R.J. Gutierrez, J.M. Marzluff and L. Sztukowski 2004. Scientific evaluation of the status of the northern spotted owl. Sustainable Ecosystems Institute, Portland, Oregon. 508 pp.

Coutant, C. C. (1999). Perspectives on temperature in the Pacific Northwest's fresh water. ORNL/TM-1999/44. Oak Ridge National Laboratory. Oak Ridge, TN.

Curtis, R. O. (1982). A Simple Index of Stand Density ofr Douglas-fir. . *Forest Service Vol. 28 No. 1*, 92-94.

Curtis, R. O. (1995). Extended rotations and culmination age of coast Douglas-fir: old studies speak to current issues. Res. Pap. PNW-RP-485. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Cushman, K., & Huff, R. (2007). *The Conversation Assessment for Fungi Included in Forest Service Regions 5 and 6 Sensative BLM California, Oregon, and Washington Special Status Species Programs.* Forest Service, Bureau of Land Management , Department of Agriculture, Department of the Interior , Calaifronia, ORegon, and Washinton.

Davis, , L. R., Puettman , K. J., & Tucker, G. F. (2007). Overstory response to alternative thinning treatments in young Douglas-fir forests of Western Oregon. *Northwest Science*, 81(1): 1-14.

Davis, R. j., Dugger, K. M., Mohoric, S., Evers, L., & Aney, W. C. (2011). *Northwest Forest Plan - the first 15 years (1994-2008) status and trends of northern spotted owl populations and habitats.* . US Department of Agriculture: Forest Service-Pacific Northwest.

Davis, R. J., Hollen, B., Hobson, J., & Gower, J. E. (2016). *Status and trends of northern spotted owl habitats; the first 20 Years (1994-2013).* . US Department of Agriculture: Forest Service-Pacific Northwest Research Station.

Davis, R.J., J.L. Ohmann, R.E. Kennedy, W.B. Cohen, M.J. Gregory, Z. Yang, H.M. Roberts, A.N. Gray and T.A. Spies. 2015. Northwest Forest Plan The First 20 Years (1994-2013): Status and trends of late-successional and old-growth forests. USDA Forest Service, Pacific Northwest Research Station. 120 pp.

Dillion, G. (2020). *U.S. Dept. of Agriculture - Forest Service - Rocky Mountain Research Station - Fire,Fuels, Smoke Science Program*. Retrieved 03 30, 2020, from Wildfire Hazard Potential: http://www.firelab.org/project/wildfire-hazard-potential

Drew, T., & Flewelling, J. (1979). Stand density management: an alternative approach and its application to Douglas-fir plantations. *Forest Service Vol. 25, No.3,* 518-32.

Dugger, K.M., F. Wagner, R.G. Anthony and G.S. Olson. 2005. The relationship between habitat characteristics and demographic performance of northern spotted owls in southern Oregon. The Condor. 107: p. 863-878.

Dunne, T. and L.B. Leopold. (1978). Water in environmental planning. New York: W.H. Freeman and Company. 818 p.

Everest, F. H, R. L Beschta, J. C Scrivener, K. V Koski, J. R Sedell, and C. J Cederholm. 1987. Fine sediment and salmonid production: a paradox. Pages 98–141 in E. O. Salo and T. W. Cundy, editors. Streamside management and forestry and fishery interactions. University of Washington, College of Forest Resources, Contribution 57, Seattle.

Forest Service, USDA; Bureau of Indian Affairs, Bureau of Land Management, Fish and Wildlfie Service, and National Park Service, USDI . (2001, 04 01). Urban Wildland Interface Communities Within the Vicinity of Federal Lands That Are at High Risk From Wildfire. Boise , Idahoe, United States.

Forsman, E.D., R.G. Anthony, K.M. Dugger, E.M. Glenn, A.B. Franklin, G.C. White, C.J. Schwarz, K.P. Burnham, D.R. Anderson, J.D. Nichols, J.E. Hines, J.B. Lint, R.J. Davis, S.H. Ackers, L.S. Andrews, B.L. Biswell, P.C. Carlson, L.V. Diller, S.A. Gremel, D.R. Herter, J.M. Higley, R.B. Horn, J.A. Reid, J. Rockweit, J.P. Schaberl, T.J. Snetsinger and S.G. Sovern. (2011). *Population demography of northern spotted owls,* University of California Press. Berkley, CA.

Forsman, E. D., Anthony, R. G., Meslow , E. C., & Zabel, C. J. (2004). Diets and foraging behavior of northern spotted owls in Oregon. *Journal of Raptor Research.* , 3(3): p. 214-230.

Forsman, E.D., R.G. Anthony, J.A. Reid, P.J. Loschl, S.G. Sovern, M. Taylor, B.L. Biswell, A. Ellingson, E.C. Meslow, G.S. Miller, K.A. Swindle, J.A. Thrailkill, F.F. Wagner and D.E. Seaman. (2002). Natal and breeding dispersal of northern spotted owls. Wildlife Monographs. 149: p. 1-35.

Forsman, E.D., E.C. Meslow and H.M. Wight. (1984). Distribution and biology of the spotted owl in Oregon. Wildlife Monographs. 87: p. 1-64.

Foster, S. C., C. H. Stein and K. K. Jones. (2001). A guide to interpreting stream survey reports. *Information Reports 2001-2006*. Bowers, P. A., Oregon Department of Fish and Wildlife - Aquatic Inventories Project, Portland, OR. http://oregonstate.edu/Dept/ODFW/freshwater/inventory/BMPfiles/interpgd.BMP.

Franklin, A.B., D.R. Anderson, R.J. Gutierrez and K.P. Burnham. (2000). Climate, habitat quality, and fitness in northern spotted owl populations in northwestern California. Ecological Monographs. 70(4): p. 539-590.

