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

Last Chance Forest Management Project

Environmental Assessment

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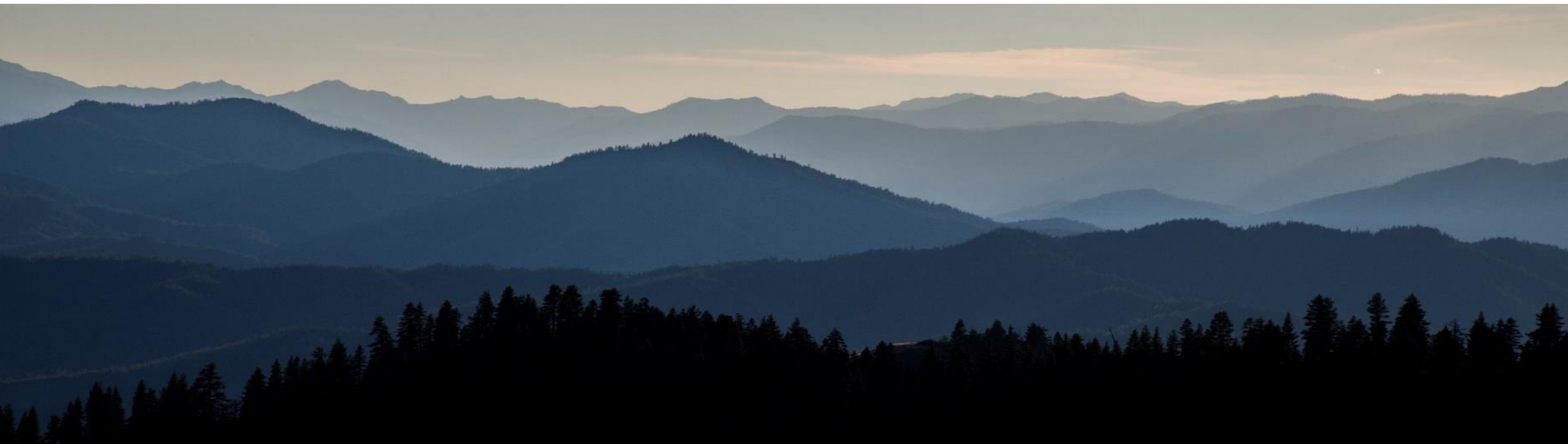

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CHAPTER 1. INTRODUCTION

The Grants Pass Field Office is proposing forest management activities including variable-retention regeneration harvest (VRH), commercial thinning, selection harvest, and hazardous fuels reduction on approximately 11,686 acres of BLM-administered lands within the project area. The Bureau of Land Management (BLM) is preparing this Environmental Assessment (EA) in accordance with National Environmental Policy Act (NEPA) requirements, the Council on Environmental Quality (CEQ) regulations for Implementing the Procedural Provisions of the NEPA (40 CFR Parts 1500-1508), and the Department of the Interior's regulations on implementing the NEPA (43 CFR part 46). This EA has been prepared to analyze and disclose any environmental consequences of the Last Chance Forest Management Project (Last Chance FMP), located within the BLM's Grants Pass Field Office (GPFO).

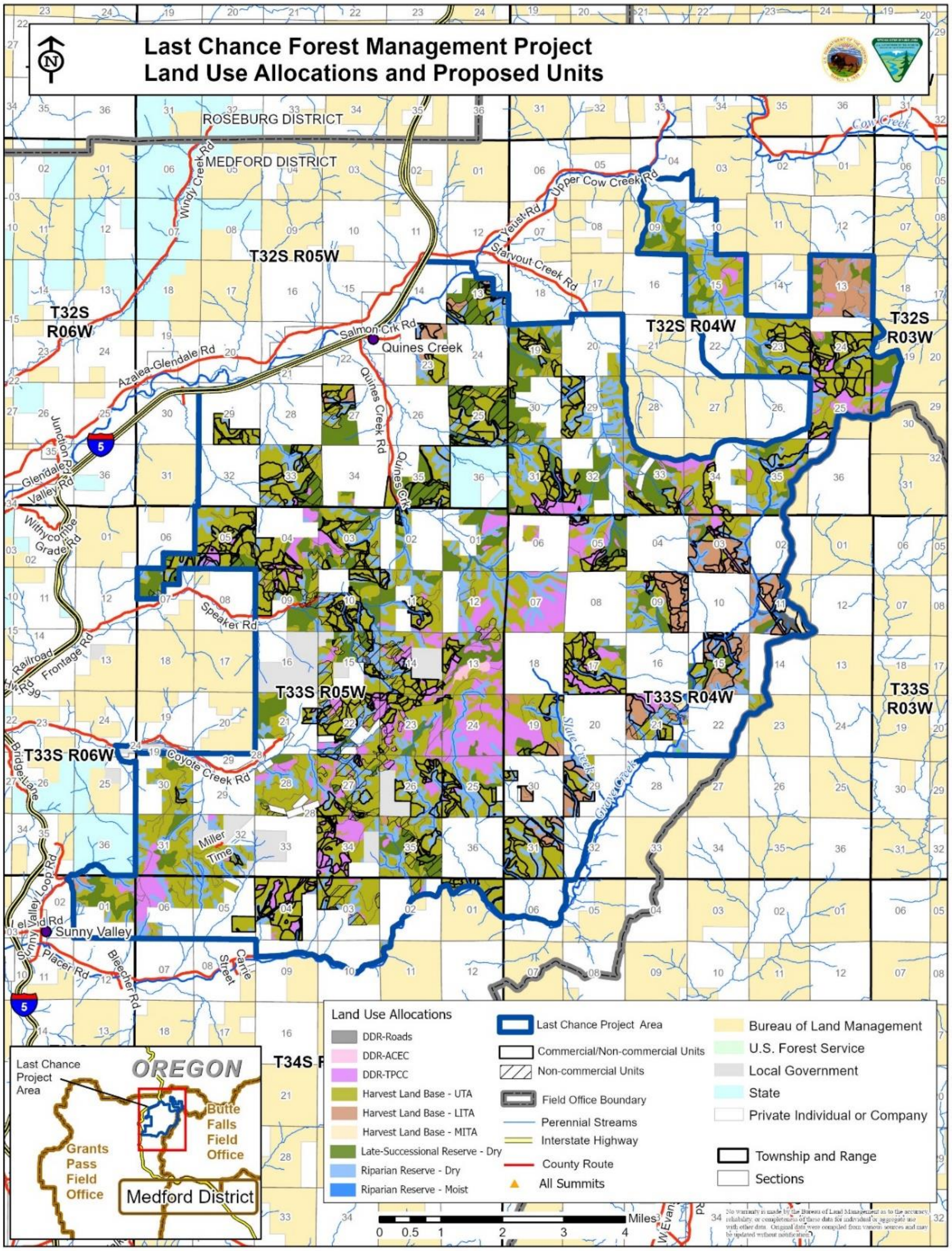
1.1. Project Location

The Last Chance project area is located within Douglas, Jackson, and Josephine counties of Oregon. It is located east of I-5, between Sunny Valley and Galesville Reservoir/Azalea exits (Map 1). The project area encompasses a total of 56,888 acres. The project units are located within the following three Hydrologic Unit Code (HUC) 10-digit watersheds: Grave Creek, Middle Cow Creek, and Upper Cow Creek. Fifty six percent of the project area occurs within the Grave Creek HUC 10 watershed, forty two percent of the project area occurs within the Middle Cow Creek HUC 10 watershed, and two percent of the project area occurs within the Upper Cow Creek HUC 10 watershed. The Middle and Upper Cow watersheds drain into the South Umpqua and Grave Creek is a tributary to the Rogue River. The project area can be found within the legal descriptions Willamette Meridian (Table 1-1).

Table 1-1 Project Area Location

Township	Range	Sections
32 South	3 West	18, 19, 30
32 South	4 West	3, 9, 10, 13, 14, 15, 17, 19, 20, 21, 23, 24, 25, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36
32 South	5 West	13, 23, 25, 27, 29, 33, 34, 35
33 South	4 West	3, 5, 6, 7, 9, 11, 15, 17, 19, 21, 23, 27, 29, 30, 31
33 South	5 West	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 30, 31, 32, 34, 35
34 South	5 West	1, 2, 3, 4, 5, 6, 9, 11
34 South	6 West	1

Map 1. Project Area with LUAs & Treatment Units



1.2. Background

The Last Chance FMP area including all lands considered in this EA regardless of jurisdiction contains 56,888 total acres, of which 32,272 acres (57%) are managed by the BLM GPFO (Table 1-2). The project area includes 30,573 acres of BLM Oregon & California Railroad Lands (O&C) and 1,699 acres of BLM public domain lands. See Table 1-3 below for details on Land Use Allocations (LUAs) within the project area. BLM-administrative lands are intermixed with private and county lands, creating a mosaic of ownership patterns across the GPFO.

Table 1-2 Land Ownership Summary for the Last Chance Project Area

Jurisdiction	Acres	Percent
Bureau of Land Management	32,272	57%
Private Land	22,662	40%
Josephine County	1,407	2%
State of Oregon	547	1%
Total	56,888	100%

The Grants Pass Field Office is proposing forest management activities including Variable Retention Harvest (VRH), commercial thinning, selection harvest, and hazardous fuels reduction on approximately 11,686 acres of BLM-administered lands within the project area. Forest management treatments consist of both commercial and non-commercial treatments that would occur in the following Land Use Allocations (LUA): Harvest Land Base (HLB)-Low Intensity Timber Area (LITA), HLB-Moderate Intensity Timber Area (MITA), HLB-Uneven-Aged Timber Area (UTA), Late- Successional Reserve (LSR)-Dry, Riparian Reserve (RR)-Dry, Riparian Reserve (RR)-Moist, District Designated Reserve – Roads (DDR-Roads), and District Designated Reserve – Timber Production Capability Classification (DDR-TPCC) (Table 1-3).

Table 1-3 BLM Land by Land Use Allocation in the Last Chance Project Area

Land Use Allocation	Acres	Percentage
HLB – LITA	1,805	5.6%
HLB – MITA	136	0.4%
HLB – UTA	14,074	43.6%
LSR-Dry	4,878	15.1%
RR-Dry	6,633	20.6%
RR-Moist	68	0.2%
DDR-TPCC	3,720	11.5%
DDR-Roads	907	2.8%
DDR-ACEC[1]	51	0.2%
Total	32,272	100%

[1] The only actions proposed in the ACEC are Transportation Management.

The BLM selected the Last Chance project area to conduct forest treatments for multiple reasons. Fifty percent (50%) of the project area is designated as Harvest Land Base (HLB), which are lands allocated for sustained-yield forest management to produce a permanent supply of timber. Current stand conditions have average stocking based on all 2061 stand exam plots measured from 2019 through 2023 of 178 trees per acre with a standard deviation of 118. This can also be expressed as an average basal area of 258 square feet per acre with a standard deviation of 97, or in commercial terms as an average gross board foot volume of 55,737 per acre with a standard deviation of 30,677. Another way to think of this is an average of 11 log truck loads per acre with a standard deviation of six. These stands are mainly composed of the following tree species with known commercial value: Douglas-fir, white fir, western hemlock, incense-cedar, ponderosa pine, Jeffrey pine, and sugar pine. Such tree species, when found in densities of at least 5 MBF/acre or at least 60 square feet of basal area per acre on average that could be removed with the treatment, coupled with the culmination of mean annual increment[2] present a known opportunity to recover maximal or near maximal return on investment from the timber value in the stand and start a new cohort of trees to provide a similar harvest opportunity within the rotation range of the stand.

BLM foresters know from 15-20 years of experience and current market conditions, that HLB acres holding a minimum of 140 to 240 square feet of basal area per acre in merchantable trees and have existing road access provide the opportunity for a commercial entry where the value of the timber exceeds costs, with allowance for a reasonable profit. These conditions increase the probability of a successful commercial bid offer which would contribute volume to the Medford District's Allowable Sale Quantity (ASQ) yearly and decadal target. The ASQ targets are described in further detail on p. 5-7 of the Southwestern Oregon Resource Management Plan (SWO/RMP) and in the project Purpose and Need below. The implementation of forest management activities occurs through different contracting mechanisms including service contracts, timber sale contracts, stewardship contracts or agreements (USDI/BLM 2016b, p. 62 n.19).

Recent local studies have shown that in southwest Oregon more Douglas-fir trees died between 2015-2019 than in the previous four decades (Bennett et al. 2023a, Bennett et al 2023b). These trees are dying in the largest numbers in the driest areas in the region. Douglas-fir are at risk of dying in areas with an average precipitation of up to 45 inches, particularly on harsh warm and drier sites. Where Douglas-fir trees are further stressed by drought and then exploited by the flatheaded fir borer (*Phaenops drummondi*), mortality is expected to continue to occur.

Many portions of the project area contain heavy hazardous fuels loads. The top 50 communities in the State of Oregon with the highest wildfire risk were identified by Scott et al. in 2018. Nearly half of those communities are within southwestern Oregon. The cities of Grants Pass, Rogue River, Glendale, and Merlin, Oregon are all within a 20-mile radius of the project vicinity. Current trends and forecasts suggest that wildfire would continue to be a major agent of change affecting the region, further increasing wildfire risk across the state. These conditions continue to put Highly Valued Resources and Assets (HRVAs) at risk. BLM's proposed project would help to ensure the risk of large-scale high-intensity/high-severity fire is reduced.

Smaller portions of the project are on lands allocated as Late-Successional Reserve – Dry and Riparian Reserves. Reserves under BLM's 2016 RMP are not like reserves under the Northwest Forest Plan. The BLM and U.S. Fish and Wildlife Service have recognized the scientific consensus that active

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[2] Culmination of mean annual increment - The age in the growth cycle of a tree or stand at which the mean annual increment (MAI) for which some attribute, e.g., wood volume of a tree or stand growth is at maximum. At culmination, MAI equals the periodic annual increment (PAI).

management of reserves is needed to speed or improve the development of habitat for the northern spotted owl and to address the loss of existing habitat to wildfire and other disturbances. In LSR-Dry, habitat for northern spotted owl is often lacking its characteristic structural complexity. These areas with highly dense even aged and single layered canopies put NSO habitat at risk of stand replacing fire as drought continues in the region.

The SWO/RMP management direction in LSR-Dry sets a decadal target of applying selection harvest or commercial thinning to at least 17,000 acres per decade. As of June 17, 2024, the Medford district has applied such treatments to 1,043 acres, leaving 15,957 more acres to treat between now and the end of FY26. This project provides an opportunity to develop, maintain and improve northern spotted owl nesting-roosting habitat, and contribute to the decadal target for acres treated in LSR. Designing projects that have commercial value is essential to ensuring such habitat-improvement and fire resiliency treatments get carried out. The BLM receives limited appropriated funds to carry out such activities and relies upon combinations of stewardship contracts (stands where timber is of insufficient volume to exceed the cost of restoration/fuels work) and timber sale contracts (those that are self-funding to achieve restoration and fire resiliency project treatment acreage goals). Commercial restoration and fire resiliency treatments that can economically support themselves improve the chances for implementation, while reducing fuel loads, investing in the existing transportation infrastructure, maintaining investments in areas previously treated for hazardous fuels, and can improve habitat for flora and fauna across the project area.

Map 2. in Appendix F. shows the project area vicinity and other projects nearby which are considered in the analysis of cumulative effects. The Last Chance FMP area is bordered by the 2018 Poor Windy project area to the west and northwest, and by the 2016 Upper Cow project area to the north. The eastern edge of the Last Chance project area is bordered by the 2018 Grave Creek fire of the Garner Complex wildfire and the BLM Butte Falls Field Office boundary. These projects are in various stages of implementation.

1.3. Decision to be Made

The BLM Grants Pass Field Office would decide whether to implement the actions outlined in the alternatives described in Chapter 2. The Authorized Officer would decide whether to offer timber for sale, and if timber is offered for sale, how many commercial sales to offer, whether to offer as stewardship or timber sale contracts, and whether to implement other actions, including hazardous fuels reduction, road construction and road renovation. These decisions would be documented through Decision Record documents that would identify specific approved actions and would be made available to the public.

1.4. Purpose and Need

The need for the Last Chance Forest Management Project and its purpose are established in the ROD/RMP (USDI/BLM 2016b p. 43, 63, 73). This section describes the LUA opportunities and how the BLM is hoping to accomplish those actions, which apply to the Proposed Actions in this project.

Need:

1. The forests identified for treatment are overly dense, lack complex structure, are at high risk of stand replacing wildfire, and have a reduced resistance to disturbance in HLB-UTA, RR-Dry (class I & III), RR-Moist (class I), DDR-TPCC.
    a. These conditions have reduced the quality of northern spotted owl (NSO) nesting roosting (NR) habitat in LSR-Dry.

        i. The RMP requires the BLM to apply commercial treatments to at least 17,000 acres in the Medford District LSR-Dry per decade (USDI/BLM 2016b p.74).

   b. These conditions risk the loss of available large stable wood contributions to streams in RR-Moist class I and RR-Dry class I (USDI/BLM 2016b p.78, 82).

2. The 2016 Southwest Oregon Record of Decision & Resource Management Plan (ROD/RMP) requires the BLM to offer ASQ from HLB-LITA, MITA, & UTA (O&C lands) annually (USDI/BLM 2016b p. 62, 64, 66, 68).

3. Timber sales must be economically viable to be offered for sale at auction.

Purpose:

1. HLB: Conduct silvicultural treatments to produce timber to contribute to the attainment of the declared ASQ for the Medford Annual Sustained Yield Unit (SYU) (USDI/BLM 2016b, p. 62, 66, 68), and reduce fire risk and insect/disease outbreaks (USDI/BLM 2016b, p. 62).
   a. UTA: Contribute to ASQ, fuels reduction, reduce stand susceptibility to disturbance.
   b. LITA: Contribute to ASQ
   c. MITA: Contribute to ASQ
2. LSR-DRY: Accelerate or improve the development of NSO habitat and complete treatments required by RMP (USDI/BLM 2016b, p. 71-72, 74-75, 92).
3. RR-Moist: Class I: Commercial thinning (middle & outer zones) to create complex stands and ensure stable wood contribution to streams in class 1 (USDI/BLM 2016b, p. 78, 79).
4. RR-Dry Class I & III: Commercial thinning (middle & outer zones) to create complex stands and ensure stable wood contribution to streams in class I and reduce the risk of stand replacing wildfire and ensure stable instream wood (USDI/BLM 2016b, p. 82, 86).
5. DDR/TPCC: Reduce stand susceptibility to disturbances and promote desired species composition (USDI/BLM 2016b, p. 55).
6. All commercial treatments will be implemented as economically viable timber sales.
7. Implement hazardous fuels reduction (HFR) treatments (maintenance and new treatments) in all LUAs (USDI/BLM 2016b, p. 91).
   a. Activity fuels in commercial treatment units.
   b. Natural fuels.

1.5. Conformance with Land Use Plan

The BLM signed the Southwestern Oregon ROD/RMP on August 5, 2016. The Last Chance Forest Management Project is in conformance with this 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 Act, 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 Alternatives and Issues Development

The Grants Pass Field Office mailed public scoping letters in December of 2020 to adjacent landowners, permittees, agencies, and other interested citizens. The BLM received five comments during the 30-day scoping period. On July 15, 2021, a public scoping letter was sent to interested mining claimants. No comments were received. In August of 2022, the Rum Creek Fire ignited via a lightning strike in the northwestern portion of the Grants Pass Field office. This fire did not burn within the footprint of the Last Chance Forest Management Project. However, the project's development was put on hold while the BLM worked to manage the fire and conduct post-fire Emergency Stabilization and Rehabilitation (ESR). In January of 2023, the planning of the Last Chance Forest Management project resumed. On February 22, 2023, scoping letters were sent to tribal governments including the Cow Creek Band of Umpqua, Confederated Tribes of Grand Ronde, and the Confederated Tribes of the Siletz Indians. No comments were received. Although no complete alternatives were received by the public during the scoping period, elements of alternatives were submitted, and many were included as part of the developed alternatives. On July 8, 2024, a draft EA was published on ePlanning for a 30-day public comment period.

1.7. Issues Identified for Analysis

The following issues were raised by the public or BLM specialists during the scoping for this project. These issues will be analyzed in detail in Chapter 3. Issues identified for detailed analysis address impacts related to the purpose and need. The issues are listed in the same order as they are analyzed in Chapter 3.

<u>Forest Actions</u>

Issue 1: What would be the economic viability and operational feasibility of commercial treatments in each alternative?

Issue 2: How would the proposed treatments in HLB contribute to the Medford District's ASQ?

Issue 3: How would the proposed treatments in HLB affect stand vigor and insect and disease susceptibility?

Issue 4: How would silviculture treatments and fuels treatments on DDR-TPCC LUA promote desired species composition and ecological conditions?

<u>Fire and Fuels</u>

Issue 5: How would the Last Chance vegetation management actions affect stand level fire resistance (or fire hazard)?

<u>Northern Spotted Owl Habitat</u>

Issue 6: Would forest management treatments in the LSR-Dry speed the development or improve the quality of nesting habitat in the long term, and not preclude or delay by 20 years or more the development of NSO nesting/roosting habitat as compared to development without treatment?

<u>Northwestern Pond Turtle</u>

Issue 7: How would timber harvest, fuels reduction, and new road and landing construction affect the northwestern pond turtle?

<u>Hydrology and Sedimentation</u>

Issue 8: Would downstream aquatic habitats be negatively affected by increased sedimentation expected from logging activities, road renovation, hauling on existing roads, and use of rock quarries to provide materials for road construction and renovation?

Fisheries and Aquatic Habitat

Issue 9: How would timber hauling, road related activities, including decommissioning affect Southern Oregon/Northern California Coast (SONCC) Coho Salmon and Oregon Coast (OC) Coho Salmon species and their habitat?

Soil Resources

Issue 10: How would ground-based logging, cable and tethered yarding, ground disturbance associated with logging operations (yarding wedges, tractor swings, and landings), road construction, roadside maintenance, and fuels treatments affect impact soil resources on BLM-administered land?

Recreation

Issue 11: How would vegetation management affect recreation opportunities, objectives, and Recreation Setting Characteristics of the following Special Recreation Management Areas (SRMA) within the Last Chance Project Area? (King Mountain Trail SRMA, and Burma Pond Campground and Trailhead SRMA).

1.8. Issues Considered but not Analyzed in Detail

Issues that were considered but not analyzed in detail are concerns raised by the public or BLM specialists during scoping which did not relate to how an alternative responded to the purpose and need, did not point to a potentially significant environmental effect beyond what was anticipated and accounted for in the PRMP/FEIS, or otherwise would not assist in making a reasoned choice among alternatives (USDI/BLM 2008, p. 41-42). A list of issues considered but not analyzed in detail is presented below and a detailed description of these issues is located in Appendix B.

Air Quality - Smoke Management

Issue B 1: How would smoke created from prescribed burning activities affect air quality?

Best Management Practices

Issue B 2: Are Best Management Practices and Project Design Features effective in preventing or reducing the amount of pollution generated by non-point sources?

Botanical Species (Rare Plants, Fungi, and Invasive Species)

Issue B 3: How would the Proposed Action including ground disturbance, decreases in woody vegetation cover, and fuel treatments affect the introduction of invasive species and prevent the spread of existing invasive plants?

Issue B 4: Would there be effects on public health from herbicide use within the Project Area and how would herbicide use be determined to be the appropriate treatment method?

Issue B 5: How would the King Mountain ACEC be managed to preserve sensitive plant and soil resources?

Issue B 6: What would be the potential impacts from the proposed activities to Gentner's Fritillary and its habitat?

Issue B 7: How would the proposed actions affect Special Status plant species and their habitat?

Carbon Storage and Greenhouse Gas Emissions

Issue B 8: What are the effects of proposed project actions on greenhouse gas emissions, carbon storage, climate change, and the social cost of carbon?

Cultural Resources

Issue B 9: How would ground disturbance from the proposed project activities affect cultural resources such as archaeological and historical sites, artifacts, and features?

Issue B 10: How would the project affect traditional cultural or religious significance, such as through ground disturbing activities, or altering accessibility or use?

Fire and Fuels

Issue B 11: How would the Last Chance forest management actions affect wildfire risk to communities?

Issue B 12: How would road construction contribute to human caused fire ignitions?

Fish and Aquatic Habitat

Issue B 13: How would timber harvest actions (ground-based, skyline-cable, tethered, and helicopter yarding) affect federally listed and native fish species and their habitats (aquatic habitat)?

Hydrology and Water Quality

Issue B 14: What are the effects of the proposed project activities (i.e., creation and use of skid trails/yarding corridors, roadwork, and log hauling) on sediment delivery to streams within the project area?

Issue B 15: Would timber harvest, fuel treatments and road construction, road renovation, and use under the Proposed Action affect annual water yields, summer low flows, streamflow magnitude-intensity-duration and/or timing of peak or low base flow conditions?

Issue B 16: How would forest hydrology (surface runoff and shallow groundwater) be impacted by timber harvest, fuels treatments, road construction, road renovation and timber hauling?

Issue B 17: How would water quality be maintained within the range of natural variability and meet Oregon Department of Environmental Quality water quality standards with timber harvest activities, fuel treatments and roads?

Issue B 18: Would stream temperature and specifically maintaining effective shade be impacted by timber harvest activities, fuel treatments, road construction and road renovation result in a measurable increase in stream temperatures?

Issue B 19: How is the risk of landslides delivering sediment to stream channels impacted by timber harvest?

Issue B 20: How would ground water, aquifers, domestic wells, and points of diversion be impacted by vegetation removal and ground disturbance associated with forest management activities?

Riparian Reserve Forest Health and Wood Recruitment for Streams

Issue B 22: How would the Riparian Reserve function be impacted by project activities (i.e. channel dynamics, processes, and the proper functioning condition of riparian areas, stream channels, and wetlands by providing forest shade, sediment filtering, wood recruitment, stream bank and channel stability, water storage and release, vegetation diversity, nutrient cycling, and cool and moist microclimates)?

Issue B 23: Would wood recruitment to streams be impacted by thinning in the Outer and Middle Riparian Zones?

Silviculture

Issue B 24: Would the Proposed Action cause Port-Orford Cedar (POC) root disease *Phythophthora latereralis* to spread within the project area?

Issue B 25: How would the salvage of timber following incidental insect and disease outbreaks, and drought related mortality contribute to the Allowable Sale Quantity?

Soil Resources

Issue B 26: How would ground-based logging, cable yarding, ground disturbance associated with logging operations (yarding wedges, tractor swings, and landings), road building, roadside maintenance, and fuels treatments affect soil productivity, slope stability, mass movement, and surface erosion within and outside of harvesting units?

Issue B 27: How would forest management actions in DDR-TPCC LUAs promote desired soil conditions and minimize or eliminate degradation to the productive capacity of these soils?

Issue B 28: How would decommissioning of roads, temp routes, and any excessive ground-based disturbance affect soil productivity, mass movement, and surface erosion?

Terrestrial Wildlife and Special Status Species

Issue B 29: How would the project be monitored to assure that canopy cover requirements for the northern spotted owl are met?

Issue B 30: How would the potential risk of windthrow and effects to post-harvest canopy and relative density retention requirements be affected by applying LUA prescriptions?

Issue B 31: How would timber harvest, activity fuels treatments, fuels maintenance treatments, and new road and landing construction affect spotted owl habitat?

Issue B 32: How would timber harvest, activity fuels treatments, fuels maintenance treatments, and new road and landing construction affect spotted owls?

Issue B 33: How would timber harvest, activity fuels treatments, fuels maintenance treatments, and new road and landing construction affect NSO Critical Habitat Unit function?

Issue B 34: How would the treatment of northern spotted owl structurally complex habitat (RA32) or nesting and roosting habitat in the Late-Successional Reserve (LSR) affect the project?

Issue B 35: How would noise associated with proposed timber harvest, fuels reduction activities, and roadwork affect northern spotted owls during their nesting season?

Issue B 36: Does the U.S. Fish and Wildlife survey protocol adequately detect northern spotted owls?

Issue B 37: How would proposed timber harvest and associated landings, road construction, and fuels reduction, affect northern spotted owl landscape dispersal?

Issue B 38: Would timber harvest, fuels reduction, and new road/landing construction affect barred owl and spotted owl encounters and interactions which could cause an increase in northern spotted owl and barred competition?

Issue B 39: Would the Proposed Action cause the incidental take of northern spotted owls?

Issue B 40: How would proposed activities affect the threatened coastal marten and its designated critical habitat?

Issue B 41: How would timber harvest, activity fuels treatments, fuels maintenance treatments, and new road and landing construction affect Franklin’s bumble bee (Bombus franklini)?

Issue B 42: How would ground disturbance from proposed project activities and timber harvest affect Bureau Special Status wildlife species?

Issue B 43: How would timber harvest, fuels reduction, and new road and landing construction affect migratory bird/landbird focal species/BLM/USFWS bird species of concern?

Issue B 44: How would the proposed activities affect the Pacific fisher?

Issue B 45: Is the BLM required to analyze for species which are not federally listed or Bureau Sensitive species?

Issue B 46: How would proposed changes in forest canopy and structure from timber harvest, fuels reduction, and roadwork activities affect woodpeckers, cavity nesters, and snags?

Issue B 47: How would fragmentation from timber harvest affect wildlife species and their habitat?

<u>Visual Resources, Recreation and Protected Areas</u>

Issue B 48: How would proposed forest management and associated roadwork operations affect dispersed recreational activity throughout the project area, as well as unauthorized off-highway vehicle use post treatment?

Issue B 49: How would proposed forest management and associated roadwork operations affect Visual Resources within the project area?

Issue B 50: How would the Proposed Action affect the preservation of Lands with Wilderness Characteristics (LWC) or Wild and Scenic Rivers (WSR)?

CHAPTER 2. ALTERNATIVES

This chapter describes the three potential alternatives in this EA (including the No Action Alternative) and one sub-alternative and compares these alternatives in terms of their environmental impacts and their achievement of objectives describes in (section 1.5 Purpose & Need). It also describes the alternatives the BLM considered but did not analyze in detail.

In developing the action alternatives, the BLM considered numerous ways to meet the purpose and needs in Chapter 1, including alternatives proposed or suggested by the public. The BLM analyzed two alternatives and one sub-alternative in detail. These alternatives selected for detailed analysis reflect a reasonable range of alternatives that respond to the purpose and needs identified in Chapter 1. This chapter provides a qualitative and comparative summary of the key points and differences among the alternatives analyzed in detail.

2.1. Alternative 1 – No Action Alternative

Under the No Action Alternative, neither commercial nor non-commercial forest management activities would occur. The proposed 11,686 acres of commercial and non-commercial forest management activities, including HFR, on BLM-managed lands would not occur within the project area. As a result, the No Action Alternative would not meet the purpose and need of the project which seeks to manage revested O&C Lands for sustained yield timber production under the statutory requirements under the O&C Act and FLMPA. The GPFO would not help achieve the ASQ by offering timber volume through individual timber sales from the HLB in FY2024-FY2026 and would not contribute to the ASQ volumes declared in the ROD/RMP for the Medford District sustained yield unit.

Transportation management activities would also not occur under the No Action Alternative. Under the No Action Alternative, 232.6 miles of existing public access roads would not be improved or maintained. Silviculture and fuels treatments in the LSR-Dry LUA to develop (improve or speed) NSO nesting-roosting habitat, reduce the risk of large-scale high intensity fire, and contribute to the Medford District's decadal acreage treatment target directed by the ROD/RMP would not occur under this project. The No Action Alternative would not contribute to the LSR-Dry treatment acreage targets that the Medford District is directed to achieve by the year 2026.

The No Action Alternative would not meet the purpose & need for RR-Dry & Moist. No treatments would occur to promote structural complexity and no HFR treatments would occur to protect and ensure a continued supply of large diameter stable wood recruitment into streams.

In DDR-TPCC, silviculture and fuels treatments to restore and maintain community level structural characteristics by culturing minor species such as pine, oak, and cedar would not occur. The No Action Alternative would not emulate ecological conditions produced by historic fire regimes.

The No Action Alternative serves as a baseline which represents current conditions and a reference point from which to compare the environmental effects of the action alternatives. Under the No Action Alternative, silvicultural treatments would not be applied within the project area. No forest management and follow-up fuels reduction activities would be implemented to accomplish project goals in the foreseeable future.

2.2. Project Elements Common to All Action Alternatives

To facilitate forest management treatments, this project would include ground-based, skyline cable, tethered, and helicopter harvest and yarding methods. These harvest operations would utilize landings, skid trails, and yarding corridor construction, guy-line anchors, and tail-hold trees in HLB-LITA, MITA, UTA, LSR-Dry, RR-Dry & Moist, DDR-Roads, and DDR-TPCC LUAs. Complete descriptions of these methods can be found in Appendix D "Additional Environmental Assessment Information", or in Appendix E "Glossary of Terms".

2.2.1. Harvest Activity Fuels Reduction

Based on the unit location (e.g. aspect, slope, access, and proximity to other values, such as adjacent to communities or private property) and residual activity fuel (e.g., live and dead tree branches and treetops) remaining following harvest in commercial units, the BLM would determine the type of activity fuel treatment needed to reduce the amount or depth of residual activity fuels. Adjacent to values and along access routes, activity fuel load would be reduced to result in expected flame lengths less than 4 feet under typical fire weather conditions. Activity fuel loading would be reduced through methods such as hand or machine pile and burn, and/or broadcast burning within 1-2 years following completion of harvest to allow fuels time to cure prior to burning. In areas not adjacent to values or access routes, the depth of activity fuels will be reduced to less than 18 inches in height by lop and scatter within 1 year of harvest.

2.2.2. Non-commercial Hazardous Fuels Reduction (HFR)

This project proposes a total of acres of HFR. These units were chosen because they are in operationally strategic areas which aid in wildland fire fighting operations. HFR treatments are designed to treat understory vegetation (less than eight (8) inches DBH) to reduce surface fuels, ladder fuels, and to promote retention tree growth and vigor. These acres were evaluated during the planning phase of this project and identified as in need of treatment. Treatments could include slashing, hand piling, hand pile burning, chipping, lop and scatter, and/or understory burning. Conifers would be spaced 16-20 feet apart while hardwoods would be spaced 25-45 feet apart. Under-burning would involve the application of fire to understory vegetation and downed woody material when fuel moisture, soil moisture, weather, and atmospheric conditions allow for the fire to be confined to a predetermined area at a prescribed intensity to achieve the planned resource objectives. Under-burning would occur within 15 years from the initial or follow-up maintenance fuels reduction treatments. Areas which have been treated for non-commercial HFR within the past 20 years are proposed for retreatment. Additionally, areas proposed for commercial timber harvest which were not previously treated for hazardous fuels reduction (HFR) would be evaluated for non-commercial HFR if not treated under Decision Records for commercial treatment. See Project Design Features, Table C-19 for more details.

2.2.3. Stream Restoration

The BLM is proposing individual tree cutting or tipping to provide logs for stream restoration activities (USDI/BLM 2016b, p. 76-77). Tree tipping is mechanically tipping or pulling over trees with root wads attached using an excavator or a truck mounted cable system, generally into or near a stream, to mimic natural wood recruitment (USDI/BLM 2016b, p. 315). The cut or tipped trees can be of any size and come from any zone in the Riparian Reserve LUA. Tree cutting, tipping and stream restoration actions would occur as funding and opportunities allow. Emphasis would be placed on trees which could be cut and removed via existing corridors, skid trails and roads. Snags would be created and scaled to the proportion of the thinned RR area to provide additional wood for streams over time from the Riparian Reserve (USDI/BLM 2016b, p. 82-86).

2.2.4. Transportation Activities

The BLM is proposing transportation management actions, including road construction, road renovation, using existing quarries, and hauling in HLB-LITA, MITA & UTA, LSR-Dry, RR-Dry & Moist, DDR-Roads, and DDR-TPCC LUAs. The BLM would identify roads available for wet season haul, depending on road surface type and current condition for each timber sale. In all LUAs, the BLM would monitor the renovation of all haul roads to accommodate the safe movement of vehicles and machines in the contractual mechanism used to implement proposed actions (Oregon OSHA 2003 Chapter 437, Division 7, Section F). Roads may be placed in a long-term closure status once timber harvest activities end.

2.3. Alternative 2

This alternative proposes commercial and non-commercial forest management activities on approximately 11,686 acres of BLM-administrative lands. These actions are proposed within HLB-LITA, MITA, & UTA, LSR-Dry, RR-Moist, RR-Dry, DDR-Roads, and DDR-TPCC LUAs. The prescribed treatments within each stand are driven by a number of factors including LUA, NSO occupancy/habitat type, stand growth rates, species composition, and stand composition/structure. The various LUAs would be treated with VRH, commercial thinning, selection harvest, hazardous fuels reduction treatments, and activity fuels reduction treatments.