Franklin, J.F. and T.A. Spies. (1991). Composition, function, and structure of old-growth Douglas-fir forests. p. 71-82 *in* Ruggiero, L. F., K. B. Aubry, A. B. Carey and M. H. Huff, *tech. coord*. *Wildlife and vegetation of unmanaged Dougals-fir forests*. Gen Tech. Rep. PNW-GTR-285. Portland, OR. US Department of Agriculture: Forest Service-Pacific Northwest Research Station.

Franklin, J. F., Van Pelt, T. A., Carey, A. B., Thornburgh, D. A., Berg, D. R., Lindenmeyer, D. B., . . . Jiquan. (2002). Disturbance and structural development of natural forest ecosystems with silvicultural implications, using Douglas-fir forest as an example. *Forest Ecology and Management no. 155*, 399-423.

Garman, , S. L., Cissel, J. H., & Willo, J. H. (2003). *Accelerating development of late-successional conditions in young managed Douglas-fir stands: A simulation study.* Portland, OR: PNW-GTR-557, USDA-Forest Service, Pacific Northwest Research Station.

Glenn, E. M., Hansen , M. C., & Anthony, R. G. (2004). Spotted owl home-range and habitat use in young forests of Western Oregon. . *The Journal of Wildlife Management. 68(1):* , pp. 33-50.

Grant, G. E. and A. L. Wolff. 1991. Long-term patterns of sediment transport after timber harvest, western Cascade Mountains, Oregon, USA. In: Proceedings of the Vienna Symposium. IAHS Publ. No. 203: 31-40.

Grant, G. E., and Lewis, S. L. (2008). *Effects of forest practices on peak flows and consequent channel response: a state-of-science report for western Oregon and Washington.* Portland, OR: Gen. Tech. Rep. PNW-GTR-760.

Gregory, S.V. and P.A. Bisson. (1997). Degradation and loss of anadromous salmonid habitat in the Pacific Northwest. In: D.J. Stouder, P.A. Bisson, and R.J. Naiman, eds. Pacific salmon and their ecosystems. New York, NY: Chapman and Hall: 277-317.

Groom, J. D., L. Dent, et al. 2011. Response of western Oregon (USA) stream temperatures to contemporary forest management. Forest Ecology and Management Vol. 262, Issue 8: 1618-1629. http://www.sciencedirect.com/science/article/pii/S0378112711004403.

Harmon, M.E., J.F. Franklin, F.J. Swanson, P. Sollins, S.V. Gregory, J.D. Lattin, N.H. Anderson, S.P. Cline, and N.G. Aumen. (1986). Ecology of coarse woody debris in temperate ecosystems. Advances in Ecological Research 15:1330302.

Harr, R. D. 1976a. Forest practices and stream flow in western Oregon. Gen. Tech. Rep. PNW-49. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station.

Harr, R. D. 1976b. Hydrology of small forest streams in western Oregon. Gen. Tech. Rep. PNW-55. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station.

Harr, R. D. 1983. Potential for augmenting water yield through forest practices in western Washington and western Oregon. Water Resource Bulletin Vol. 19, No. 3: 383–393.

Harr, R. D., R. L. Fredrikson and J. Rothacher. 1979. Changes in streamflow following timber harvest in southwestern Oregon. Res. Pap. PNW-249. Portland, OR: U.S. Dept. of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station. http://www.fs.fed.us/pnw/pubs/pnw_rp249.pdf.

Harr, R. D. and J. T. Krygier. 1972. Clearcut logging and low flows in Oregon coastal watersheds. Research Note No. 54. Corvallis, OR: Oregon State University, School of Forestry, Forest Research Laboratory.

Hartfield, R. A., & Sauder, J. (2020). *Pacific Northwest Bumble Bee Atlas.* Retrieved from www.PNWBumbleBeeAtlas.org

Hayes, J. R. (1997). Wildlife response to thinning young forests in the Pacific Northwest. *Journal of Forestry 91(8)*, 28-33.

Heithhecker, T. D., & Halpern, C. B. (2007). Edge-related gradients in microclimates in forest aggrogates following structural retention harvest in western Washington. *Forest Ecology and Management 248*, 163-173.

Hersey, T., Maslow, E., & Ramsey, F. (1998). Characteristic of forest at spotted owl nest sites in the Pacific Northwest. *The Journal of Wildlife Management* , 1398-1410.

Hibbs, D.E. and P.A. Giordano. (1996). Vegetation characteristics of alder-dominated riparian buffer strips in the Oregon Coast Range. Northwest Science:70(3), 213-222.

Hicks, B.J., J.D. Hall, P.A. Bisson, and J.R. Sedell. (1991). Responses of Salmonids to Habitat Changes. Pages 483-518 *in* W.R. Meehan, editor. Influences of forest and rangeland management on salmonid fishes and their habitats. American Fisheries Society Special Publication 19, Bethesda, Maryland.

Hicks, B. J., R. L. Beschta, and R. D. Harr. (1991). Long-term changes in streamflow following logging in western Oregon and associated fisheries implications. Water Resources Bulletin Vol. 27, No. 2: 217–226.

Howard, J. O. and D. J. DeMars. 1985. Comparison of logging residue from lump sum and log scale timber sales. Res. Pap. PNW-33Z. U.S. Dept. of Agriculture - Forest Service - Pacific Northwest Forest and Range Experiment Station, Portland, OR

Huff, T. (2019). Past pre-commercial thinning data. Umpqua Field Office forester. (8 October).

Iles, K. 2003. A Sampler of Inventory Topics: A Practical Discussion for Resource Samplers, Concentrating on Forest Inventory Techniques, First edition. Kim Iles & Associates. Nanaimo, B.C

IMST (Independent Multidisciplinary Science Team). (2004). Oregon’s water temperature standard and its application: causes, consequences, and controversies associated with stream temperature.