2.3.1. Harvest Land Base – Low Intensity Timber Area

Alternative 2 proposes commercial treatments on approximately 938 acres within HLB-LITA. Approximately 729 acres within HLB-LITA outside of NSO occupied home ranges are proposed for VRH and approximately 57 acres within HLB-LITA located within occupied NSO stands are proposed for commercial thinning. Both treatments would meet the need to produce timber which contribute to the attainment of the declared ASQ. VRH treatments would include commercial harvest, followed by site preparation, and planting a mix of native tree species (USDI/BLM. 2016b, p. 64-65). VRH treatments would retain 15-30 percent of the pre-harvest stand basal area of live trees. Trees would be retained in a diversity of spatial patterns, including aggregated groups, and individual trees. As required by the RMP, trees that are ≥ 36 inches DBH and that were established prior to 1850 shall be retained on site. Natural or artificial regeneration (planting) or both would occur to reforest the site with native tree species to attain stand-level averages of at least 130 trees/acre within 5 years of harvest (USDI/BLM. 2016b, p. 65).

Commercial thinning harvests would retain an average relative density of 35 (+/- 10) percent post-harvest, would leave skips on 5 percent of the stand, and create group selection openings on less than 10 percent of the stand. As required by the ROD/RMP, trees that are both ≥40 inches DBH and that were established prior to 1850 shall be retained on site.

Alternative 2 also proposes non-commercial HFR treatments of approximately 1,001 acres in HLB-LITA. Of the 1,001 acres proposed for treatment, 938 acres overlap with the areas proposed for commercial harvest in HLB-LITA.

Table 2-1: NSO & Proposed Treatments within HLB-LITA

NSO Site Occupancy and NSO Habitat Type	Prescription Type and Post-Harvest Basal Area[3] or Relative Density Retention:	Group Selections
Unoccupied NSO home ranges or outside of NSO home ranges – Dispersal, Foraging, and/or Nesting habitat	VRH: Retain 15-30% of the pre-harvest stand basal area in live trees post-harvest	
Unoccupied NSO home ranges or outside of NSO home ranges –	Commercial Thin: Retain 25-45% post-harvest relative density	Group selections up to 4 acres in size and up to 10% of the stand area.

[3] Post harvest retention metrics are quantified in basal area to be consistent with NSO consultation (USDI BLM 2023, pp. 29-33).

NSO Site Occupancy and NSO Habitat Type	Prescription Type and Post-Harvest Basal Area[3] or Relative Density Retention:	Group Selections
Dispersal, Foraging, and/or Nesting habitat		
Occupied NSO home ranges[4] – Dispersal habitat	• Commercial Thin – Retain 25-45% post-harvest relative density and: Retain 80-120 square feet of basal area/acre in plantations/even aged younger stands. • Retain 100-150 square feet of basal area/acre in uneven aged/ "natural stands".	Group selections under 1 acre in size and up to 10% of the stand area.
Occupied NSO home ranges[4] – Foraging habitat	Commercial Thin: Retain 25-45% post-harvest relative density and 150-200 square feet of basal area/acre	Group selection under 1 acre in size and up to 10% of the stand area.
Occupied NSO home ranges[4] – Nesting habitat	Commercial Thin: Retain 25-45% post-harvest relative density and 180-200 square feet basal area/acre	Group selection under 1 acre in size and up to 10% of the stand area.

2.3.2. Harvest Land Base – Moderate Intensity Timber Area

Alternative 2 proposes commercial VRH treatment in approximately 57 acres of HLB-MITA. The HLB-MITA outside of NSO occupied stands are proposed for VRH and the HLB-MITA located within occupied NSO stands are proposed for commercial thinning. Both treatments would produce timber which would contribute to the attainment of the declared ASQ. Treatments within HLB-MITA vary depending on the NSO site occupancy and the field verified NSO habitat type within a stand (Table 2-2).

VRH treatments activities would include commercial harvest, followed by site preparation, and planting a mix of different tree species (USDI/BLM. 2016b, p. 64-65). VRH would retain 5-15 percent of the pre-harvest stand basal area in live trees. Trees would be retained in a variety of spatial patterns, including aggregated groups, and individual trees. As required by the ROD/RMP, trees that are ≥40 inches DBH and that were established prior to 1850 shall be retained on site. Natural or artificial regeneration or both would occur to reforest the site with appropriate species to attain stand-level averages of at least 150 trees/acre within 5 years of harvest (USDI/BLM. 2016b, p. 65).

Commercial thin harvests would retain an average stand relative density of 35 (+/- 10) percent post-harvest, would leave skips on 5 percent of the stand, and create group selection openings (up to 4 acres in size) on less than 10 percent of the stand.

Alternative 2 proposes non-commercial HFR treatments on approximately 81 acres within HLB-MITA. Of the 81 acres proposed for treatment, 57 acres overlap with the areas proposed for commercial harvest.

Table 2-2: NSO & Proposed Treatments in HLB-MITA

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[4] No treatment would occur in NSO occupied nest patches.

NSO Site Occupancy and NSO Habitat Type	Prescription Type and Post-Harvest Basal Area[5] or Relative Density Retention:	Group Selections
Unoccupied NSO home ranges or outside of NSO home ranges – Dispersal, Foraging, and/or Nesting habitat	VRH: Retain 5-15% of the basal area in live trees post-harvest	
Unoccupied NSO home ranges or outside of NSO home ranges – Dispersal, Foraging, and/or Nesting habitat	Commercial Thin: Retain 25-45% post-harvest relative density	Group selections up to 4 acres in size and up to 10% of the stand area.
Occupied NSO home ranges[6] – Dispersal habitat	Commercial Thin – Retain 25-45% post-harvest relative density and: • Retain 80-120 square feet of basal area/acre in plantations/even aged younger stands • Retain 100-150 square feet of basal area/acre in uneven aged/ “natural stands”	Group selections under 1 acre in size and up to 10% of the stand area
Occupied NSO home ranges[6] – Foraging habitat	Commercial Thin: Retain 25-45% post-harvest relative density and 150-200 square feet of basal area/acre	Group selection under 1 acre in size and up to 10% of the stand area
Occupied NSO home ranges[6] – Nesting habitat	Commercial Thin: Retain 25-45% post-harvest relative density and 180-200 square feet of basal area/acre	Group selection under 1 acre in size and up to 10% of the stand area

2.3.3. Harvest Land Base – Uneven-aged Timber Area

Alternative 2 proposes commercial treatments on approximately 4,994 acres within HLB-UTA. Activities would include selection harvest, vegetation control, prescribed fire, and reforestation (USDI/BLM. 2016b, p. 68-69). Treatments within the HLB-UTA vary depending on the NSO site occupancy and the field verified NSO habitat type within a stand (Table 2-3).

In stands ≥ 10 acres, selection harvest would retain an average stand relative density of 30 (+/- 10) percent post-harvest, would leave skips on at least 10 percent of the stand, and create group selection openings on less than 30 percent of the stand. The group selection openings would be less than 4 acres in size. As required by the ROD/RMP, Douglas-fir and pine species that are ≥ 36 inches DBH and were

[5] Post harvest retention metrics are quantified in basal area to be consistent with NSO consultation (USDI BLM 2023, pp. 29-33).
[6] No treatment would occur in NSO occupied nest patches.

established prior to 1850 would be retained. Madrone, maple, oak, and other hardwood species ≥ 24 inches DBH would be retained.

Alternative 2 proposes non-commercial HFR treatments on approximately 6,525 acres in HLB-UTA. Of the 6,525 acres proposed for treatment, 4,994 acres overlap with the areas proposed for commercial harvest in HLB-UTA.

Table 2-3: NSO & Proposed Treatments within HLB-UTA

NSO Site Occupancy and NSO Habitat Type	Post-Harvest Basal Area[7] or Relative Density Retention:	Group Selections
Unoccupied NSO sites or outside of NSO sites– Dispersal, Foraging, and/or Nesting habitat	Retain 20-40% post-harvest relative density	Group selections up to 4 acres in size and up to 30% of the stand area
Occupied NSO home ranges[8]– Dispersal habitat	Retain 20-40% post-harvest relative density and: • Retain 80-120 square feet of basal area/acre in plantations/even aged younger stands • Retain 100-150 square feet of basal area/acre in uneven aged/ "natural stands"	Group selections under 1 acre in size and up to 20% of the stand area
Occupied NSO home ranges[8] – Foraging habitat	Retain 20-40% post-harvest relative density and 150-200 square feet of basal area/acre	Group selection under 1 acre in size and up to 20% of the stand area
Occupied NSO home ranges[8] – Nesting habitat	Retain 20-40% post-harvest relative density and 180-200 square feet of basal area/acre	Group selection under 1 acre in size and up to 20% of the stand area

2.3.4. Late-Successional Reserve – Dry

Alternative 2 proposes commercial treatments on approximately 291 acres in LSR-Dry. Within LSR-Dry, integrated vegetation management treatments are proposed to promote the development of NSO habitat (USDI/BLM. 2016b, p. 70-72) and to improve and maintain landscape and ecosystem resilience to large-scale high-intensity/high-severity wildfire (USDI/BLM. 2016b, p. 74). Activities would include commercial thinning, selection harvest, HFR, and prescribed fire (USDI/BLM. 2016b, p. 74-75).

In stands ≥ 10 acres, selection harvest would retain an average stand relative density of 30 (+/- 10) percent post-harvest, would leave skips on at least 10 percent of the stand, and create group selection openings on less than 10 percent of the stand. The group selection openings would be less than 1 acre in size. As required by the RMP, Douglas-fir and pine species that are ≥ 36 inches DBH and were

[7] Post harvest retention metrics are quantified in basal area to be consistent with NSO consultation (USDI BLM 2023, pp. 29-33).
[8] No treatment would occur in NSO occupied nest patches.

established prior to 1850 would be retained . Madrone, big leaf maple, oak species, and other hardwood trees ≥ 24 inches DBH would be retained[9]. All treatments would retain the required trees per acre, ground cover, snags and canopy cover metrics listed in the RMP (USDI/BLM. 2016b, p. 70-75).

Alternative 2 proposes non-commercial HFR treatments on approximately 950 acres in LSR-Dry. Of the 950 acres proposed for treatment, 291 acres overlap with the areas proposed for commercial harvest in LSR-Dry.

Treatments within the LSR-Dry vary depending on the NSO site occupancy and the field verified NSO habitat type within a unit (Table 2-4). Overall, the proposed logging, yarding, and hauling activities in the LSR-Dry would provide for the conservation and recovery of the NSO in the short and long term.

Table 2-4: NSO & Proposed Treatments in LSR-Dry

NSO Habitat Type	Post-Harvest Basal Area[10] or Relative Density Retention:	Group Selections
Dispersal habitat[11]	Retain 20-40% post-harvest relative density and: 80-120 square feet of basal area/acre in plantations/even aged younger stands 100-150 square feet of basal area/acre in uneven aged/ “natural stands”	Group selection less than 1 acre and up to 10% of the stand
Foraging habitat[11]	Retain 20-40% post-harvest relative density and 150-180 square feet of basal area/acre	Group selection less than 1 acre and up to 10% of the stand
Nesting habitat[11]	Retain 20-40% post-harvest relative density and 180 or greater square feet basal area/acre, consider no treatment	Group selection less than 1 acre and up to 10% of the stand

2.3.5. Riparian Reserve (RR) – Moist and Dry

Alternative 2 proposes commercial treatment of approximately 7 acres in RR-Moist and approximately 1,290 acres in RR-Dry. The project area contains Class I and Class III sub-watersheds. McGinnis Creek is a tributary to Snow Creek and Cow Creek and is in the Upper Cow watershed. It is a Class III RR-Dry watershed and is 2% of the Last Chance proposed action. RR buffers are determined based on the slope distance and not the horizontal distance. Assumptions are made in GIS based on slope distances when the RR Zones are calculated based on the best available field data.

2.3.5.1. *Inner Riparian Zone*

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[9] Except where falling is necessary for safety or operational reasons and no alternative harvesting methods is economically viable or practically feasible. If such trees need to be cut for safety reasons or operational reasons, retain cut trees in the stand (USDI/BLM. 2016, p. 74).
[10] Post harvest retention metrics are quantified in basal area to be consistent with NSO consultation (USDI BLM 2023, pp. 29-33).
[11] No treatment would occur in NSO occupied nest patches.

No commercial harvest would occur in the Inner Riparian Zone. For fish bearing and perennial streams in both Class I and III sub-watersheds, the Inner Riparian Zone buffer occurs within 120 feet from streams. For intermittent streams in both Class I and III sub-watersheds, the Inner Riparian Zone buffer occurs within 50 feet from the stream. This alternative proposes non-commercial hazardous fuels reduction within the Inner Riparian Zone; however, these treatments would not occur within 60 feet of perennial and fish-bearing streams (USDI/BLM. 2016b, p. 82 and 86). All treatments would retain the trees per acre, and canopy cover metrics for RR-Dry listed in the RMP (UDSI/BLM. 2016b, p. 82-87). Individual tree cutting or tipping is proposed in the Inner Riparian Zone to meet the tree-tipping management direction associated with outer zone commercial thinning (USDI/BLM. 2016b, p. 76-77).

2.3.5.2. *Outer and Middle Riparian Zone*

For fish-bearing, perennial, and intermittent streams in Class I sub watersheds, the Outer Riparian Zone buffer occurs 120 feet from the stream outward to the edge of the RR-Dry LUA which is the Site Potential Tree Height for each watershed (Upper Cow Creek (200ft), Middle Cow Creek (195ft), and Grave Creek (200ft). For intermittent non-fish bearing streams in Class I watersheds, there is an additional Middle Riparian Zone that occurs from 50 to 120 feet (USDI/BLM. 2016b, p. 82-83). Within the Outer and Middle Riparian Zones, this project proposes commercial thinning, activity fuels reduction treatments, and non-commercial treatments including hazardous fuels reduction, tree tipping, and cutting, yarding, and placement of trees for fish habitat restoration. For Class III watersheds, there is a 50ft RR width for intermittent streams (USDI/BLM. 2016b, p. 87). There are no Middle or Outer Riparian Zones for intermittent streams in the Class III subwatersheds. In general, commercial treatments would retain between 120 and 200 square feet of basal area post-harvest. All treatments, both non-commercial and commercial, would retain the required trees per acre and canopy cover metrics listed in the ROD/RMP (USDI/BLM 2016b, pp. 78-79, 82-87).

Relevant RR thinning management direction would be followed for commercial thinning and fuels treatments (USDI/BLM. 2016b, p. 78-79, 83-84):

- Maintain at least 30% canopy cover and 60 trees per acre.
- Creating one snag/acre of over 20 inches DBH, and one snag/acre over 10 inches DBH for the RR-Dry Outer Zone, this is scaled to the proportion of the thinned RR area.
- Retain existing snags ≥ 6 inches DBH, cut snags, and existing down woody material ≥ 6 inches in diameter at the large end and > 20 feet in length, except for safety, operational, or fuel reduction reasons (USDI/BLM. 2016b, p. 76).

Alternative 2 proposes non-commercial hazardous fuel reduction treatments of approximately 29 acres in RR-Moist. Of the 29 acres proposed for treatment, 7 acres overlap with the areas proposed for commercial harvest in RR-Moist. Alternative 2 also proposes non-commercial hazardous fuel reduction treatments of approximately 2,053 acres within the RR-Dry. Of the 2,053 acres proposed for treatment, 1,290 acres overlap with the areas proposed for commercial harvest in RR-Dry.

2.3.6. District Defined Reserve – TPCC

Alternative 2 proposes commercial treatment of approximately 663 acres in DDR-TPCC. Alternative 2 also includes non-commercial HFR treatments of approximately 1,047 acres in DDR-TPCC. Of the 1,047 acres proposed for HFR treatment, 663 acres overlap with the areas proposed for commercial harvest in DDR-TPCC.

Commercial and non-commercial treatments in DDR-TPCC would implement silvicultural prescriptions to restore and maintain community-level structural characteristics and promote desired species composition by culturing more drought tolerant species such as pine, oak, and cedar. This would be accomplished by removing encroaching Douglas-fir and young madrone from these characteristically less-densely forested areas. The project would also re-introduce prescribed fire to reduce the presence of dense understory vegetation, therefore, emulating ecological conditions produced by historic fire regimes. Some units may require understory reduction treatments to remove excess vegetation prior to the re-introduction of prescribed fire to ensure that ecological conditions produced by historic fire regimes can be achieved.

DDR-TPCC LUAs are intermixed with the other LUAs in the project area. To accomplish the management direction for the DDR-TPCC, it is necessary to evaluate lands within this LUA to determine if treatment would restore or maintain community-level structural characteristics, promote desired species composition, and emulate ecological conditions produced by historic fire regimes.

2.3.7. Transportation Management

Alternative 2 proposes 253 miles of road renovation, 29 miles of road construction, and potential entry into 14 existing rock quarries. Previously decommissioned roads, or roads placed in a long-term closure status, are proposed to be renovated for the project and may be closed upon project completion (USDI/BLM 2016b p. 311, 312). For a detailed discussion on Transportation Management please see Appendix D section D.3.

2.4. Sub-Alternative 2a

This alternative is a sub-alternative stemming from Alternative 2 above. It is identical to Alternative 2 with the difference being the 786 acres proposed for VRH in Alternative 2 would instead be treated with commercial thinning.

2.5. Alternative 3

Alternative 3 provides an additional alternative to meet the purpose and need. This alternative proposes commercial harvest activities, consisting of commercial thinning and selection harvest, on approximately 1,059 acres and non-commercial hazardous fuels reduction treatment on 11,686 acres (of which, 1,059 acres overlap with commercial harvest treatments). The treatments in this alternative are within the same LUAs as in Alternative 2 & Sub-Alternative 2a: HLB-LITA, UTA & MITA, LSR-Dry, DDR-TPCC, and RR-Dry & Moist.

Alternative 3 includes:

- No commercial treatment in occupied NSO home ranges
- Increased tree retention levels and a lower DBH harvesting limit (20-inch max)
- No new road construction in the Project Area.

Alternative 3 retains higher levels of average relative density per unit in comparison to Alternative 2. This includes the retention of all trees greater than 20 inches DBH in all units, eliminates treatment of NSO habitat in occupied NSO territories, eliminates treatment of NSO nesting habitat, increases the post-harvest relative density to 40-45 percent in each unit, and eliminates all new road construction. Empirical data shows that helicopter logging needs to extract X mbf/acre to be economically viable and operationally helicopter yarding cannot safely nor efficiently operate in stands with canopy cover greater than 60 percent. The analysis shows the average volume per acre of removal in Alternative 3 to be X mbf/acre. For these reasons, helicopter yarding in Alternative 3 does not meet the purpose and need of the project to offer economically viable timber sales, therefore areas that could only be logged with helicopter yarding were dropped from Alternative 3. Alternative 3 proposes the use of ground-based yarding, skyline and tethered yarding, landing construction, and the use of tail-hold trees and guy-line anchors.