Tech. Rep. 2004-1 to the Oregon Plan for Salmon and Watersheds, Oregon Watershed Enhancement Board, Salem, OR.

Janisch, J. E., S. M. Wondzell, and W. J. Ehinger. (2012). Headwater stream temperature: interpreting response after logging, with and without riparian buffers, Washington, USA. Forest Ecology and Management

Kerns, B. K., Alexander, S. J., & Bailey, J. D. (2004). Hucklebery abundance, stand conditions, and use in western Oregon: evaluating the role of forest management. . *Economic Botany. 58(4):*, 668-678.

Lancaster, S. T., S. K. Hayes, and G. E. Grant. 2003. Effects of wood on debris flow runout in small mountain watersheds, Water Resour. Res., 39, 1168, doi:10.1029/2001WR001227, 6.

Lesmeister, D., & McCafferty., C. (2018). *Demographic characteristics of spotted owls in the Oregon Coast Range, 1990-2017*. US Department of Agriculture: Forest Service-Pacific Northwest Research Station.

Long, J. D. (1990). Assessment of growing stock in uneven-aged stands. . *Western. Journal of Applied Forestry*, pp. 93–96.

Malt, J. and D. Lank. 2007. Temporal dynamics of edge effects on nest predation risk for the marbled murrelet. Biological Conservation. 140: 160-173.

Malt, J.M. and D.B. Lank. 2009. Marbled murrelet nest predation risk in managed forest landscapes: dynamic fragmentation effects at multiple scales. Ecological Applications. 19(5): 1274-1287.

Maser, Z., Maser , C., & Trappe, J. M. (1985). Food habits of the northern flying squirrel (Glaucomys sabrinus) in Oregon. . *Canadian Journal of Zoology. 63:*, p 1084-1088.

May, C. L., R. E. Gresswell. 2003a. Large wood recruitment and redistribution in headwater streams in the southern Oregon Coast Ranges, U.S.A. Can. J. For. Res. 33: 1352–1362.

May, C. L., R. E. Gresswell. 2003b. Processes and rates of sediment and wood accumulation in headwater streams of the Oregon Coast Range, USA. Earth Surf. Process. Landforms 28, 409-424.

May, C. L., R. Gresswell, J. Erickson. 2004. The importance of wood in headwater streams of the Oregon Coast Range. Cooperative Forest Ecosystem Research, Corvallis, OR.

McArdle, W. H. Meyer, and D. Bruce. 1961. The yield of Douglas fir in the Pacific Northwest. Tech. Bul. No. 201. U.S. Deaprtment of Agriculture.

McDonnell, J. J., J. Evaristo, et al. (2018). Water sustainability and watershed storage. Nature Sustainability Vol. 1: 378–379.

McHenry, M.L., E. Shott, R.H. Conrad, and G.B. Greete. (1998). Changes in the quantity and characteristics of large woody debris in streams of the Olympic Peninsula, Washington, USA (1982-1993). Canadian Journal of Fisheries and Aquatic Sciences 55, 1395-1407.

Meehan, W.R., editor. (1991). Influences of forest and rangeland management on salmonid fishes and their habitats American Fisheries Society special Publication 19.

Meyer, C.B., L.L. Irwin and M.S. Boyce. 1998. Influence of habitat abundance and fragmentation on northern spotted owls in Western Oregon. Wildlife Monographs. 139: 1-51.

Meyer, C.B., M.D. Sparkman, and B.A. Klatte. (2005). Sand seals in Coho salmon redds: do they improve egg survival? North American Journal of Fisheries Management 25:105–121, 2005.

Miller, D.J. and K.M. Burnett. (2007). Effects of forest cover, topography, and sampling extent on the measured density of shallow, translational landslides. Water Resources Research. 43, W03433. doi:10.1029/2005WR004807.

Miller, S.L. and C.J. Ralph. 1995. Relationship of marbled murrelets with habitat characteristics at inland sites. Albany, CA. 205-215.

Montgomery, D.R. and W.E. Dietrich. (1994). A physically based model for the topographic control on shallow landsliding. Water Resources Research. 30, 1153–1171.

Montgomery, D.R., T.B. Abbe, J.M. Buffington, N.P. Peterson, K.M. Schmidt, and J.D. Stock. (1996). Distribution of bedrock and alluvial channels in forested mountain drainage basins. Nature 381, 587-589.

Moore, G. W., B. J. Bond, et al. (2004). Structural and compositional controls on transpiration in 40- and 450-year-old riparian forests in western Oregon, USA. Tree Physiology 24: 481–491.

Moore, J. A. and J. R. Miner. (1997). Stream temperatures some basic considerations. EC 1489. Oregon State University.

Moore, J. R. (2003). Wind Damage in Alternative Silvicultural Systems: Review and Synthesis of Previous Studies. *International Conference 'Wind Effects on Trees'.* University of Karlsruhe, Germany.

Moore, K.M.S. (1997). Habitat benchmarks. Unpublished manuscript. Oregon Department of Fish and Wildlife, Portland.

Moore, R. D., S. M. Wondzell. (2005). Physical hydrology and the effects of forest harvesting in the Pacific Northwest: a review. Journal of the American Water Resources Association August 2005: 763–784.

Moriarty, K. M., Verschuyl, J., Kroll, A. J., & Davis, R. 2019. Describing vegetation characteristics used by two rare forest-dwelling species: would established reserved provide for coastal marten in Oregon. *PLOS ONE. 14(1):*, 25. Retrieved from https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0210865#references

Moriarty, K., J. Thompson, M. Delheimer, B. Barry, M. Linnell, T. Levi, K. Hamm, D. Early, H. Gamblin, M. Szykman Gunther, J. Ellison, J. S. Prevey, J. Hartman, and R. Davis. *In Review*. Predicted distribution of a rare and understudied forest carnivore: Humboldt martens (*Martes caurina humboldtensis*). BbioRxiv: 68 pp.