2.5.1. Harvest Land Base – Low Intensity Timber Area

Alternative 3 proposes commercial thinning of 23 acres within HLB-LITA to post-harvest relative density of 40-45 percent, would leave skips on 5 percent of the stand, and would create group selection openings less than 1 acre in size on less than 10 percent of the stand. Alternative 3 proposes 1,001 acres within the HLB-LITA for non-commercial hazardous fuels reduction (of which 23 acres overlaps with the area proposed for commercial thinning). All trees >20 inches DBH would be retained.

2.5.2. Harvest Land Base – Moderate Intensity Timber Area

Alternative 3 proposes commercial thinning of 5 acres within HLB-MITA to post-harvest relative density of 40-45 percent, would leave skips on 5 percent of the stand, and would create group selection openings less than 1 acre in size on less than 10 percent of the stand. Alternative 3 proposes 81 acres within the HLB-MITA for non-commercial hazardous fuels reduction (of which 5 acres overlaps with the area proposed for commercial thinning). All trees >20 inches DBH would be retained.

2.5.3. Harvest Land Base – Uneven-aged Timber Area

Alternative 3 proposes treating 763 acres with selective harvest in HLB-UTA to post-harvest 40-45 percent relative density, would leave skips on at least 10 percent of the stand. All these commercial treatment acres overlap with non-commercial hazardous fuels reduction. These treatments would retain all trees >20 inches DBH. Group selection openings would not exceed 1 acre in size and 25-30 percent of the stand area. No treatment would occur within occupied NSO nor structurally complex older forest stands.

2.5.4. Late-Successional Reserve – Dry

This alternative proposes commercial thinning or selective harvest on 65 acres of LSR-Dry with a post-harvest relative density of 40-45%. All these commercial treatment acres overlap with non-commercial hazardous fuels reduction. Treatments would retain all trees >20 inches DBH. Group selection openings would not exceed 1 acre in size and 10 percent of the stand area.

2.5.5. Riparian Reserve (RR) – Dry and Moist

Alternative 3 proposes treating 1 acre in RR-Moist and 159 acres in RR-Dry with commercial thinning to post-harvest relative densities of 40-45 percent and the retention of all trees >20 inches DBH in the Outer and Middle Riparian Zones. This would equate to thinning no more than 30 percent canopy cover and 60 trees per acre. Alternative 3 proposes 29 acres within the RR-Moist for non-commercial hazardous fuels reduction (of which 1 acre overlaps with the area proposed for commercial thinning) and 2,053 acres within the RR-Dry for non-commercial hazardous fuels reduction (of which, 159 acres overlaps with the area proposed for commercial thinning). As in Alternative 2, no commercial harvest would occur in the Inner Riparian Zone.

2.5.6. Transportation Management

Alternative 3 proposes no road construction. This alternative proposes 53 miles of road renovation and potential entry into 6 existing rock quarries. Like Alternative 2, previously decommissioned roads, or roads placed in a long-term closure status, are proposed to be renovated for the project and may be closed upon project completion (USDI/BLM 2016b p. 311, 312). For a detailed discussion on Transportation Management please see Appendix D section D.3.

2.6. Alternatives Considered but Eliminated from Detailed Analysis

During the project's public scoping period, the BLM received four comments, some of which contained suggestions for alternatives to the Proposed Action. Alternatives to the Proposed Action may be considered but eliminated from detailed analysis for any of the following reasons: They do not meet the purpose and need, are technically or economically infeasible, they are inconsistent with the basic policy objectives for the management of the area, implementation is remote or speculative, they are substantially similar in design to an alternative that is analyzed in detail, or it would have substantially similar effects to an alternative that is analyzed in detail.

The IDT considered other alternatives for analysis during the interdisciplinary process. Most of these alternatives were submitted in the form of public comments during scoping. Although there were no fully developed alternatives submitted by the public many of the requested elements submitted by the public have been incorporated into the Alternatives or as part of the Proposed Action. The BLM has considered the following additional action alternatives and provides rationale as to why detailed analysis was not completed or how detailed analysis has been incorporated into the Alternatives.

The development of an alternative that treats the stands in the Last Chance area consistent with those vegetation models for the first decade of the plan's implementation.

Background: The BLM received a comment during scoping that proposed that BLM follow the sustained yield harvest regimes used for analysis in the FEIS and adhere to what was modeled in the first decade of implementation in the FEIS.

Rationale: Alternative 2 maximizes the commercial harvest acres treated and maximizes the intensity of the treatment, when it is appropriate and within the bounds of the RMP. Each treatment unit has specific circumstances, such as the occupancy status of northern spotted owl sites, which would limit the ability to maximize the size and percentage of group select areas while also avoiding "take" as required by the RMP. VRH in HLB-LITA and HLB-MITA, as well as the maximization of group selects in HLB-UTA is incorporated into Alternative 2, where appropriate, therefore this component is similar in design to the proposed action and does warrant an additional alternative.

An Alternative that creates the minimum percentage of skips (10 percent) and the maximum percentage of gaps (30 percent) using Group Selection Harvest in the Uneven Aged Treatment units.

Background: The BLM received a comment during scoping that proposed developing an alternative that creates the minimum number of "skips" (10%) and the maximum amount of group selections (30%) in the Uneven Aged Treatment Units.

Rationale: This action is a part of Alternative 2, Uneven Aged Timber Units. In stands ≥ 10 acres commercial thinning and selection harvests would retain an average stand relative density of 30 (+/- 10) percent post-harvest, would leave untreated skips on at least 10 percent of the stand, and create group selection openings on less than 30 percent of the stand.

An Alternative that treats UTA stands to the lowest Relative Density allowed by the RMP.

Background: The BLM received a comment during scoping that proposed developing an action alternative that treats UTA stands to the lowest RD allowed by the RMP.

Rationale: The 2016 RMP management direction calls for forest stands ≥ 10 acres treated with selection harvest or commercial thinning, to result in stand average relative density between 20 percent and 45 percent after harvest (USDI/BLM. 2016b p.68). Alternative 2 proposes that selection harvests would retain an average stand relative density of 30 (+/- 10) which is within the allowable range given in the RMP. The BLM may elect to defer harvest at times on particular stands in the UTA for reasons described in the management direction or in Appendix A (USDI/BLM. 2016b p. 126-127). Alternative 2 allows for post-harvest RD 20. Each treatment unit has specific circumstances, such as the occupancy status of northern spotted owl sites, which may limit the treatment of HLB-UTA stands to the lowest RD allowed by the RMP while also avoiding "take" as required by the RMP. The retention of the lowest RD allowed by the RMP is incorporated into Alternative 2, where appropriate, therefore this component is similar in design to the proposed action and does not warrant an additional alternative.

An Alternative in the Dry LSR that maximizes forest health and fire resilience objectives while maintaining NSO nesting and roosting habitat.

Background: The BLM received a comment during scoping that proposed maximizing forest health and fire resilience objectives while maintaining NSO nesting and roosting habitat in the Late-Successional Reserve-Dry.

Rationale: This action has been incorporated into Alternative 2 for the LSR-Dry LUA. The project proposes treatment of approximately 949.5 acres within the LSR-Dry. Within in the LSR-Dry integrated vegetation management treatments are intended to promote the development of NSO habitat (USDI/BLM 2016b, p. 70-72) and improve, enhance, and maintain landscape and ecosystem resilience to large-scale high-intensity/high-severity wildfires (USDI/BLM 2016b, p. 74). Activities would include commercial thinning, selection harvest, vegetation control, hazardous fuel reduction, and prescribed fire (USDI/BLM 2016b, p. 74-75). A majority of the 949.5 acres of LSR-Dry proposed for treatment in the Last Chance Project are prescribed to maintain the current habitat type and function. Only 4 acres of LSR-Dry are not proposed or analyzed for habitat maintain because, as allowed by RMP management direction, these areas are needed for access routes (such as road construction) to enter adjacent HLB and LSR-Dry stands.

Selection of small diameter timber to be thinned in overly dense stands will be based on ecological principles informed though both BLM expert knowledge and experts within the community.

Background: The BLM received a comment during scoping that proposed the selection of small diameter timber to be treated in overly dense stands based on ecological principles, incorporating BLM expert knowledge and experts within the community.

Rationale: Common to Alternatives 2 and 3 each unit within the project area has been surveyed by qualified BLM staff and has been assigned appropriate treatment prescriptions based on current conditions, using accepted methods, and following established protocols and guidelines for timber and fuels treatments based on peer reviewed science. In addition, BLM has carried out consultation with experts at the USFWS and NOAA to ensure that this project will not impair fish or wildlife habitat. Certain safeguards such as Best Management Practices and Project Design Features are written into the prescriptions and contracts to minimize adverse effects to habitat. Because the BLM has incorporated ecological principals into Alternatives 2 and 3 and is following established protocols by consulting with appropriate fish and wildlife agencies there is no need to establish a new Alternative for this issue.

An Alternative that retains large diameter trees over 20 inches.

Background: The BLM received a comment during scoping that proposed retaining mature forests and fire-resilient, large diameter trees over 20 inches.

Rationale: This action is incorporated into Alternative 3, applicable to all LUA's.

Avoid downgrading and removal of suitable spotted owl habitat, especially within the identified Late Successional Reserves.

Background: The BLM received a comment during scoping that proposed avoiding the downgrade and removal of suitable spotted owl habitat, especially within the LSR.

Rationale: This is currently an element in all alternatives. The LSR-Dry integrated vegetation management treatments are designed to promote NSO habitat development (BLM 2016b, p. 70-72) and improve, enhance, and maintain landscape and ecosystem resilience to large-scale high-intensity/high-severity wildfires (BLM 2016b, p. 74). All commercial treatments proposed to in LSR-Dry would not downgrade or remove spotted owl habitat but would lightly thin foraging or dispersal-only spotted owl habitat in order to promote NSO habitat development and resiliency. Treatments within HLB and LSR for occupied sites would retain 180 or greater square feet basal area/acre, and where appropriate would consider no treatment. Group selection in LSR-Dry would be less than 1 acre and up to 10-20 percent of the stand. Treatments within the LSR-Dry vary depending on the NSO site occupancy and the field verified NSO habitat type within a unit. Overall, the proposed logging, yarding, and hauling activities in LSR-Dry would provide for the conservation and recovery of the NSO in the short and long term. Because Alternative 2 analyzes this element of avoiding downgrading NSO habitat when possible, there is no need to develop a similar Alternative.

Existing roads are upgraded while new road construction is avoided.

Background: The BLM received a comment during scoping that proposed upgrading existing roads and avoiding new road construction.

Rationale: This alternative element has been incorporated into Alternative 3 which proposes no road construction. Alternative 3 also proposes 53 miles of road renovation. Therefore, this proposed alternative element has been incorporated into Alternative 3 and there is no need to develop and analyze a separate alternative.

2.7. Comparison of Alternatives

Table 2-5 Treatment Acreage Comparisons between Alternatives by Land Use Allocation

Treatment Management Actions	Land Use Allocation	Alternative 1 – No Action (Acres)	Alternative 2 (Acres)	Sub-Alternative 2a (Acres)	Alternative 3 (Acres)
Commercial Treatment: Variable-retention Regeneration Harvest	HLB-LITA	0	729	0	0
	HLB-MITA	0	57	0	0
Commercial Treatment: Commercial Thin	HLB-LITA	0	209	938	23
	HLB-MITA	0	0	57	5
	RR-Dry	0	1,290	1290	159
	RR-Moist	0	7	7	1
Commercial Treatment: Selection Harvest	HLB-UTA	0	4,994	4,994	763
	LSR-Dry	0	291	291	65
	DDR-TPCC	0	663	663	43
Sub-Total		**0**	**8,240**	**8,240**	**1,059**
Non-Commercial Hazardous Fuels	HLB-LITA	0	938	938	23
	HLB-MITA	0	57	57	5

Treatment Management Actions	Land Use Allocation	Alternative 1 – No Action (Acres)	Alternative 2 (Acres)	Sub-Alternative 2a (Acres)	Alternative 3 (Acres)
Reduction Treatments which DO overlap with Commercial Treatments	HLB-UTA	0	4,994	4,994	763
	LSR-Dry	0	291	291	65
	RR-Dry	0	1,290	1,290	159
	RR-Moist	0	7	7	1
	DDR-TPCC	0	663	663	43
Sub-Total		0	**8,240**	**8,240**	**1,059**
Non-Commercial Hazardous Fuels Reduction Treatments which DO NOT overlap with Commercial Treatments	HLB-LITA	0	63	63	978
	HLB-MITA	0	24	24	76
	HLB-UTA	0	1,531	1,531	5,762
	LSR-Dry	0	659	659	885
	RR-Dry	0	763	763	1,894
	RR-Moist	0	22	22	28
	DDR-TPCC	0	384	384	1,004
Sub-Total		**0**	**3,446**	**3,446**	**10,627**
Total Commercial and Non-Commercial Treatments	HLB-LITA	0	1,001	1,001	1,001
	HLB-MITA	0	81	81	81
	HLB-UTA	0	6,525	6,525	6,525
	LSR-Dry	0	950	950	950
	RR-Dry	0	2,053	2,053	2,053
	RR-Moist	0	29	29	29
	DDR-TPCC	0	1,047	1,047	1,047
Total		0	11,686	11,686	11,686
Logging Systems		(Acres)	(Acres)	(Acres)	(Acres)
Cable Yarding		0	2,590	2,590	387
Ground-based Yarding		0	5,080	5,080	672
Helicopter Yarding		0	570	570	0
Helicopter Landing Construction		0	15	15	0

Treatment Management Actions	Land Use Allocation	Alternative 1 – No Action (Acres)	Alternative 2 (Acres)	Sub-Alternative 2a (Acres)	Alternative 3 (Acres)
Total		**0**	**8,255**	**8,255**	**1,059**
Transportation Management Activities		(Miles)	(Miles)	(Miles)	(Miles)
Road Construction		0	29	29	0
Road Renovation		0	253	253	53
Total Haul Roads		**0**	**282**	**282**	**53**
Existing Quarry Entries	DDR, DDR-TPCC, HLB-UTA, HLB-LITA, RR-DRY, & LSR-DRY	Entries at 0 Quarries	Entries at 14 Quarries	Entries at 14 Quarries	Entries at 6 Quarries

CHAPTER 3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL IMPACTS

This chapter describes the affected environment and the environmental consequences of the alternatives discussed in Chapter 2, as they related to the issues identified for detailed analysis. The BLM has combined the affected environment and the environmental consequence into this single chapter to provide all of the relevant information on an issue in a single discussion. Under each issue, the BLM describes the affected environment, the methods and assumptions of the analysis, and then answers the question captured in the issue statement by describing the environmental consequence of the alternatives analyzed in detail, including the No Action Alternative.

3.1. Forest Management

Issue 1**:** What would be the economic viability and operational feasibility of commercial treatments in each alternative?

Issue 2: How would the proposed treatments in HLB contribute to the Medford District's ASQ?

Issue 3: How would the proposed treatments in HLB affect stand vigor and insect and disease susceptibility?

3.1.1. Methods and Assumptions

Methods for this analysis included project area reconnaissance, stand exam data collection from 2,061 plots in the project area, and multiple Geographic Information System (GIS) datasets including: US Forest Service Region 6 insect and disease aerial surveys, Google Earth imagery, Medford District Forest Operations Inventory (FOI) and BLM Micro*Storms (activity tracking databases), Rogue Basin 2012 Light Detection and Ranging (LiDAR) data products, as well as the analyses, direction and conclusions found in the Southwest Oregon ROD/RMP (2016) and the supporting Proposed Resource Management Plan/Final Environmental Impact Statement. Stand trajectories were modeled using the Forest Vegetation Simulator (FVS), ORGANON Southwest (OC) Variant was used over a 50-year time horizon starting in 2019 to model anticipated treatment outcomes. Stand exams were performed for the Last Chance project in 2019 and 2023.

3.1.2. Affected Environment

The proposed Last Chance project area encompasses 56,843 total acres. About 57% (32,247 acres) is managed by BLM. The project area is primarily located in three HUC 5 watersheds: Upper Cow Creek and Middle Cow Creek to the north and Grave Creek watershed to the south with a small inclusion in the Evans Creek watershed on the east side of the project area.

Overstory dominant tree species and associated understory vegetation within the project area is summarized according to Plant Associations Groups (PAGs) subseries of southern Oregon (Atzet, 1990) in Table 3-1. These areas do not include roads, landing, quarries, and other areas without much vegetation. Brief descriptions of the characteristics of the most common associations follow. As shown in Table 3-1, these forests are made up of a diverse collection of Plant Association Groups that support diverse stand compositions of conifers such as Douglas-fir, ponderosa pine, sugar pine, western hemlock, white fir, and incense cedar, as well as hardwoods such as California black oak, madrone, canyon live oak, and tanoak. These PAGs exhibit a wide variety of conditions, differing by slope, aspect, elevation, and soil types. South and west aspects exhibit relatively more cover in sugar pine, ponderosa pine, madrone, California black oak, and canyon live oak, while northern and eastern slopes, as well as more productive soil types display more white fir, hemlock, and chinquapin.

Table 3-1. PAGs & Proposed Commercial Treatments

Plant Association Group Subseries	BLM Project Area		BLM Proposed Commercial Units	
	Acres	%	Acres	%
Douglas-fir, Dry	7008	22%	1977	22%
Douglas-fir, Moist	5222	16%	1358	15%
Douglas-fir, Ultramafic	218	1%	64	1%
Ponderosa pine	481	1%	214	2%
Southwest Oregon Jeffrey pine	4883	15%	1062	12%
Western hemlock - dry	5230	16%	1558	17%
Western hemlock - intermediate	176	1%	30	0%
White fir - intermediate	4899	15%	1588	18%
White fir warm - moist	2251	7%	633	7%
Non-forest vegetation	1879	6%	453	5%
Total	**32,247**	**100%**	**8,937**	**100%**

Douglas-fir, Dry: Douglas-fir behaves as a drought tolerant pioneer in these warm, dry sites dominated by overstory Douglas-fir, occasionally with sugar pine and ponderosa pine present. The understory often contains canyon live oak, madrone, and California black oak. The two PAGs of this series in the project area are Douglas-fir/Canyon Live Oak/Poison Oak (6393 acres) and Douglas-fir/California Black Oak/Poison Oak (615 acres).

Douglas-fir, Moist: While the temperature and precipitation can be comparable to Dry associations, Moist associations tend to occur on more productive sites with better soils dominated by overstory Douglas-fir with incense-cedar. The understories often contain canyon live oak, madrone, and Pacific yew. Common PAGs of this series in the project area are Douglas-fir/Whipple vine/Western Sword Fern (4889 acres) and Douglas-fir/Dwarf Oregon grape/Western Sword Fern (316 acres).

Ponderosa Pine: These are mainly dry sites dominated by ponderosa pine and Douglas-fir. The understory often contains incense-cedar, canyon live oak, and sugar pine. In the project area these are often found as small inclusions on dry, exposed sites. The only PAG of this series in the project area is Ponderosa Pine/Douglas-fir/Southwest Oregon (481 acres).

Jeffrey Pine: Jeffery pine is often the dominating species on ultramafic sites. A characteristic feature of the series is an open canopy of trees, shrubs, and herbs. Douglas-fir and incense-cedar are often found in most associations in both the overstory and the understory. The two PAGs of this series in the project area are Jeffrey Pine/Douglas-fir/Incense-cedar (4521 acres) and Jeffrey Pine/Red Fescue (363 acres).

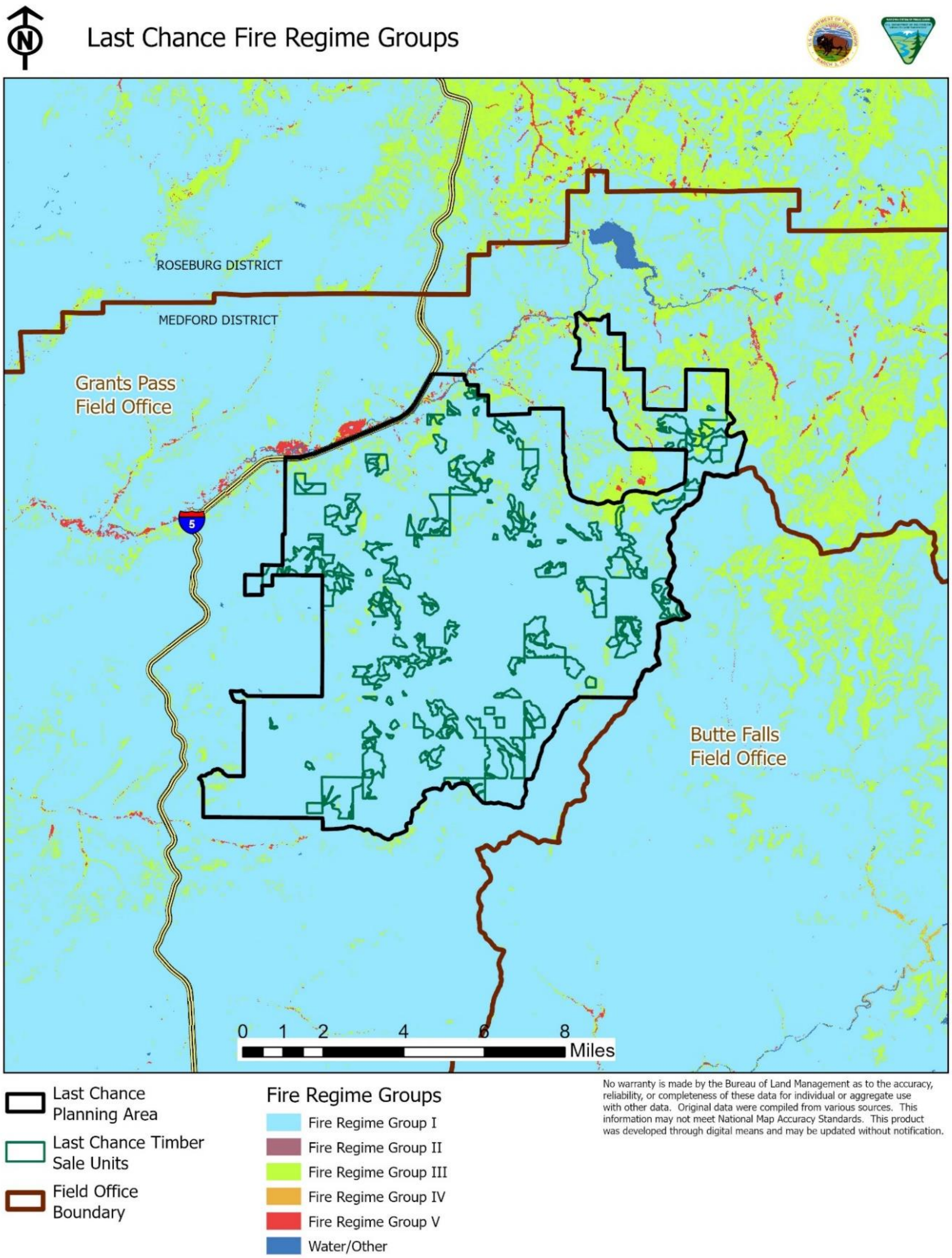
Western Hemlock: At the southern edge of the hemlock range where the project is located, hemlock associations tend to exist in moist, cool drainages or north aspects. Overstories are still dominated by Douglas-fir with occasional hemlocks present, but hemlock is common in the understory along with chinquapin, madrone, and incense-cedar. By far the most common PAG of this series in the project area is Western Hemlock/Dwarf Oregon grape/Salal/Western Sword Fern (5230 acres). This PAG is a dry subseries of western hemlock. The other western hemlock PAGs are very minor components and classified as intermediate subseries.

White Fir, Intermediate: Much like the hemlock associations above, this white fir series are dominated by Douglas-fir, with an overstory cohort of white fir that likely established after Douglas-fir pioneered the site following disturbance. Understories also include chinquapin and yew. These stands tend to occur on cool sites. Common PAGs of this series in the project area are White Fir/Douglas-fir/Creeping Snowberry/Bald hip Rose/Western Star flower (2908 acres), White Fir/Dwarf Oregon grape/Common Prince's Pine/Western Twin flower (1991 acres).

White Fir, warm moist: This white fir series is also dominated by Douglas-fir. White fir and incense-cedar are frequent in the overstory and present in the understory. In the understory, golden chinquapin and Pacific madrone are frequent, and sugar pine is common. The only PAG of this series in the project area is White Fir/Dwarf Oregon grape/Whipple vine (2251 acres).

Before the fire suppression and intensive management practices of the twentieth century, the project area was characterized by high frequency, low severity fires that would have reduced fuel loadings and maintained a mosaic of open stand conditions different from what is seen today. In the Last Chance project area 95% is within Fire Regime Group 1 characterized by a fire return interval of less than 35 years of low and mixed severity. The remaining 5% is Fire Regime Group 3 with fire intervals of between 35-200 years of low and mixed severity (Figure 2) (LANDFIRE, 2016). All other groups are less than 0.5% of the project area.

Figure 2. Fire Regime Groups within the Last Chance Project Area



Under the active disturbance regime described, stands would have been dominated by drought-tolerant Douglas-fir, pines and oaks that develop fire resistant, complex forms in open growing conditions following these frequent low to mixed severity fires. After missing several fire return cycles, the likelihood of uncharacteristic fire behavior and high severity fire increases due to the buildup of fuels (Brown et al. 2004, Hessberg et al. 2005, Kauffman 2004, Reinhardt et al. 2008, Ryan et al. 2013).

As shown in Table 3-1 and Figure 3-1 approximately half of the BLM lands contained in the Last Chance planning area have had some form of commercial timber management since 1950. This data comes from the BLM's Micro*Storms database. While it is the best available, it may be incomplete.

Table 3-2. History of Commercial Silvicultural Practices in the Last Chance Project Area

Decade	**Clearcut/ Regeneration (acres)**	**Selective Cut (acres)**	**Thinning (acres)**	**Salvage (acres)**	**Total by Decade (acres)**
1945-1949	422	1,673	60	0	2,155
1950-1959	1,738	839	0	22	2,599
1960-1969	2,210	824	0	22	3,056
1970-1979	1,757	3,803	0	53	5,613
1980-1989	4,382	891	119	0	5,392
1990-1999	1,469	99	169	0	1,737
2000-2009	39	0	275	7	321
2010-2022	0	0	311	0	311
Total by Type	12,017	8,129	934	104	21,184
% BLM Lands					

About a third of the planning area has undergone some form of clearcut or VRH which was the most common silvicultural management approach. 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. These practices were most common in the 1960s, and then again in the 1980s.

Selection harvest has been implemented in the planning area, accounting for about 20% of the BLM managed lands. This approach can take on a variety of forms. Usually, it refers to the overstory removal of some of the dominant trees in a stand to release the middle and understory trees.

Approximately 7% of the stands in the planning area have been thinned. Thinning refers to the partial harvest of an overly dense stand, intending to redistribute resources and stimulate growth of residual trees. Salvage refers to the harvest of trees following disturbance, such as mortality due to wildfires, windstorms, insects, or disease. About 2% of the planning area stands have been salvage harvested. Thus removing the dead, dying and high-risk trees to slow pest progression and recoup economic value.

It is important to note that the same acres may have been treated in different years with different techniques, for example thinning in the 2000s likely is occurring on the same piece of ground that was clearcut in the 1960s. In the Last Chance project area these practices, along with fire suppression, effectively shifted the tree species diversity towards more dominance of shade tolerant Douglas-fir over less tolerant pine and oak species. This change converted late seral open and closed canopy forests into mid seral closed canopy forest as average tree diameters decreased and the lack of regular disturbance allowed dense regeneration to persist in light limited settings.

Recent aerial surveys of forest health were conducted over the entire Last Chance project area in 2017, 2018, 2019, 2022 and 2023, (USDA Forest Service, Forest Health Protection, 2024). About 20% of the area was surveyed in 2020 and none of the area was surveyed in 2021. Based on the last five years of completed survey, acreage of mortality by pests increased from endemic levels in 2017 and no significant damage in 2018 to widespread defoliation and mortality in 2022 and 2023 (Figures 4 & 5).

Douglas-fir experienced a noticeable spike in mortality from 2019-2023 associated with flatheaded fir borer activity on lower elevations in the northwest side of the project area. This type of mortality usually occurs when overstocked lower elevation stands of Douglas-fir are weakened by drought then finished off by scavenging borers. However much of this mortality is probably from drought alone, (Bennett et al, 2023). Bear feeding and Douglas-fir beetles were other significant sources of Douglas-fir mortality. However, most of the recent mortality in the project area has been concentrated on true fir stands by the introduced balsam wooly adelgid, along with native *Cytospora* canker and fir engraver beetles. Madrone defoliation was also common in the project area in 2022.

Pests of sugar pine (mountain pine beetle) and ponderosa pine (Ips engraver and western pine beetle) were less common in later survey years compared to 2017. This is to be expected since these host trees are less common due to the introduced white pine blister rust killing sugar pine and competition induced mortality of ponderosa pine due to fire exclusion both working in concert with their respective insect pasts for much of the past century. These now relict conifer species appear most frequently in the top layer of forest stands, making up a very small legacy component of stands. Regeneration and younger trees of these species are uncommon. This simplification of stands into less fire resistant, closed canopy, mid seral conditions is an undesirable shift in terms of stand level tree species diversity and forest resilience.

Much of this mortality is in densely stocked stands of relatively tolerant species such as true fir and Douglas-fir. Densely stocked stands develop in the absence of disturbance, which has also increased the overall cover of Douglas-fir in all stand layers (top, middle, and bottom). Douglas-fir tends to produce conditions that favor fire because it is self-pruning, often sheds its needles, and tends to increase the rate of fuel buildup and drying (Atzet and Wheeler 1984). Subsequently, this substantial shift in species composition has heightened the competitive advantage of shade tolerant trees, increasing its absolute cover and relative density (BLM 1996, p.36), thereby increasing the overall fire hazard. Refer to the Fuels Report for additional information on fire risks.

Figure 3-1. Location of Past Commercial Silvicultural Treatments in the Last Chance Project Area

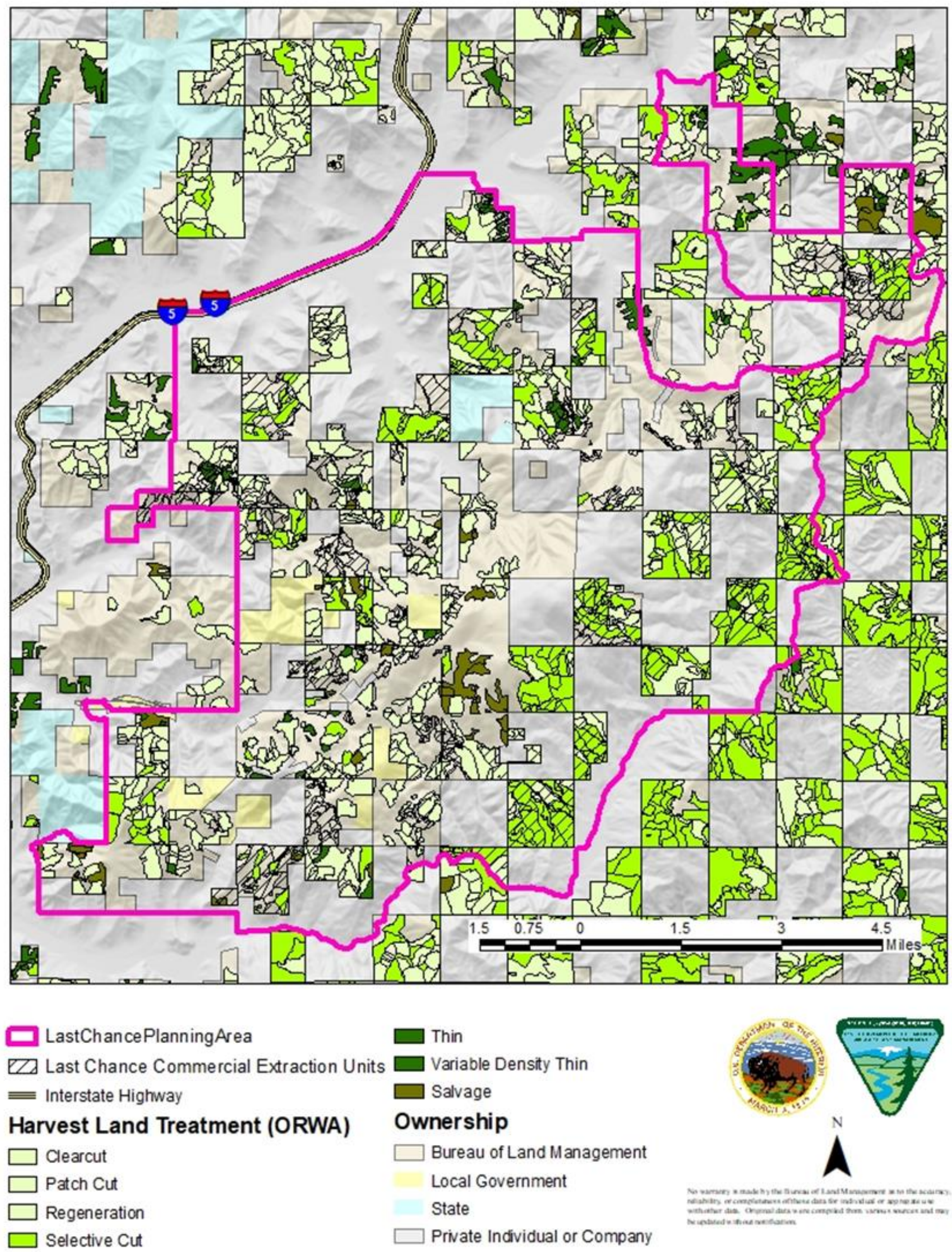


Figure 4. Location of Major Damaging Forest Agents in the Last Chance Project Area 2017-2023

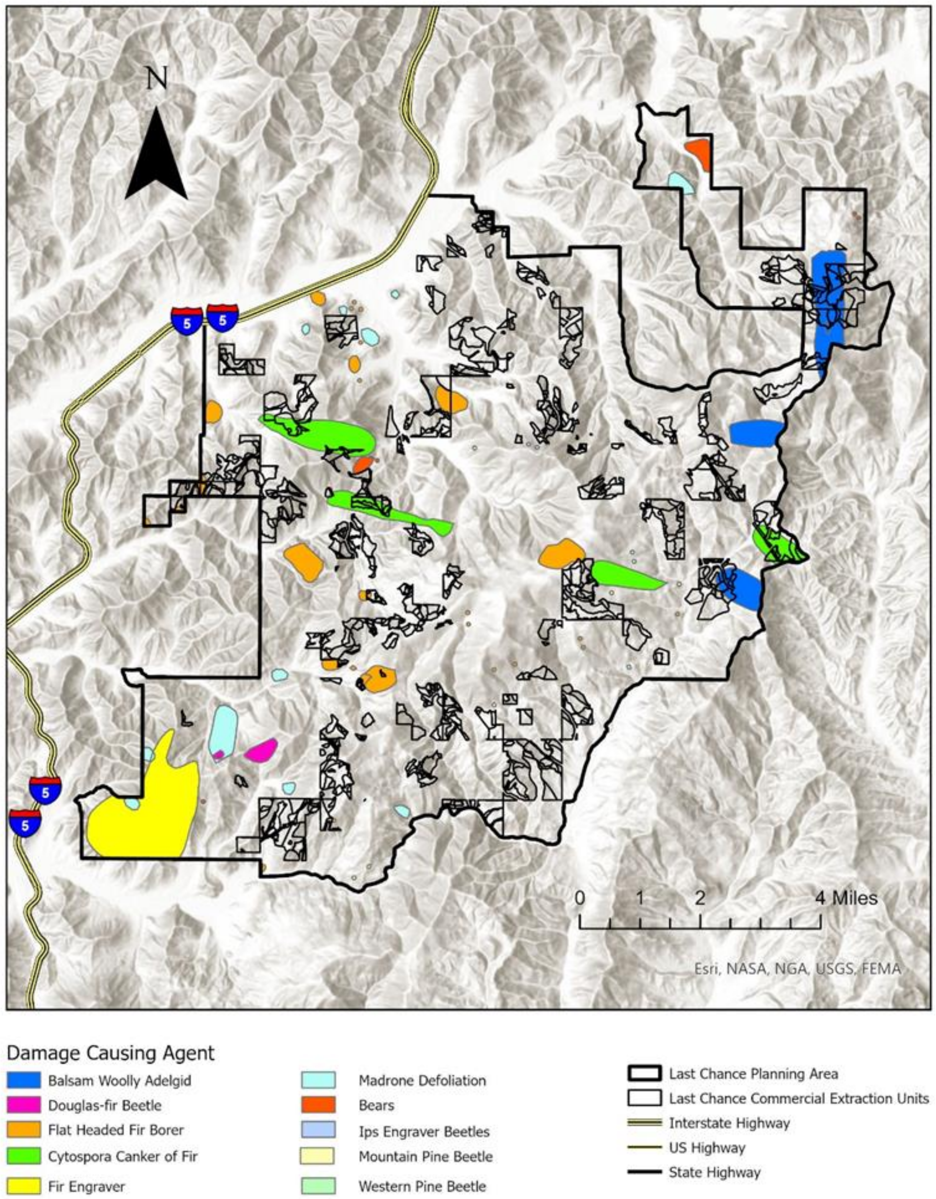
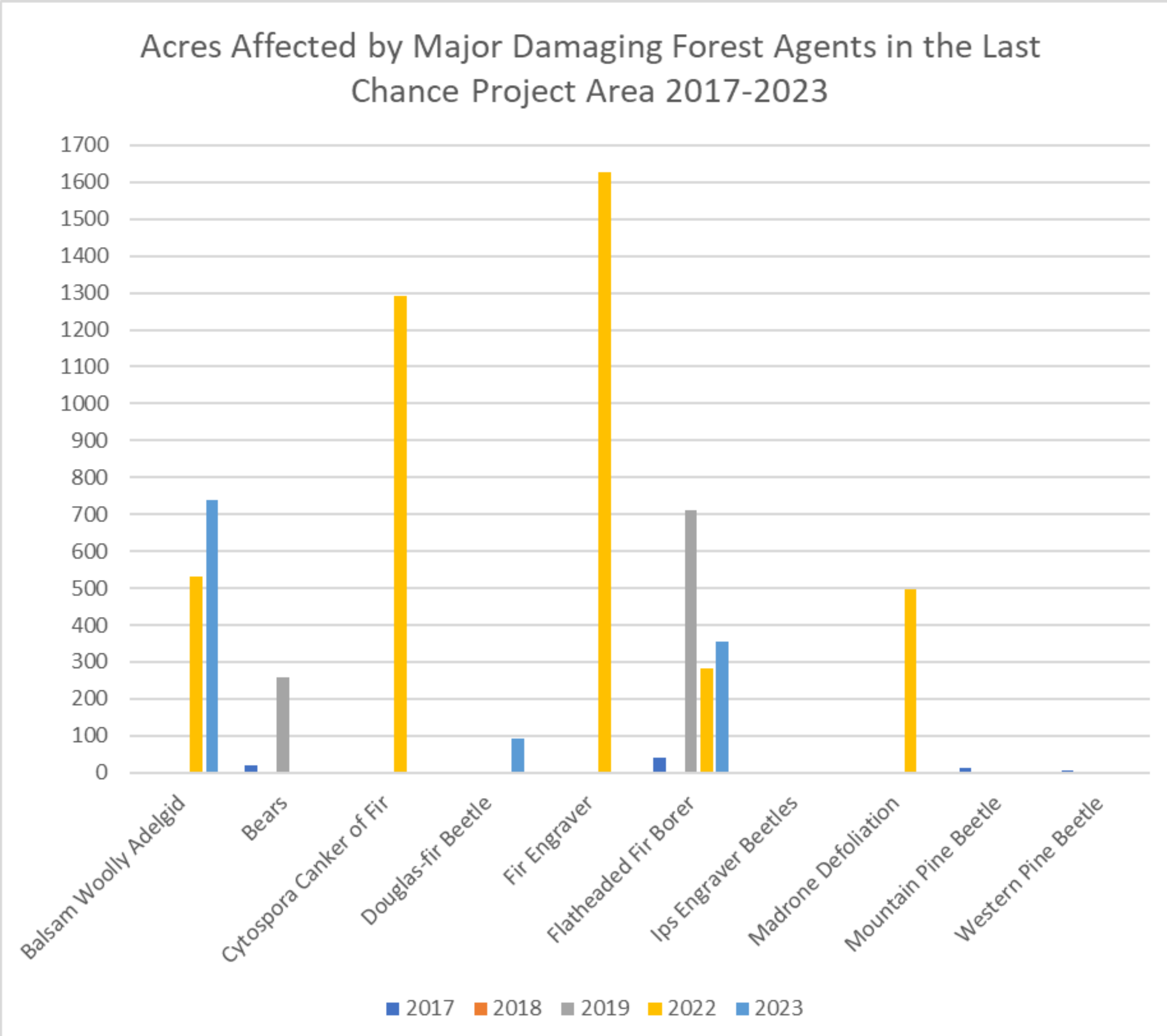