Nadeau, T. 2015. Streamflow duration assessment method for the Pacific Northwest. EPA 910-K-14-001, U.S. Environmental Protection Agency, Region 10, Seattle, WA.

Naiman, R.J., T.J. Beechie, D.R. Benda, P.A. Berg, L.H. Bisson, M.D. MacDonald, P.L. O'Connor, and E.A. Steel. 1992. Fundamental elements of ecologically healthy watersheds in the Pacific

Northwest coastal ecoregion. In: R.J. Naiman, ed. Watershed management: balancing sustainability and environmental change. New York, NY: Springer-Verlag: 127-188.

Nelson,, K. S., & Wilson, A. K. (2002). *Marbled Murrelet habitat characteristics on state lands in western Oregon.* Corvalis, OR: Oregon Cooperative Fish and Wildlife Research Unit, Oregon State University, Department of Fisheries and Wildlife.

ODFW 2014-2020. Oregon Dept. of Fish and Wildlife Aquatic Inventory Project. Stream Habitat Reports. Corvallis, OR.

ODEQ (Oregon Department of Environmental Quality). (2005). Draft revised Figure 300A: fish use designations South Coast Basin, Oregon. https://www.oregon.gov/deq/Rulemaking%20Docs/figure300a.pdf.

ODEQ (Oregon Department of Environmental Quality). (2019). 2012 Integrated Report Assessment Geodatabase Ver. 2 (2019). https://www.oregon.gov/deq/Data-and-Reports/Pages/GIS.aspx.

ODF. (2003). *High Landslide Hazard Locations, Shallow, Rapidly Moving Landslides and Public Safety: Screening and Practices.* Salem, OR. : Technical Note Number 2 Version 2.0. Oregon Department of Forestry.

Oregon Department of Forestry. (2003). *Oreogn Department of Forestry wet season road use monitoring project final report.* Forest Practices Monitoring Program Tech. Rep. #17.

Oregon Department of Environmental Quality. 2010. URL: <http://www.deq.state.or.us/wq/assessment/rpt2010/search.asp >.

Oregon Department of Environmental Quality. 2012. URL: <http://www.deq.state.or.us/wq/assessment/rpt2012/search.asp>.

Oregon Department of Fish and Wildlife. 2005. 2005 Oregon Native Fish Status Report, Volume I Species Management Unit Summaries. ODFW. Salem, Oregon.

Oregon Department of Fish and Wildlife. 2007. Oregon Coast Coho Conservation Plan for the State of Oregon. ODFW. Salem, Oregon.

O'Hara, K. (2014). Multiaged Silviculture. . *Oxford University Press*.

Oliver, C. D. (1980). Forest development in North America following major disturbances. *Forest Ecology and Management*, vol. 3, p. 153-168.

Oliver, C. D., & Larson, B. C. (1996). Forest Stand Dynamics . *Updated Edition. John and Wiley and Sons, New York*, 141.

Olsen, M. J.-M. (2015). *Impacts of Potential Seismic Landslides on Lifeline Corridors (No. FHWA-OR-RD-15-06).* Federal Highways Administration. Retrieved from https://www.oregon.gov/ODOT/Progra

Olson, G.S., E.M. Glenn, R.G. Anthony, E.D. Forsman, J.A. Reid, P.J. Loschl and W.J. Ripple. 2004. Modeling demographic performance of northern spotted owls relative to forest habitat in Oregon. Journal of Wildlife Management. 68(4): 1039-1053.

OPSW (Oregon Plan for Salmon and Watersheds). (1999). Water Quality Monitoring Guidebook, Chapter 6 Stream Temperature Protocol.

Oregon Department of Forestry . (2015). *Blowdown and Douglas-fir Bark Beetles in Western Oregon* . Oregon Department of Forestry .

Oregon Partnership for Disaster Resilience and the Community Planning Workshop . (2011). *Coos County Community Wildfire Protection Plan* . Eugene OR: Oregon County Board of Commissioners .

Osterkamp, W. R. (2008). Annotated definitions of selected geomorphic terms and related terms of hydrology, sedimentology, soil science and ecology. Open File Report 2008-1217. U.S. Dept. of the Interior – U.S. Geological Survey. Reston, VA.

OSU (Oregon State University). (2017). H.J. Andrews Experimental Forest Long-Term Ecological Research Andrews Watershed 3 detailed history.

OWRD (Oregon Water Resources Department). (2020). Historical Streamflow Data. https://apps.wrd.state.or.us/apps/sw/hydro_report/gage_data_request.aspx?station_nbr=14323997 . (26 March).

Page-Dumroese, D. S. (2009). *Forest soil disturbance monitoring protocol—Volume 1: Rapid assessment. General Technical Report WO-82a.* Moscow, ID.: USDA Forest Service, Rocky Mountain Research Station. Retrieved from https://www.fs.fed.us/rmrs/publications/forest-soil-disturbance-monitoring-protocol-volume-i-rapid-assessment

Perry, G., J. Lunquist, and R. D, Moore. (2016). Review of the potential effects of forest practices on stream flow in the Chehalis River basin. Report in preparation.

Perry, T. D. (2007). Do vigorous young forests reduce streamflow? Results from up to 54 years of streamflow records in eight paired-watershed experiments in the H.J. Andrews and South Umpqua Experimental Forests. M.S. Oregon State University, Corvallis, OR.

Perry, T. D. and J. A. Jones. (2016). Summer streamflow deficits from regenerating Douglas-fir forest in the Pacific Northwest, USA. Ecohydrology 1–13.

Pike, R. G., T. E. Redding, et al. (2010). Chaper 16: Detecting and predicting changes in watersheds. In Compendium of Forest Hydrology and Geomorphology in British Columbia Vol. 2 of 2, R. G. Pike, T. E. Redding, R. D. Moore, R. D. Winkler, and K. D. Bladon editors. B.C. Ministry of Forests and Range Forest Science Program, Victoria, B.C. and FORREX Forum for Research and Extension in Natural Resources, Kamloops, B.C.

Pilgrim D. H., I. Cordery, and B. C. Baron. (1982). Effects of catchment size on runoff relationships. Journal of Hydrology, 58: 205–221.

Poage, N. J., & Tappeiner II, J. C. (2004). Tree species and size structure of old-growth Douglas-fir forest in central western Oregon, USA. *Forest Ecology and Management*, 329-343.

Pollock, M. M. and T. J. Beechie. (2014). Does riparian forest restoration thinning enhance biodiversity? The ecological importance of large wood. Journal of the American Water Resources Association 50(3), 543-559.

Powers, R. F. (1990). *Sustaining site productivity in North American forests: Problems and prospects.* Gessel, S. P., D. S.

Puettman, K. J., Ares, A., Burton, J. I., & Dodson, E. K. (2016). *Forest Restoration Using Variable Density Thinning: Lesson from Douglas-Fir Stands in Western Oreogn.* MDPI.

Rambo, T.R. and M.P. North. 2008. Spatial and temporal variabiliy of canopy microclimate in a Sierra Nevada riparian forest. Northwest Science. 82(4): p 529-568.

Raphael, M.G., D. Evans Mack, J.M. Marzluff and J.M. Luginbuhl. 2002. Effects of forest fragmentation on populations of the marbled murrelet. Studies in Avian Biology. 25: 221-235.

Rashin, E., C.Clishe, A.Loch, and J.Bell. (2006). Effectiveness of timber harvest practices for controlling sediment related water quality impacts. Journal of the American Water Resources Association.Paper No. 01162.

Reeves, G.H., K.M. Burnett, and E.V. McGarry. (2003). Sources of large woody debris in the main stem of a fourth-order watershed in coastal Oregon. Canadian Journal of Forest Research. 33, 1363–1370.

Reeves, G. B. (2016). *An Initial Evaluation of Potential Options for Managing Riparian Reserves of the Aquatic Conservation Strategy of the Northwest Forest Plan.* Gen. Tech. Rep. PNW-GTR-937. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Reid, L.M. and T. Dunne. (1984). Sediment production from forest road surfaces. Water Resources Research Vol. 20. No. 11, 1753-1761.

Reineke, L. (1933). Perfecting a stand-density index for even-aged forest. *Journal of Agricultural Research* , 46:627-638.

Reiter, M. L. and R. L. Beschta. (1995). Chapter 7 Effects of forest practices on water. In Cumulative Effects of Forest Practices in Oregon, R. L. Beschta, J. R. Boyle, et al. editors. Oregon Dept of Forestry. Salem, OR.

Robison, E. G. and R. L. Beschta. (1990). Identifying trees in riparian areas that can provide coarse woody debris to streams. Forest Science 36(3), 790-801.

Roering, J. J. (2004). *Characterizing structural and lithologic controls on deep-seated landsliding: Implications for topographic relief and landscape evolution in the Oregon Coast Range, USA,.* GSA Bulletin.

Rosenberg, D.K. and K.M. McKelvey. 1999. Estimation of habitat selection for central-place foraging animals. Journal of Wildlife Management. 63(3): 1028-1038.

Rosenfeld, J.S., and L. Huato. (2003). Relationship between Large Woody Debris Characteristics and Pool Formation in Small Coastal British Columbia Streams. North American Journal of Fisheries Management 23, 928-938.

Rothacher, J. (1964). A study of the effects of timber harvesting on small watersheds in the sugar pine Douglas-fir area of S.W. Oregon. U.S. Department of Agriculture, Forest Service.

Ruzicka Jr., K.J. K.J. Puettmann, and D.H. Olson. (2014). Management of riparian buffers: upslope thinning with downslope impacts. Forestry Science 60(5), 881-892.

Satterlund, D. R. and P. W. Adams. (1992). Wildland Watershed Management. John Wiley & Sons. New York.

Schrott, , G. R., & Shinn, J. (2020). *A landscape connectivity analysis for the coastal marten (Martes caurina humboldtensis).* , . Arcata, CA: U.S. Fish and Wildlife Service. Retrieved from https://www.fws.gov/arcata/shc/marten.

Segura, C, K. D. Bladon, et al. (2020). Long-term effects of forest harvesting on summer low flow deficits in the Coast Range of Oregon. Journal of Hydrology Vol. 585.

Slauson, K. M., Schmidt, G. A., Zielinski, W. J., Detrich, P. J., Callas, R. L., Thrailkill, J., . . . West, C. J. (2019a). *A Conservation assessment and strategy for the Humboldt marten in California annd Oregon.* U.S. Depertment of Agriculture: Forest Service-Pacific Southwest Research Station.

Slauson, K. M., Zielinski, W. J., Kirk , T. A., & LaPlante, D. W. (2019b). A landscape habitat suitability model for the Humboldt marten (Martes caurina humboldtensis) in Coastal California and Coastal Oregon. *Northwest Science. 93(1):*, 30-51.

Schrott, G.R. and J. Shinn 2020. A landscape connectivity analysis for the coastal marten (*Martes caurina humboldtensis*). U.S. Fish and Wildlife Service, Arcata, CA. https://www.fws.gov/arcata/shc/marten. 123 pp.