Figure 5. Acreage by Survey Year of Major Damaging Forest Agents in the Last Chance Project Area

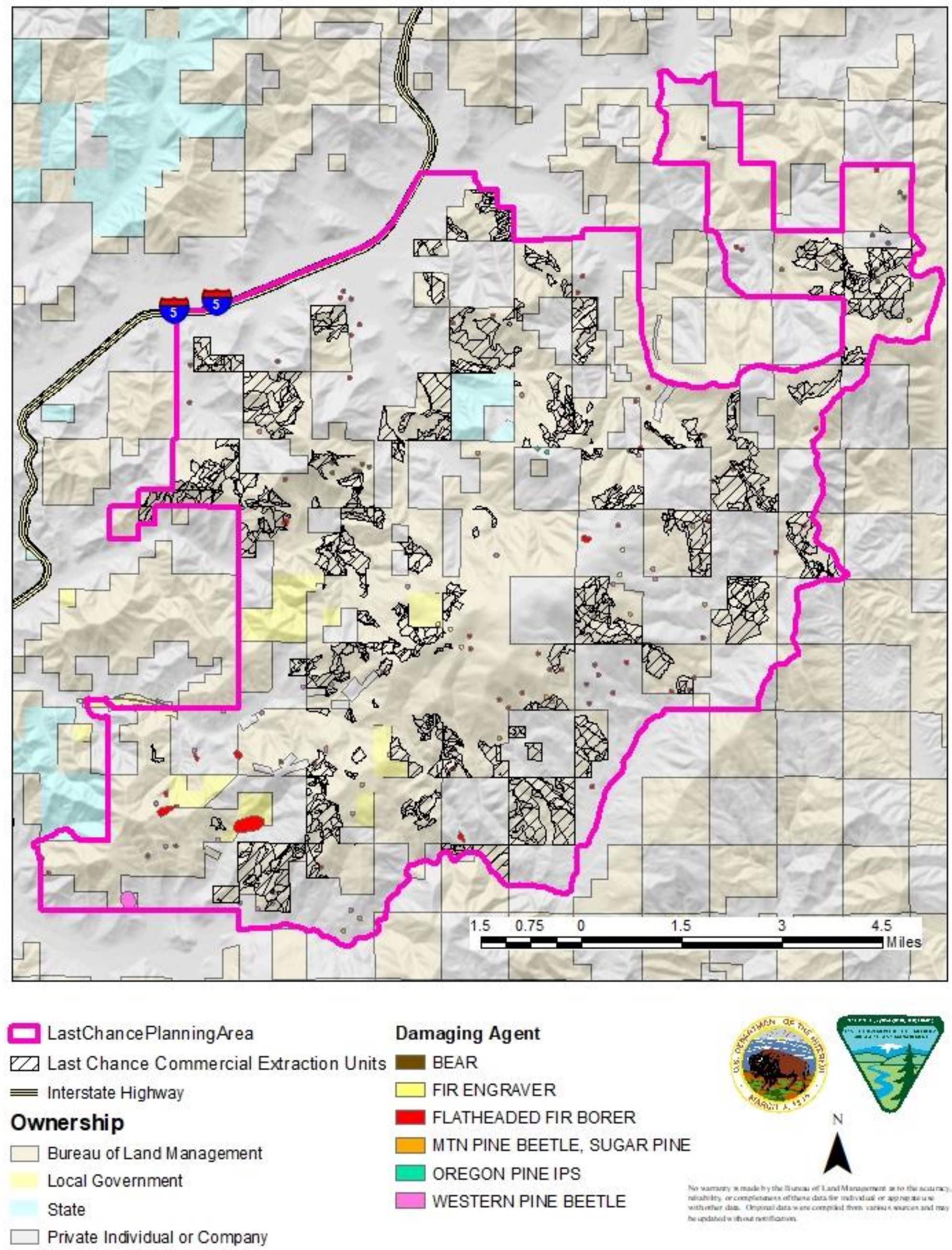


Even in areas that were not commercially harvested, the impact of fire suppression has changed the forest successional condition. As shown in Table 3-3, the forest seral stage conditions in the Last Chance project area track with the same patterns seen in the FEIS supporting the 2016 ROD/RMP (FEIS vol. 3, p. 1314). There is a prominent excess of mid-seral, closed canopy forest, and a deficiency of late seral open canopy forest as well as a shortage of high quality early seral conditions. The harvest actions proposed in Last Chance are consistent with the RMP/ROD 2016, such as Selection Harvest, VRH, and Riparian Reserve areas etc. depending on the Land Use Allocation involved. These actions would, over time, move the BLM administered lands towards the suite of desired conditions as described for the included Land Use Allocations (USDI/ROD 2016b, pg. 3, 47).

Table 3-3. Last Chance Stand Seral Class and Structure

Stand Seral Class and Structure	***Historical Range of Variation (HRV) for Douglas-fir-Dry and Moist: SW Oregon*** [13]	***Approximate Acres in Last Chance Project Area (Percent all ownerships)***	***Approximate Acres in Proposed Last Chance Commercial Units (Percent of Commercial Units)***
Early Seral	***7-17%***	***4,113 (8%)***	***316 (4%)***
Mid Seral Closed Canopy	***2-8%***	***9,269 (75%)***	***6,916 (83%)***
Mid Seral Open Canopy	***11-22%***	***3,732 (7%)***	***205 (2%)***
Late Seral Open Canopy	***40-55%***	***316 (1%)***	***26 (0%)***
Late Seral Closed Canopy	***16-25%***	***5175 (10%)***	***851 (10%)***
TOTAL		***52,606 (100%)***	***8,314 (100%)***

Figure 3-2. Location of Forest Pest Outbreaks in the Last Chance Project Area



3.1.3. No Action Alternative Common to Issue 1 and Issue 2

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 an over representation of closed canopy, mid seral stand conditions as discussed above in Table 3-3. Because trees growing in dense conditions grow in height, but very little in diameter (Oliver and Larson 1996, pg. 75). Overall stand growth would remain stagnant as stands would be left in overly dense conditions (Tappeiner et al. 2007, p.124). Alternative 1 ensures the direct and indirect effect of declining individual tree and stand vigor because if a stand is allowed to grow for many years within the zone of imminent competition mortality, mortality would occur (Drew and Flewelling 1979). In dense stands, non-vigorous large trees would likely not persist, and a non-vigorous stand would likely not develop large woody structure. 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. As a result of the limited resources for tree growth in the stand, diameter growth would lag behind height growth (O'Hara, 2014 pg. 100), and the risk for windthrow would increase over time as height: diameter ratios continue to increase and crown ratios decrease. Forest floors would continue accumulating fuel as trees continue to self-prune. Current densities threaten the persistence of minor species composition both directly by fire risk and indirectly by the effects of competition mortality from Douglas-fir as shade intolerant pine and oak species continue to decline.

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 BLM Resource Management Plan (RMP/ROD 2016), 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) and County Protection Agencies.

In summary, the No Action Alternative would restrict the development of uneven aged, multi-cohort stands and open grown trees. It would decrease vegetative species diversity and growing space for hardwood and pine persistence. There would be fewer opportunities for pine and hardwood regeneration. It would not produce timber to contribute to the declared Allowable Sale Quantity (ASQ). There would be a cumulative adverse effect of reduced conifer growth and vigor. The economic value of timber stands would not be enhanced in the Harvest Land Base as directed by the 2016 RMP/ROD. Fuel loadings would increase in Late Successional and Riparian Reserve allocations.

3.1.4. Direct and Indirect Effects Common to Action Alternative

The effects of management actions common to Action Alternative are:

A reduction in stand densities would promote growth and vigor on the remaining stand. Residual trees would increase in height and to a greater extent diameter growth as the resources of the stand are reallocated to the trees most likely to take advantage of the additional water, sunlight and soil nutrients. This increased growth would be generally in the proportion of the percentage of stand removed within the range of Relative Density Indexes considered for retention (20-45%) (Oliver and Larson 1996, pg. 36, Tappeiner et al. 2007, p.127).

By taking additional measures to promote and protect most healthy individuals early seral tree species (primarily pines and oaks) stand diversity and resilience to fire and other damaging agents would be increased, ensuring that RMP species diversity goals could be met and sustained (RMP/ROD 2016, p.

68). This diversity in tree species and sizes is important for ecosystem function and resilience (Franklin et al. 2002).

Risk of windthrow could be increased in the short term from 2 to 10 years after thinning, before tree stems and root systems have adapted after thinning, selection harvest, or variable retention harvest of timber stands. By removing a part of the canopy, thinning immediately reduces stand stability by increasing the wind load on residual trees (Moreau et al, 2022**).** However, windthrow occurs in both managed and unmanaged stands and predicting these events is speculative. Wind events of enough magnitude to substantially modify the post-treatment stands are inherently random in nature, and our prescriptions that favor the retention of larger, healthier and more firmly rooted trees would suffer significantly fewer problems than the edges of large clearcuts created by other nearby ownerships. The pine species generally designated for protection in this project all form deep taproots and are considered windfirm, while Douglas-fir roots less likely to form deep taproots and the wind firmness) is more variable (Burns and Honkala, 1990).

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: 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, 1961, pg. 21, Moore et al. 2003, Wonn and O'Hara, 2001, pg. 92, Tappeiner et al. 2007, pg. 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, pg. 100).

3.1.5. Alternative 2 and 3 Direct and Indirect Effects

The Role of Relative Density

The 2016 RMP/ROD (pg. 311) defines Relative Density as: "A means of describing the level of competition among trees or site occupancy in a stand, relative to some theoretical maximum based on tree density, size, and species composition. Relative density percent is calculated by expressing Stand Density Index (SDI) (Reineke 1933) as a percentage of the theoretical maximum SDI, which varies by tree species and range. Curtis's relative density (Curtis 1982) is determined mathematically by dividing the stand basal area by the square root of the quadratic mean diameter."

The onset of competition is at 25%, 35% is the lower limit of full site occupancy, and 60% is associated with the lower limit of self-thinning, which is tree mortality (Long and Daniel, 1990). For the purposes of this analysis, 20-45% Relative Density Index (RMP/ROD 2016 pg. 68) is considered desirable in that trees would occupy the site, and self-thinning would not yet have occurred at the stand level.

"Low Thinning" versus "Selection/Free Thinning" Methods

Classical thinning regimes are intermediate operations that are usually associated with even-aged systems, but are also applicable to uneven aged management. Two classical thinning methods and their effects on stand development are of particular interest in this analysis: low thinning/thinning from below which cuts mostly smaller trees to reduce densities while retaining a higher proportion of large trees, and selection harvest/free thinning which allows for tree removal of various sizes to reduce densities. The former removes entire cohorts of trees and simplifies stand structure, while the latter allows for greater structural diversity, and adjustments of species composition over time. In addition to the stand tending operations such as thinning, uneven aged management systems must consider regeneration or else the system cannot be sustained over time (O'Hara, 2014, pg. 84-97). Gap dynamics account for this.

Gap Dynamics and Regeneration in Uneven Aged Systems

York et al. (2004) and York and Battles (2008) studied the effect of various created gap sizes on the residual stand growth and the new cohorts of trees that were established post-harvest. The results indicated that group selection needed to be larger than 0.6 hectares (about 1.5 acres) to avoid severe height suppression in the newly established seedlings, and that 1 hectare (about 2.5 acres) and larger maximized growth potential of seedlings. They also suggest that in order to maximize the availability of resources to the residual trees, thinning should also occur throughout the stand, rather than implementing group selection only. Group selections smaller than half an acre (0.2 ha) are associated with stunted growth, particularly in pine species; such a management approach would inhibit tree regeneration and is unlikely to promote the development of multi-cohort stands, open grown trees or allow for pine persistence.

Vegetation Modeling Assumptions from the PRMP Final EIS

Appendix C of the Final Environmental Impact Statement (pg. 1163-1227) describes the assumptions applied to sustained yield vegetation modelling for use in the final RMP/ROD 2016. While these modelling assumptions are not Management Direction or Decisions found in the 2016 RMP/ROD, they did inform the Allowable Sale Quantity Decision for the Medford sustained yield unit and are relevant information as such. Page 1196 describes the modeled treatment return interval for the Uneven Aged Timber Area as 40-50 years; while this was not a required interval, and agency discretion allows for considerable variation depending on site specific considerations and a project's Purpose and Need, there was no assumption that subsequent commercial re-treatment occur within 20 years or less in a stand. As described above, uneven aged management systems must consider regeneration or else the system cannot be sustained over time (O'Hara, 2014, pg. 84-97). The assumptions applied in the model were that if a stand's initial relative density was too low to allow for economically viable commercial thinning, or if the stand was older than 80-90 years, 30% of the stand would be harvested through group selections and commercial thinning would occur elsewhere (USDI/BLM, 2016a, p. 1196). In summary, logging portions of stands through group selection would allow for a vigorous, young cohort to establish, while thinning other portions would allow for enhanced growth of reproduction that could also be available for harvest in the future, overall promoting a sustained yield of timber over time.

3.1.6. Issue 3: How would the proposed treatments in HLB affect stand vigor and insect and disease susceptibility?

Moreau et al (2022) reviewed recent literature to identify the effects of thinning on both stand-and tree-level resistance and resilience to stressors. While their review suggests that thinning should not be promoted as a tool that would universally increase the resistance and resilience of forests, their review supports that evidence strongly suggests that thinning offers great potential at limiting the overall risk at the stand level could be an effective tool to reduce forest vulnerability to drought, insects and pathogens. Thinning increases the growth and vigor by retaining trees with favorable traits, making them less susceptible to eruptive insects and pathogens, while reducing density and targeted removal of host species, susceptible individuals, and infected trees, which can slow the development and spread of outbreaks. Thinning can mitigate the impacts of insect and pathogen out-breaks by increasing the overall diversity and evenness of species. The application of thinning has been shown to significantly reduced the negative effects of bark beetles (Moreau et al 2022).

The onset of stand level competition is at 25% relative density, 35% is the lower limit of full site occupancy, and 60% is associated with the lower limit of self-thinning, which is tree mortality (Long and Daniel, 1990). For the purposes of this analysis, 20-45% Relative Density Index (RMP/ROD 2016 pg. 68) is considered desirable in that trees would occupy the site, and self-thinning would not yet have occurred at the stand level.

3.1.6.1. *Alternative 1*

Direct, Indirect, and Cumulative Effects

The No Action Alternative would promote the continuation of increased relative density and decreased nutrients and resources available to support the higher densities, resulting in reduced individual tree and stand level vigor and until mortality from reduced resource availability or other stressors (insects, disease) occurs and self-thinning (reduced density) occurs, which may also spread to other adjacent stands. It would not increase or promote vegetative species diversity and growing space for hardwoods and pine persistence. There would be fewer opportunities for pine and hardwood to reestablish through natural regeneration. There would be a cumulative adverse effect of reduced conifer and hardwood growth and vigor within existing stands.