Sollmann, R., White, A. M., Tarbill, G. L., Manley, P. N., & Knapp, E. E. (2016). Landscape heterogeneity compensates for fuel reduction treatment effects on Northern flying squirrel populations. . *Forest Ecology and Management. 373:* , 100-107.

Sovern, Stan G., Foresman, Eric D., Dugger, Katie M., Taylor, Margret, (2015) Roosting Habitat Use and Selection By Northern Spotted Owls During Natal Dispersal. *The Journal of Wildlife Management 79(2):254-262.*

Stednick, J. D. (2008). Chapter 9 Long-term streamflow changes following timber harvesting. In Hydrological and Biological Responses to Forest Practices The Alsea Watershed Study, J. D. Stednick editor.

Stone, C., Hudak, A., & Morgan , P. (2008). Forest harvest can increase subsequent forest fire servity. *In: Gonzalez-Caban, Armando (Teshnical Coordinator). Proceedings of the second international synposium on fire economics, planning, and policy: a global view. PSW-GTR-208.* (pp. 525-534). Albany, CA: USDA Forest Service, Pacific Southwest Research Station.

Strahler, A. N. (1957). Quantitative analysis of watershed geomorphology. Transactions, American Geophysical Union Vol. 38, No. 6.

Sinokrot, B.A. and H.G. Stefan. 1993. Stream temperature dynamics: measurements and modeling. Water Resources Research. 29(7), 2299–2313.

Spence, B. C., G. A. Lomnicky, R. M. Hughes, and R. P. Novitzki. 1996. An ecosystem approach to salmonid conservation. TR-4501-96-6057. ManTech Environmental Research Services Corp., Corvallis, OR.

Spies T., M. Pollock, G. Reeves, and T. Beechie. 2013. Effects of riparian thinning on wood recruitment: a scientific synthesis. Science Review Team Wood Recruitment Subgroup, USDA Forest Service, PNW Research Station, Portland.

StreamNet. 2015. Metadata for Pacific Northwest Coho salmon fish distribution spatial data set. Portland (OR): StreamNet, 2012. URL: http://www.streamnet.org/data/interactive-maps-and-gis-data/

Surfleet, C. G. and A. E. Skaugset. (2013) The effect of timber harvest on summer low flows, Hinkle Creek, Oregon. West. J. Appl. For. 28(1).

Swanson, F. J., R. D. Harr, and R. L. Fredriksen. (1980). Geologic field trips in western Oregon and southwestern Washington. Bulletin 101 State of Oregon Department of Geology and Mineral Industries.

Swanson, F. J., R .L. Fredricksen, F. M. McCorison. (1982). Material transfer in a western Oregon forested watershed. In: Edmond, R. L., ed. Analysis of coniferous forest ecosystems in the western United States. New York: Hutchinson Ross: 233-267.

Taki,, H. R., Murao,, K. M., & Yamaura., Y. (2018). The species richness/abundance-area relationship of bees in an early successional tree plantation. *Basic and Applied Ecology*, 26: 64-70. Retrieved from https://doi.org/10.1016/j.baae.2017.09.002

Tappeiner, J., Maquire, D., & Harrington, T. (2007). Silviculture and ecology of western U.S. forests. *Oregon State University Press,* 440.

Thomas, J. W., Forsman, E. D., Lint, J. B., Meslow, E. C., Noon, B. B., & Verner, J. (1990). *A conservation strategy for the northern spotted owl.* . Portland, OR.: Interagency Scientific Committee to Address the Conservation of the Northern Spotted Owl, .

USDA and USDI. (1998). South Coast – Northern Klamath Late-Successional Reserve Assessment, Final Copy, May 1998. North Bend, OR, USDA Forest Service (Mapleton Ranger District, Siuslaw National Forest); USDI BLM (Coos Bay, Roseburg and Medford Districts).

USDA FS and USDI BLM. (2003). *Survey Protocols for Survey and Manage Category A&C Lichens in the Northwest Forest Plan Area, Version 2.1.* BLM-Instruction Memorandum Number OR-2003-078.

USDA FS and USDI-BLM. (1997). *Survey Protocols for Survey and Manage Component 2 Bryophytes, Version 2.0.* . BLM-Informaiton Bulletin No. OR-98-051.

USDA FS R-5/6 and USDI-BLM OR/WA/CA. (2001). *Record of Decision and Standards and Guidance for Amendment to the Survey and Manage, Protection Buffer, and other Mitigation Measure Standards and Guidlines.* U.S. Forest Service.

USDC. (2008). Proactive Conservation Program: Species of Concern. [10 April 2008]. URL: http://www.nmfs.noaa.gov/pr/species/concern/.

USDC NMFS. (2015). Review of Draft Environmental Impact Statement for the revision of the Resource Management Plan of the Western Oregon Bureau of Land Management Districts. Portland, OR: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service.

USDC NMFS. (2016a). Endangered Species Act Section 7(a)(2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat for the Resource

Management Plan for Western Oregon. WCR-2016-4089. U.S. Department of Commerce - National Marine Fisheries Service, West Coast Region.

USDC NMFS. (2016b). Recovery Plan for Oregon Coast Coho Salmon Evolutionarily Significant Unit. National Marine Fisheries Service, West Coast Region, Portland, Oregon.

USDI. (2000). East Fork Coquille Watershed Analysis. Bureau of Land Management, North Bend, OR.

USDI-BLM. 1989a. BLM Handbook H-5310-Timber Cruising. U.S. Dept. of the Interior - Bureau of Land Management. Portland, OR.

USDI-BLM. 1989b. 3P Sample Cruising Probability, Proportion, Prediction BLM Manual Supplement Handbook 5310-1. U.S. Department of the Interior - Bureau of Land Management. Portland, OR.