3.1.6.2. *Alternative 2, 2a, 3*

Direct, Indirect, and Cumulative Effects

A reduction in stand densities would promote growth and vigor on the remaining stand. The action alternatives all propose reducing relative densities below 60%, and residual trees would increase in height and diameter growth as the resources of the stand are reallocated to the trees most likely to take advantage of the additional water, sunlight and soil nutrients. This increased growth would be generally in proportion to the percentage of stand removed within the range of Relative Density Indexes considered for retention (20-45%) (Oliver and Larson 1996, pg. 36, Tappeiner et al. 2007, p.127).

Moreau's review (Moreau et al, 2022) determined that the positive effects of reduced drought mortality increase with thinning intensity, with heavy thinning removing more than 40 percent of basal area (BA) being most effective, and positive benefits becoming negligible within 20–40 years as crowns grow and nutrient demands increase, and that removing less than 30 percent of BA had no measurable effect on the response to drought.

The Action Alternatives would increase tree and stand vigor and resilience and resistance to insect and disease susceptibility by reducing relative densities to below levels associated with the lower limit of self-thinning (60% RD) however, Alternative 3 may not provide enough benefit as the lower level of relative density (40%) combined with 20" DBH retention, may not achieve the minimum level of heavy thinning (40 percent of basal area removal) for most effectiveness as described by Moreau et al (2022). Increased resilience and resistance up to 729 acres in Alternative 2&2a would occur by reducing relative densities to 20-45% RD or less, in HLB (EA tables 2.1, 2.2, 2.3) compared to Alternative 3 which would retain higher 40-45% RD and basal area and would treat only up to 291 acres. Relative density does not correlate directly with basal area, however, the benefits to vigor, resiliency, resistance, and reduced susceptibility would be generally in proportion to the percentage of the stand removed.

3.1.7. Issue 4: How would silviculture and fuels treatments in the DDR-TPCC LUA promote desired species composition and ecological conditions?

Commercial and non-commercial treatments in DDR-TPCC would implement silvicultural prescriptions to restore and maintain community-level structural characteristics and promote desired species composition by culturing more drought tolerant species such as pine, oak, and cedar. This would be accomplished by removing encroaching less drought and fire-resistant Douglas-fir and madrone from these characteristically more open forested areas. The project would also re-introduce prescribed fire to reduce the presence of dense understory vegetation, therefore, emulating ecological conditions produced by historic fire regimes. Some units may require understory reduction treatments to remove excess vegetation prior to the re-introduction of prescribed fire to ensure that ecological conditions produced by historic fire regimes can be achieved.

3.1.7.1. *Analytical Methods and Assumptions*

Eight stands containing 127 total acres of DDR were analyzed with Forest Vegetation Simulator runs over a 40-year timeframe to determine the probable trajectories of canopy and basal area growth of each stand under the no action and the two actions scenarios.

The stand modeling applied several assumptions to the treated and untreated stands. Outside influences that could occur in the future (e.g., mortality from insects/disease, fire, windthrow, or new land management policies) were not included because these were unknown and impossible to predict. Stands were modeled to include natural seedling and sapling regeneration extrapolated from those in stand exam plots. The BLM modeled only one single entry of selection harvest during the analysis timeframe (2025-2065). No additional understory small diameter thinning, or prescribed fire treatments were applied to the stand modeling. The PRMP/FEIS "modeling team modeled the application of a combination of group selection (patch cut) harvests and thinning to various stand components at intervals of 40-50 years, depending on site productivity" (2016 PRMP/FEIS, BLM 2016b p. 1196). Skips and group selection openings would be factored into the overall residual relative density at the stand level. At least 10 percent of the stand would be in skips, and no more than 25 percent of the stand would be in group selection openings (BLM 2016a, p. 72) in stands that are 10 acres or greater in size.

3.1.7.2. *Affected Environment*

DDR-TPCC (non-suitable forest land and non-forest land) accounts for 708 acres across the project area. These areas are largely in a band running from the southwest corner to the northeast corner of the project area. Most of these acres are in the Southwest Oregon Jeffrey Pine Plant Association Group.

In this area and Plant Association group Jeffrey pine is often the dominant tree species on soils derived from ultramafic parent material. Ultramafic bedrock is high in minerals with a high proportion of nickel and chromium that is toxic to most plants, resulting in a unique species and diverse flora. These species would be frequently found yet often have low covers. Jeffrey pine is common in both the overstory and the understory, as are Douglas-fir and incense-cedar. A common feature of this Series is an open canopy of trees, shrubs, forbs, and grasses, with tree cover averaging only 35% On Bureau of Land Management sites, (Atzet et al, 1996).

However, in recent years these open forests of Jeffrey pine grasslands have been encroached upon by faster growing less fire tolerant and more shade tolerant conifers, primarily Douglas-fir and to a lesser extent incense-cedar, as well as hardwoods, primarily madrone. The action alternatives seek to use commercial harvest and fuels treatments to restore these open Jeffrey pine stands with an understory dominated by native grasses, forbs, and other unique endemic plants. This would be accomplished by removing most of the conifers that are less resilient to fire and other disturbances than Jeffrey pine.

3.1.7.3. *Environmental Consequences*

<u>No Action</u>

The no action would not remove this faster growing encroaching vegetation. The existing forest would continue to grow and suppress Jeffrey pine, ponderosa pine, oaks, and other unique early successional species. Stand structure would continue to simplify and be more uniform and more prone to disturbance.

Of the eight modelled stands basal area increased in all stands by an average of 14% over the 40-year time frame. Conversely, total canopy cover was reduced in six of eight stands and over all eight stands from 79% to 74%. This uneven reduction is probably the result of reductions of lower and middle canopy layers by the variability of dominating overstory competition from stand to stand.

Alternative 2

Alternative 2 would remove much of this faster growing encroaching vegetation throughout the 8 inch to 36-inch diameter classes. The remaining post-harvest forest would contain a much higher proportion of Jeffrey pine, ponderosa pine, oaks, and other early successional species. Stand structure would much be less uniform than before and consist of a variable density forest with openings less than 4 acres, small gaps, and uncut areas (skips). Remaining pines and other early seral species would have room to expand by removing many of the larger trees around them. Open meadows and other non-forested areas would increase. The post-harvest areas would be much more resistant to disturbances.

Of the eight modelled stands basal area decreased after harvest and remained below this level after 40 years in all stands. The average of these stands went from preharvest basal area 284 square feet per acre to post harvest levels of 111. After 40 years mean basal area was back up to 163. Total canopy cover was reduced in all eight stands from 76% preharvest to 46% post-harvest and then back up to 57% after 40 years. This should give ample time for early seral vegetation to recover and maintenance operations to be performed to maintain and possibly enlarge this open forest type.

Alternative 3

Alternative 3 would remove only trees of the 8 inch to 20-inch diameter classes of this faster growing encroaching vegetation. To make this harvest economical, most of these trees would have to be removed. However, the remaining larger Douglas-fir would continue to grow and suppress Jeffrey pine, ponderosa pine, oaks, and other unique early successional species. Stand structure would continue to simplify and be prone to disturbance.

Of the eight modelled stands basal area decreased in 7 of 8 stands by the end of the 40-year analysis. The average of these stands went from preharvest basal area of 284 square feet per acre to post harvest levels of 189. After 40 years mean basal area was back up to 237. Total canopy cover was reduced in all eight stands from 76% preharvest to 58% post-harvest, but in contrast to alternative 2 it continued to slowly decline to 56% after 40 years. This is probably because of a vigorous overstory reducing much of the vegetation underneath it. Few of the desired species would be able to flourish in these conditions. Very few small trees would be left, and few open space would be available for them to grow in.

Cumulative Effects

To be determined in final draft.

3.2. Fire and Fuels

3.2.1. Issue 5: How would the Last Chance Vegetation Management actions affect stand level fire resistance (or fire hazard)?

3.2.1.1. *Background*

See Appendix D.5 for more detailed information relevant to this issue.

3.2.1.2. *Summary of Analytical Methods*

The BLM evaluated direct and indirect effects to temporary (1-2 years) surface fuel hazard and short-term (up to 20 years) stand-level fire resistance and hazard following implementation of proposed actions. The BLM also evaluated direct and indirect effects for the moderate-term time frame (up to 50 years). The BLM discussed cumulative effects at the stand scale over time, considering the incremental impact of proposed actions when added to other past, present, and reasonably foreseeable future actions or natural disturbance.

In this analysis section, the BLM tiers to the assumptions and results from the PRMP/FEIS (Issue #2 pp. 243-252, Appendix H) to assess effects of the alternatives on the fuel profile continuity and thus the relative resistance to stand-replacement fire rating (i.e., expected fire behavior). To assess environmental effects by alternative the BLM calculated the percent distribution of maximum proposed action acreage in relative resistance to stand replacement fire categories by alternative as a measurement indicator. This rating is based on likely fire behavior under typical fire weather conditions, given the structural stage and wildland fuel profile (see Appendix D.5 Methods and Assumptions sections). The BLM used a standard approach to derive a relative resistance to stand-replacement fire categories, based on the relationship between indices of relative crown fire potential. The BLM generated these crown fire potential indices with the Nexus 2.1 crown fire modeling program, which links separate models of surface fire behavior and crown fire behavior. In the fire behavior modeling, the BLM accounted for slope and the sheltering effect the canopy has on windspeeds and applied standard wind adjustment factors according to NEXUS recommendations and guidance for estimating wind speeds in the Fire Behavior Field Reference Guide (NWCG 2021) and fine dead fuel moisture (Appendix D.5 Analytic Assumptions).The BLM also analyzed change in small-scale heterogeneity patterns consistent with fuel loadings and arrangements associated with frequent fire, dry forest low and mixed severity fire regimes.

3.2.1.3. *Assumptions*

The BLM applied a standard approach to derive a relative resistance to stand-replacement fire for *mixed* resistance categories, based on the relationship between indices of relative crown fire potential: crowning index (CI) and torching index (TI) (See Appendix D.5). The rating was as follows: if CI is less than 20 mph, relative resistance is *low*, however if TI is greater than 20 mph, relative resistance is *moderate-low*; if CI is between 20-30 mph, and TI is less than 20 mph, relative resistance is *moderate-low,* if CI is between 20-30 mph, and TI is greater than 20 mph, relative resistance is *moderate-high*; and if predicted CI is greater than 30 mph, relative resistance is *high*, unless the TI is less than 30 mph, then resistance would be *moderate-high*. (Appendix D.5, Table 3.5.1).

Table 3.5.1. Explanation of the relationship between crowning index (CI), torching index (TI), and relative stand replacement fire resistance.

Crowning Index (CI)	Torching Index (TI)	Relative Stand Replacement Fire Resistance
<20 mph	<20 mph	LOW
	>20 mph	MODERATE-low[12]
20 – 30 mph	<20 mph	MODERATE-low
	>20 mph	MODERATE-high
>30 mph	<30 mph	MODERATE-high
	>30 mph	HIGH

[12] If TI is greater than CI, this indicates that within-stand crown fire initiation is unlikely, however stand canopy connectivity may support crown fire spread from adjacent areas under windspeeds equal or below CI windspeeds (i.e., independent crownfire).

Wildland Fuel Profile

The BLM assumed the following metrics define continuity of the wildland fuel profile (Appendix D.5,): canopy fuels (canopy connectivity (canopy cover and canopy bulk density), ladder fuels (canopy base height), surface fuels (surface fuel models) (Scott and Burgan 2005) and fuel heterogeneity and thus influence fire resistance (or fire hazard). See Appendix D.5 for further detail around canopy fuel, ladder fuel, and surface fuel assumptions. The BLM assumed LANDFIRE (LF) (USGS 2020) data represents Canopy Base Height (CBH) and surface fuels in the affected environment. The BLM assumed that the No Action Alternative short-term (up to 20 years) fuel profile would be the same as the current condition. The BLM assumes stand refers to the unit scale.

Structural Stage

Non-commercial fuels reduction in mature forest structural stages would not shift the mature structural stage to another stage within the short-term. Commercial thinning and group selection openings conducted in mature forest structural stages would not shift the mature structural stage to another stage within the short-term. Variable retention harvest would shift forest structural stage from mature structural stage to the stand establishment structural stage over 20 years, thus shifting resistance rating from *mixed* to *moderate* (with Structural Legacies) or *low* (without Structural Legacies) (USDI BLM 2016a, Table 3-32 p. 243, Appendix H pp. 1319-1321, Appendix C pp.1203-1204), while the fire hazard rating would be *high* (USDI BLM 2016a, Table 3-34 p. 254, Appendix H pp. 1320-1321, Appendix C pp.1203-1204).

Activity Fuels Treatments

Common to all action alternatives, based on the unit location (e.g. aspect, slope, access, and proximity to other values, such as adjacent to communities or private property) and residual activity fuel (e.g., live and dead tree branches and treetops) remaining following harvest in commercial units, the BLM would determine the type of activity fuel treatment needed to reduce the amount or depth of residual activity fuels. Adjacent to values and along access routes, activity fuel load would be reduced to result in expected flame lengths less than 4 feet under typical fire weather conditions. Activity fuel loading would be reduced through methods such as hand or machine pile and burn, and/or broadcast burning within 1-2 years following completion of harvest to allow fuels time to cure prior to burning. In areas not adjacent to values or access routes, the depth of activity fuels would be reduced to less than 18 inches in height by lop and scatter within 1 year of harvest. Similarly, following non-commercial fuels reduction of ladder fuels (i.e. thinning of small trees to raise canopy base heights) these small fuels would be placed in handpiles and allowed to cure for 1-2 years. Piles would be burned after they cure. (See NAID Air Quality Issue B1 and Project Design Features Table C-19 for more details). While piles cure, surface fuel loading and potential flame length is temporarily increased. This temporary increase [in commercial and non-commercial treatment units] is not represented in the 20 year post-treatment surface fuel model assumptions, as the temporary increase in fuels would have been reduced within 1-2 years by the treatments described above.

The effects of the temporary increase (1-2 years) in risk from residual activity fuels are within the scope of those effects analyzed for in the PRMP/FEIS (USDI BLM 2016a, pp. 260 and 263, Figure 3-380). That analysis, which is incorporated here by reference, concluded that immediately following commercial harvest, residual activity fuels left on the forest floor (e.g., tree tops and limbs) would increase surface fuel loadings and have the potential to increase surface fire behavior and pose a risk to the residual stand and other human values (e.g., Wildland Developed Areas (WDAs)), if not adequately treated (USDI BLM 2016a, p. 266, 269).

Fuel Heterogeneity

Based on dry forest stand reconstruction reference sites located in low-mixed severity fire regimes, which provide a guide for vegetation patterning representative of the functioning fire regime, gap sizes were historically less than 2 acres and generally less than 1 acre (Appendix D.5).

Resistance to Other Disturbances

Consistent with the PRMP/FEIS, to which this issue tiers, the BLM assumes that relative stand-level fire resistance ratings would also apply to stand-level resistance to drought and insect disturbance, as increased fire resistance often also increases resistance to drought and insects (USDI BLM 2016a, p. 201). The combined effects of reducing stand density and reintroducing fire in drought-prone and fire-prone regions, can increase water availability and tree growth and vigor (Halofsky et. al 2016; Hood et. al 2018), allowing individual trees to better withstand drought and insect attacks (Hood et. al 2015).

Maintenance

Most treated areas would require low to moderate intensity disturbance maintenance (e.g. reducing surface and ladder fuels with prescribed fire or thinning if too much time has passed) every 15 to 30 years to maintain high to moderate relative stand level resistance (See Appendix D.5 for additional details).

3.2.1.4. *Affected Environment*

Within the project area, landscape patterns of wildfire size distribution and occurrence have shifted over time (Appendix D.5). Historically, wildfire was more frequent and burned more acreage within the project area, than in recent years, however wildfires do still occur within the project area (see Appendix D.5).

Within the Last Chance project area, approximately 6,249 acres of hazardous surface and ladder fuel reduction treatments (handpile burning and underburning) have been implemented in the recent past (See Appendix D.5). However, these treatments occurred 20+ years ago and are in need of maintenance treatments. Select areas are being proposed for maintenance under this project in order to sustain wildfire resistance.

Within the maximum footprint of proposed action acres, 76 percent of the acreage has a high amount of canopy fuels with greater than 60 percent canopy cover. The current canopy base height is variable, ranging from 2ft to 8ft across the majority of the proposed acreage . The majority (87 percent) of proposed action acreage is best represented by very high load forest surface fuel models . The general current condition of vegetation illustrates the current abundance and connectivity of canopy, ladder, and surface fuels and lack of structural and spatial heterogeneity departed from historic frequent-fire conditions in forested landscapes. (See Appendix D.5 for additional detail).

3.2.1.5. *Environmental Consequences: No Action Alternative*

Short-term (up to 20 years) Direct and Indirect Effects

The No Action Alternative would have no short-term direct effects to the fuel profile or indirect effects to stand level fire resistance or fire hazard. Activities comprising the proposed action would not be implemented and would not directly alter the vertical and horizontal continuity of the wildland fuel profile (i.e., surface, ladder, or canopy fuels) or increase heterogeneity. Stand-level fire resistance would remain low for 75 percent of the unit acres and moderate-low for 16 percent, and moderate-high for 8 percent (Appendix D5 Table 3-7) under 90th percentile weather conditions. The lack of small-scale patchiness (or heterogeneity) would persist.

Moderate term (up to 50 years) and Cumulative Effects

Based on climate and wildfire trends discussed in Appendix H, wildfire and drought would continue to challenge the persistence of forested stands in southwestern Oregon. Heterogeneity representative of low-mixed severity fire regimes and fire-resistant species would continue to decline, and vegetation would continue to accumulate and die, increasing fuel loading and threatening the persistence of large fire-resistant trees. These aspects, coupled with expected climatological changes, such as increased background conifer mortality due to longer periods of hot drought (USDI BLM 2016a, p. 185), increase the likelihood for larger proportions of high severity fire (Mote et al. 2019) and reduced stand resistance to replacement fire or increased hazard.

Under the No Action Alternative, high fire resistance would not be created by proposed actions, so there would be no high or moderate stand-level resistance to maintain with frequent low to moderate severity disturbance and high fire hazard would persist. Intersection by wildfire would also be less likely to provide beneficial outcomes. There would be no maintenance of previous treatments, unless or conducted as part of a different vegetation management project (e.g., commercial and non-merchantable actions, including prescribed fire) or if burned by wildfire.

3.2.1.6. *Environmental Consequences: Direct and Indirect Effects common to all Action Alternatives*

Short-term (up to 20 years) Direct and Indirect Effects

Among all action alternatives, combined direct effects from proposed commercial thinning and selection harvest and natural hazardous surface and ladder fuel reduction and activity fuel treatments would reduce surface, ladder, and canopy fuels, reduce fuel profile continuity, and increase heterogeneity, as compared to the No Action Alternative (See Appendix D.5 for more details). These changes to the fuel profile would indirectly increase wildfire resistance and reduce wildfire hazard over the No Action Alternative.