USDI-BLM. 1990. Cruising Handbook Requirements and Standards Instruction Memo No. OR120-90-33. U.S. Department of the Interior - Bureau of Land Management. North Bend, OR

USDI BLM. (1995). *Coos Bay District Record of Decision and Resource Management Plan* . North Bend : Department of Interior .

USDI BLM. (2003). *A Range-wide Assessment of Port-Orford-Cedar on Fedaral Lands.* BLM.

USDI BLM. (2004). *Decision and Resource Management Plan Ammendment of Port-Orford-cedar in Southwest Oregon, Coos Bay, Medford, and Roseburg Districts.* Portland, Oregon : U.S. Department of Interior Bureau of Land Management.

USDI BLM. (2007). Watershed Analysis of the Middle Fork Coquille Analytical Watershed Version 1.1. Bureau of Land Management, North Bend, OR.

USDI BLM. (2010). *Transportation Management Plan.* Portland, Oregon: Bureau of Land Management.

USDI BLM. (2013). *8100 Mannual - The Foundations for Managing Cultural Resourses.* Washington D.C.: U.S. Department of the Interior - Bureau of Land Management. Washingtin, D.C. https://www.blm.gov/sites/blm.gov/files/uploads/IM2013-103_att1.pdf.

USDI BLM and Oregon SHPO. (2015). *State Protocol between the Oregon-Washington State Director of the Bureau of Land Management (BLM) and the Oregon State Historic Preservation Officer (SHPO) regarding the manner in which the Bureau of Land Management will meet its responsibilities under.* Portalnd, Oregon: U.S. Department of the Interior - Bureau of Land Management. Retrieved from http://www.blm.gov/sites/blm.gov/files/OR%20Protocol.pdf

USDI BLM. (2016). *BLM Handbook H-1780-1 Improvming and Sustaining BLM-Tribal Relations. Giuidlines for Conducting Tribal Relations.* Washington D.C.: U.S. Department of the Interior - Bureau of Land Management. Retrieved from http://www.blm.gov/sites/blm.gov/files/uploads/H-1780-1

USDI BLM. (2016a). *Biological Assessment Western Oregon Proposed Resource Management Plan.* ortland: United States Department of Interior Bureau of Land Management.

USDI BLM. (2016b). *Northwestern and Coastal Oregon Record of Decision and Approved Resource Managment Plan.* Bureau of Land Management.

USDI BLM. (2016c). *Proposed Resource Management Plan/Final Environmental Impact Statement for the Resource Management Plans for Western Oregon-Coos Bay, Eugene, Medford, Roseburg, and Salem Districts, and Klammath Falls Field Office of Lakeview District.* Portland: Bureau of Land Management.

USDI BLM. (2018). *Coos Bay District Invasive Plant Management Environmental Assessment,DOI-BLM-ORWA-C000-2017-0003-EA.* North Bend, OR: U.S. Department of the Interior - Bureau of Land Management. Retrieved from https://eplanning.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=dispatchToPatternPage&currentPageId=114328

USDI-BLM. 2018. West Fork Smith River variable retention thinning- Biological Assessment. US Department of Interior-Bureau of Land Management: Coos Bay District, North Bend, OR. 127 p.

USDI BLM. (2019). *Final State Directo'r Special Status Species List. IM Num. OR-2019-003.* Portland: U.S. Department of the Interior: Bureau of Land Management-Oregon .

USDI-BLM and USDI-USFWS. 2017. Recovery plan implementation guidance: interim recovery action 10. US Department of the Interior: Bureau of Land Management-Coos Bay District, Coos Bay, OR. 42 pp.

USDI BLM, ACHP and NCSHPO. (2012). *Programmatic agreement among the Bureau of Land Management, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers regarding the manner in which the BLM will meet its responsibilities under NHPA.* U.S. Department of the Interior - Bureau of Land Management. Retrieved from http://www.blm.gov/sites/blm.gov/files/OR%20Protocol.pdf

USDI-BLM and Oregon SHPO. 2015. State Protocol between the Oregon-Washington State Director of the Bureau of Land Management (BLM) and the Oregon State Historic Preservation Officer (SHPO) regarding the manner in which the Bureau of Land Management will meet its responsibilities under the National Historic Preservation Act and the National Conference of State Historic Preservation Officers. U.S. Department of the Interior - Bureau of Land Management. Portland, OR. http://www.achp.gov/blm/OR%20PROTOCOL%20SIGNED.pdf.

USDI USFWS. (1997). Recovery plan for the marbled murrelet (Washington, Oregon, and California Populations). US Department of the Interior: Fish and Wildlife Service, Portland, Oregon. 286 pp.

USDI USFWS. (2008). *Birds of Conservation Concern 2008.* Arlington, VA: US Department of the Interior: Fish and Wildlife Service- Division of Migratory Bird Management. Retrieved from http://www.fws.gov/migratorybirds/NewReportsPublications/SpecialTopics/BCC2008/BCC2008.

USDI USFWS. 2009. Regulatory and scientific basis for U.S. Fish and Wildlife Service guidance for evaluation of take for northern spotted owls on private timberlands in California's northern interior region. US Department of the Interior: Fish and Wildlife Service. 78 pp.

USDI USFWS. (2011). *Revised Recovery Plan for the Northern Spotted Owl (Strix occidentalis caurina).* . Portland, OR.: US Department of the Interior: Fish and Wildlife Service.

USDI USFWS. (2012a). Endangered and threatened wildlife and plants . In U. D. Service., *Designation of revised critical habitat for the northern spotted owl.Final Rule. 4 December* (p. 77 FR 71876:).

USDI USFWS. 2012b. Protocol for surveying proposed management activities that will impact northern spotted owls. US Department of Interior: US Fish and Wildlife Service. 42 pp.

USDI USFWS. (2013). Programmatic biological opinion for aquatic restoration activities in Oregon, Washington, portions of Calaifornia, Idaho, and Nevada (ARBO II). *FWS reference: 01EOOFW00-2013-F-0090*. Portland , Oregon: US Department of the Interior: Fish and Wildlife Service .

USDI USFWS. 2015. Coastal Oregon and Northern Coastal California populations of the Pacific marten-Species report. USDI-FWS. 143 pp.

USDI USFWS . (2016). Biological Opinion on Bureau of Land Management's approval of the proposed Resource Management Plan for Western Oregon. Portland , Oregon: Department of Interior .

USDI USFWS. (2018). *Species Status Assessment for the Costal Marten (Martes caurina) Version 2.0.* Arcata, CA: Department of the Interior: Unitied States Fish and Wildlfie Service. Retrieved from https://www.fws.gov/arcata/es/mammals/HumboldtMarten/documents/2018%2012%20Month%20Finding/20181009_Coastal_Marten_SSA_v2.0.pdf.

USDI USFWS . (2019). *Interpretation of the Bureau Land Management's (BLM) managment direction for marbled murrelet.* Portland, OR: Department of the Interior: Unitied State Fish and Widllife Service .

USDI USFWS. (2020). Biological Opinion for the Coos Bay District Bureau of Land Management’s Big Weekly Elk Project. Roseburg, Oregon.

USEPA (U.S. Environmental Protection Agency). (2013). Potential modeling approach to evaluate the effects of thinning activities on stream shade. USEPA Comment – 11/19/2013 to BLM Re: Draft Environmental Impact Statement for the RMPs for Western Oregon.

USGS (U.S. Geological Survey). (2020). StreamStats. https://streamstats.usgs.gov/ss/. (26 March).

Van Rooyen, J.C., J.M. Malt and D.B. Lank. 2011. Relating Microclimate to Epiphyte Availability: Edge Effects on Nesting Habitat Availability for the Marbled Murrelet. Northwest Science. 85(4): p 549-561.

Van Sickle, J. and S. V. Gregory. 1990. Modeling inputs of large woody debris to streams from falling trees. Canadian Journal of Forest Research 20(10), 1593-1601.

Washington Forest Practices Act. 1995. Rules-WAC 222, Board Manual (Including Standard Methodology for Conducting Watershed Analysis) and Forest Practices Act RCW 76.09. Department of Natural Resources, Olympia, Washington. URL: http://www.dnr.wa.gov/about/boards-and-councils/forest-practices-board/rules-and-guidelines/forest-practices-board-manual

Waters, T.F. (1995). Sediment in streams: sources, biological effects, and control. American Fisheries Society Monograph 7.

Webb, B.W. and Y. Zhang. 1997. Spatial and seasonal variability in the components of the river heat budget. Hydrological Processes. 11, 79–101.

Wiens, J. D., Anthony , R. G., & Forsman, E. D. (2014). Competative interactions and resource partitioning between northern spotted owls and barred owls in western Oregon. . *Wildlife Monographs. 185:*, 1-50.

Wilson, J. S. (2000). Stability and density management in Douglas-fir plantations. *Canadian Journal of Forest Research 30(6)*, 910-920. Retrieved from http://www.nrcresearchpress.com/doi/pdf/10.1139/x00-027

Winkler, R. D., Moore, R. D., et al. (2010). Chapter 7: The effects of forest disturbance on hydrologic processes and watershed response. In Compendium of Forest Hydrology and Geomorphology in British Columbia Vol. 1 of 2, R. G. Pike, T. E. Redding, R. D. Moore, R. D. Winkler, and K. D. Bladon editors. B.C. Ministry of Forests and Range Forest Science Program, Victoria, B.C. and FORREX Forum for Research and Extension in Natural Resources, Kamloops, B.C.

Winter, T. C., J. W. Harvey, O. L. Franke, and W. M. Alley. (1998). Ground water and surface water a single resource. U.S. Geological Survey Circular 1139, Denver, CO.

Wolf , S., Hartl, B., Carroll, C., Neel, M. C., & Greenwald, D. N. (2015). Beyond PVA: why recovery under the Endangered Species Act is more than population viabiliby. . *BioScience.* , 65(2): 200-207.

Wonn, H. T. (2001, WJAF 16(2) 2001.). *Height:Diameter Ratios and Stability Relationships for Four Northern Rocky Mountain Tree Species* . WJAF 16(2) . Retrieved from https://www.fs.fed.us/rm/pubs/rmrs_gtr292/2001_wonn.pdf

Worthington, N. P. (1961). *Commercial Thinning of Douglas-fir in the Pacific Northwest USDA Forest Service Technical Bulletin No. 1230.* Retrieved from https://naldc.nal.usda.gov/naldc/download.xhtml?id=CAT87201173&content=PDF

York, R. A. (2004). Group selection management in conifer forests: relationships between opening size and tree growth. *Canada Journal of Forest Research, 34(3)*, 630-641.

York, R. A. (2008). Growth response of mature trees versus seedlings to gaps associated with group selection management in the Sierra Nevada, California. . *Western Journal of Applied Forestry,23 (2)*, 94-98.

Zabel, C.J., K.M. McKelvey and J. Ward, P, Jr. 1995. Influence of primary prey on home-range size and habitat-use patterns of northern spotted owls (Strix occidentalis caurina). Canadian Journal of Zoology. 73: 433-439.

Zald, H. S., & Dunn, C. J. (2018). Severe fire weather and intensive forest management increase fire severity in a multi-ownership landscape. *Ecological Applications 28,* 1068-1080.