Moderate term (up to 50 years) Effects

Over 50 years, understory fuels would re-grow (including natural or artificial regeneration), vegetation would also die, and surface and ladder fuels would re-accumulate, unless the stands experience low-moderate severity disturbance.

In 50 years, all Mature stands would shift to *Mixed* relative resistance stand-replacement fire, which can exhibit the range of *Low* to *Moderate* to *High* relative resistance to replacement fire, depending on cumulative effects of vegetation re-growth, wildfire interactions, and maintenance treatment actions (e.g. prescribed fire or thinning) implemented under other projects.

Additionally, among action alternatives, stand average tree diameter (QMD) would continue to increase in thinned and selection harvest areas, thus improving resistance to stand-replacing fire in Mature stands.

3.2.1.7. *Environmental Consequences: Alternative 2*

Short-term (up to 20 years) Direct and Indirect Effects

In the short-term, of the 8,240 acres of commercial harvest and 3,446 fuels (small diameter thinning only) proposed action acres 15 percent of proposed acres would have high relative fire resistance, 43 percent moderate-high resistance, 24 percent moderate-low resistance, and 14 percent low resistance. Fire hazard would be slightly different, where 15 percent would have low fire hazard, 36% would have moderate-low fire hazard, 24% would have moderate-high fire hazard, and 21% would remain at high fire hazard under 90th percentile weather conditions (See Appendix D.5 for more detail).

In addition to effects to canopy fuels described common to all above, the 787 proposed acres of variable retention harvest would convert the mature structure stage to early successional and stand establishment, delaying promotion of large fire resistant trees.

Across approximately, 3,860 acres of the proposed commercial actions, creation of up to 4 acre gaps would not contribute to variable and patchy vegetation patterns and fuel loadings and arrangements comparable to low and mixed severity fire regimes (Churchill et al. 2013, Hesburg et al. 2015) where gaps were variable in size, typically less than 2 acres and most were less than 1 acre. Bigelow and North (2012) observed moderate increases in average wind gusts in thinned stands (up to 1.5 mph) and greater increases in openings (up to 5.6 mph in openings of 2 acres). Increased surface wind speeds could contribute toward localized increased surface winds and fire behavior, however as described in the methods and assumptions, the sheltering effects of canopy fuels have been incorporated into the fire behavior modeling for stand average canopy cover.

Elsewhere, creation of variable sized openings up to 1 acre would introduce heterogeneity more reflective of fuel loadings and arrangements comparable to low and mixed severity fire regimes, (USDI BLM 2016a, pp. 225-226; Churchill et al. 2013; Hessburg et al. 2015), where gaps were variable in size, typically less than 2 acres and most were less than 1 acre (Appendices D.5).

Moderate term (up to 50 years) Effects

Effects common to all action alternatives would apply to Mautre stands. The early successional structural stage would remain in the Stand Establishment structural stage or begin trending into the young-stand phase, with a moderate-low relative fire resistance and high fire hazard (see Assumptions).

3.2.1.8. *Environmental Consequences: Alternative 2a*

Short-term (up to 20 years) Direct and Indirect Effects

In the short-term, of the 8,240 acres of commercial harvest and 3,446 fuels (small diameter thinning only) proposed action acres 17 percent of proposed acres would have high relative fire resistance, 48 percent moderate-high resistance, 18 percent moderate-low resistance, and 14 percent low resistance (Table 3.10). The inverse would be present for fire hazard. The effects to canopy fuels described common to all action alterative above apply.

Across approximately, 3,860 acres of the proposed commercial actions, creation of up to 4 acre gaps would not contribute to variable and patchy vegetation patterns and fuel loadings and arrangements comparable to low and mixed severity fire regimes (Churchill et al. 2013, Hesburg et al. 2015) where gaps were variable in size, typically less than 2 acres and most were less than 1 acre. Additionally, Bigelow and North (2012) observed moderate increases in average wind gusts in thinned stands (up to 1.5 mph) and greater increases in openings (up to 5.6 mph in openings of 2 acres). Increased surface wind speeds could contribute toward localized increased surface fire behavior, however as described in the methods and assumptions.

Elsewhere, creation of variable sized openings up to 1 acre would introduce heterogeneity more reflective of fuel loadings and arrangements comparable to low and mixed severity fire regimes, (USDI BLM 2016a, pp. 225-226; Churchill et al. 2013; Hessburg et al. 2015), where gaps were variable in size, typically less than 2 acres and most were less than 1 acre (Appendices F, G, and H).

3.2.1.9. *Environmental Consequences: Alternative 3*

Short-term (up to 20 years) Direct and Indirect Effects

In the short-term, of the 1,051 acres of commercial harvest and 10,627 acres of fuels (small diameter thinning only) proposed action, none of the proposed acres would have high relative fire resistance, 14 percent moderate-high resistance, 67 percent moderate-low resistance, and 13 percent low resistance (Table 3.10).

In addition to effects to canopy fuels described common to all above, a diameter restriction of 20 inches would limit the ability to improve the growth and resiliency of remaining trees where there is a high density in these diameter classes (Riling et al. 2019).

The effects of opening creation of variable sized openings up to 1 acre would introduce heterogeneity fairly reflective of fuel loadings and arrangements comparable to low and mixed severity fire regimes, (USDI BLM 2016a, pp. 225-226; Churchill et al. 2013; Hesburg et al. 2015), where gaps were variable in size, typically less than 2 acres and most were less than 1 acre (Appendices D.5).

Moderate term (up to 50 years) Effects

Moderate -term effects common to all action alternatives would apply to the mature structural stages. The 787 acres which transition to the early successional structural stage following proposed action would begin transitioning into the young-stand phase with a moderate-low relative fire resistance and high fire hazard (see Assumptions).

3.2.1.10. *Cumulative Effects*

The potential stand-level cumulative effects would be a result of the proposed actions, combined with reasonably foreseeable actions at the stand-level and recent and future trends of wildfire and fire suppression efforts. Direct and indirect short-term effects have considered the incremental cumulative effect of prior stand condition, combined with commercial thinning, small diameter thinning and prescribed burning (handpile burning). There would be no additional short-term cumulative effects at the stand scale, unless intersected by a wildfire, which would provide fuel maintenance and re-set conditions to short-term effects.

Without frequent maintenance disturbance, understory fuels would re-grow (including natural or artificial regeneration), vegetation would also die, and surface and ladder fuels would re-accumulate (See Appendix D.5 for more detail). Treated areas would require maintenance every 15 to 30 years to maintain high to moderate relative stand level resistance (see assumptions). Maintenance actions, such as low intensity prescribed underburning, or thinning and handpile burning, if enough time has passed, would contribute toward maintaining high to moderate relative stand-level fire resistance and return stand-resistance to short-term conditions. As each treatment stage is completed, the stand’s resistance to fire would increase and reflect short-term effects. If longer intervals go between maintenance phases, the stand-level resistance would decrease and stand-level hazard increase.

The Action alternatives vary in the frequency of low-moderate severity maintenance that would be needed to sustain stand-level fire behavior relative resistance. Alternative 2.b and alternative 2 would result in the most high and moderate-high resistance and require more frequent maintenance than alternative 3 (Table 3-10).

Based on climate and wildfire trends discussed in Appendix D.5, wildfire and drought would continue to challenge the persistence of forests in southwestern Oregon. However, proactive treatments designed to moderate fire behavior and minimize uncharacteristic high severity fire, so that a wildfire can burn through a stand without detrimental consequences and allow the stand to persist and thrive when intersected by wildfire. Thus, low intensity wildfires can also provide maintenance of treated areas.

3.2.1.11. *Summary Comparison of Alternatives*

Under all action alternatives, combined direct effects from proposed forest management actions would reduce (surface, ladder, and canopy fuels), reduce fuel profile continuity, and increase heterogeneity, over the No Action Alternative. The majority of these changes to the fuel profile would indirectly increase wildfire resistance or reduce wildfire hazard in the short term.

Alternative 2 would result in majority short-term *moderate-high* stand-level fire resistance (43 percent), and require fairly frequent maintenance to sustain this level of resistance (Table x). Large trees would be protected, promoted in commercial thinning and selection harvest, the likelihood of tree-to-tree crown fire spread under typical fire weather indices (Scott and Reinhardt 2001) would be reduced, and stand diameter increased, thus improving resistance to stand-replacing fire. In the 787 proposed acres of regeneration harvest, the mature structure stage would be converted to early successional and stand establishment. In areas of permanent road construction, large trees may be removed. This alternative would also introduce heterogeneity aligned with fire regime structure across approximately 4,000 acres. On approximately 3,800 acres, proposed openings could be up to 4 acres and contribute larger and problematic for surface winds.

Alternative 2.b would have similar effects as Alternative 2, with the exception of the 787 acres of variable retention harvest proposed in Alternative 2. Under this alternative, those acres would contribute toward additional *moderate-high* stand-level that would be thinned and result in moderate-high to high fire resistance.

Alternatives 3 would result in majority moderate-low stand-level fire resistance in the short-term but require less frequent maintenance to sustain this level of resistance than Alternative 2. Alternative 3 would introduce heterogeneity in fuel composition more closely aligned with frequent fire regime structure than Alternative 4. In Commercial thinning and selection harvest, the likelihood of tree-to-tree crown fire spread under typical fire weather indices (Scott and Reinhardt 2001) would be reduced, and stand diameter increased, thus improving resistance to stand-replacing fire, however a diameter restriction of 20 inches would limit the ability to improve the growth and resiliency of remaining trees where there is a high density in these diameter classes.

The difference in magnitude of maintenance actions that would be required to sustain high fire resistance acreage between Alternative 2 and Alternative 3 is an important distinction, particularly when considering 15% of the proposed action acreage is within a quarter mile of Communities at Risk, a focused component of the Wildland Urban Interface (CWPP, 2019; Metlen et al., 2017) (See Appendix D.5 Affected Environment and wildfire risk NAID issue) and 43% is within one mile of Wildland Developed Areas (WWRA 2013) (See map Appendix H). Maintenance of high to moderate-high stand-level fire resistance in the frequent-fire adapted dry forest, hinges on frequent low-moderate intensity disturbance and Alternative 2 would require 45% of acres to be frequently treated to maintain high to moderate-high stand-level resistance, requiring frequent entry on 5,239 acres.

Table 3-10: Summary of Action Alternative metrics associated with short-term and cumulative effects to stand-level fire resistance: relative stand-level fire resistance rating, structural heterogeneity consistent with fire regime, and maintenance frequency needed to sustain relative resistance (i.e. stand-level cumulative effects).

Resistance and Hazard Metrics		No Action	Alternative 2	Alternative 2.a	Alternative 3
Relative Stand-level Fire Resistance Rating	Low	75%	14%	14%	13%
	Moderate-low (%)	16%	24%	18%	64%

	Moderate-high (%)	8%	43%	48%	14%
	High (%)	0%	15%	17%	0%
Structural Heterogeneity Aligned with Fire Regime		Least consistent	less consistent	less consistent	most consistent
Large Trees Promoted, Protected, and Removed[13]		Not Applicable	Promoted, protected, and removed	Promoted, protected, and removed	Protected
Maintenance Frequency to Maintain Stand-level Resistance	High	Not Applicable	45%	52%	0%
	Moderate		14%	14%	14%
	Low		24%	18%	67%
Relative Stand-level Fire Hazard Rating	Low	0%	21%	14%	13%
	Moderate-low (%)	8%	24%	18%	64%
	Moderate-high (%)	16%	36%	48%	14%
	High (%)	75%	15%	17%	0%

*Large trees may be removed for route construction

3.3. Northern Spotted Owl

3.3.1. Issue 6: Would forest management treatments in the LSR-Dry speed the development or improve the quality of nesting habitat, and not preclude or delay by 20 years or more the development of NSO nesting/roosting habitat?

The Last Chance FMP proposes forest management treatments in foraging, dispersal-only NSO habitats within the LSR-Dry LUA. Would these treatments preclude or delay the development of the treated stands into nesting-roosting habitat by 20 years or more compared to BLM leaving these stands untreated (no action alternative)?

3.3.1.1. *Background*

This project area is located within the range of the NSO, which is listed as threatened under the Endangered Species Act. NSOs prefer coniferous forest with multiple layers of vegetation; a variety of tree species and age classes; and the presence of large down, woody material (to serve as habitat for prey species) and large diameter live and dead trees (snags) for nesting-roosting habitat. NSO nesting-roosting and foraging habitat in southwest Oregon is mixed-conifer habitats with recurrent fire history, patchy habitat components, and higher incidences of woodrats. NSOs also utilize younger stands with closed canopies for foraging and dispersing. Based on studies of owl habitat selection, including habitat structure

[13] Large trees may be removed for route construction.

and use, and prey preference throughout the range of the owl, NSO habitat consists of three components: nesting-roosting, foraging, and dispersal (Thomas et al., 1990).

When a proposed treatment would occur in the LSR-Dry LUA, the BLM must ensure that any proposed treatment does not preclude or delay by 20 years or more the development of a treated stand into nesting-roosting, as compared to development without treatment (2016 ROD/RMP, BLM 2016a). In the Last Chance FMP, this purpose and need applies to stands in the LSR-Dry LUA that are currently not functioning as NSO NR-habitat.

3.3.1.2. *Methodology*

The analysis for this issue assesses how the proposed commercial thinning treatments in the LSR-Dry LUA under each alternative meet the following LSR LUA Management Direction:

"In stands that are not NSO nesting-roosting habitat, apply silvicultural treatments to speed the development of NSO nesting-roosting habitat or improve the quality of NSO 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 NSO 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." (BLM 2016c, p. 72).

All commercial treatment units proposed for the Last Chance FMP underwent field habitat evaluations and silviculture stand examinations during the early planning stages of the project. Based on these habitat evaluations, all units were categorized into three NSO habitat categories: nesting-roosting, foraging, and dispersal-only habitat, as well as two categories representing conditions currently not functioning as NSO habitat (capable and non-habitat). This analysis used the three sub-types of NSO habitat: nesting-roosting, foraging, and dispersal-only habitat (See NSO Habitat Definitions, NAID Wildlife Issue B-31, Table B-31.1) to evaluate the present and future conditions of the modeled stands.

For this analysis, units that contained five or more acres of LSR-dry LUA were selected from the Last Chance treatment area to model the effects of the proposed prescriptions on non-nesting NSO habitat in the LSR LUA under each alternative to determine the ability of treatments to comply with the RMP management direction listed above. The stands used in this effects analysis are commercial units that were classified by field evaluations as either foraging or dispersal-only habitat and do not currently function as NSO nesting-roosting habitat.

The BLM compiled stand-level inventory plot data collected on the ground for all selected LSR-Dry stands and modeled future changes to the stands using the Forest Vegetation Simulator (FVS), a tree growth and yield simulator. Growth for each representative stand was modeled through time under a no-treatment scenario and two treatment scenarios based on the proposed alternatives. The models used a prescription of thinning throughout specific diameter classes corresponding with each alternative's prescriptive elements, which removed different ranges of tree sizes during the simulated treatments between alternatives. Metrics for nesting-roosting habitat were used to determine when these stands would reach nesting-roosting conditions when modeled into the future. The treated stands were modeled for an additional 20 years of growth (beyond when they would reach nesting roosting under the No Action Alternative) to determine if treatment would cause a delay longer than 20 years in the development of nesting-roosting habitat when compared to the no action alternative. The composition of each stand prior to (pre-treatment) and after treatment modeling are presented by alternative in tabular format for each proposed treatment unit by unit below.

3.3.1.3. *Assumptions*

The stand modeling applied several assumptions to the treated and untreated stands:

- Outside influences that could occur in the future (e.g., mortality from insects/disease, fire, windthrow, or new land management policies) were not included because these were unknown and impossible to predict.
- Stands were modeled to include artificial regeneration of ponderosa and sugar pine at five and 10 years post treatment accounting for regeneration that contributes towards layering.
- The BLM modeled only one single entry of selection harvest during the analysis timeframe (2023-2123). No additional understory small diameter thinning, or prescribed fire treatments were applied to the stand modeling. The PRMP/FEIS "modeling team modeled the application of a combination of group selection (patch cut) harvests and thinning to various stand components at intervals of 40-50 years, depending on site productivity" (2016 PRMP/FEIS, BLM 2016b p. 1196).
- Skips and group selection openings would be factored into the overall residual relative density at the stand level. At least 10 percent of the stand would be in skips and no more than 25 percent of the stand would be in group selection openings (BLM 2016a, p. 72) in stands that are 10 acres or greater in size.

3.3.1.4. *Summary of Analytical Methods*

As described above, the BLM evaluated the canopy cover, basal area, tree size, average overstory DBH, presence of, the presence and amount of decadence features (snags and down woody material, broken top trees, nesting platforms, mistletoe, etc) and canopy layering in proposed treatment areas to describe and define NSO habitat. Habitat elements, such as tree DBH, canopy cover, basal area, and large tree DBH metrics are available in FVS and BLM used them to analyze this issue because they are important habitat elements to predict spotted owl use. As noted in the Medford Integrated Vegetation Management (IVM) EA, Appendix 6, in southwestern Oregon nesting-roosting habitat are conifer stands with a multi-layered, multispecies canopy dominated by large conifer overstory trees, canopy cover ≥ 60 percent, overstory tree diameter of >21 inches DBH, >12 trees with 20 inches or greater DBH trees/acre, quadratic mean diameter (QMD) >15 DBH, basal area from 180 to 240 $feet^2$/acre (most often greater than 240 $feet^2$/acre), and a basal area from larger trees grater than 26 inches DBH and greater than 30 $feet^2$ in basal area (USDI BLM 2022, Appendix 6). The BLM is using these metrics as minimum thresholds to determine when the analyzed stands would develop into nesting-roosting habitat after treatment, compared to no treatment. The effects descriptions below summarize the ability of the treatments to improve the development of nesting-roosting habitat, while ensuring the treatments comply with the SWO RMP direction that LSR-dry treatments would not delay or preclude the development of NR habitat by 20 years or more.

Many of the proposed treatment units in the Last Chance FMP include a multitude of LUAs within a single unit. In the case of units containing only portions of LSR-Dry LUA, the data associated with the LSR portion of the unit was separated from the remaining portion of the unit for analysis and is labeled with a letter ("A", "B", or "C") to help the BLM track each component part of a large unit separately.

3.3.1.5. *Affected Environment*

All of the proposed commercial thinning treatments in LSR-Dry stands mentioned above would occur in stands currently functioning as foraging, dispersal-only, or non-habitat and do not currently display the characteristics of spotted owl nesting-roosting habitat (as defined in NAID Issue B-31, Table B-31.1). These stands lack the one or more elements of diversity, structure, layering, large trees, higher canopy cover, and other important habitat elements required to function as nesting-roosting habitat. Some of the these stands have average tree sizes and structure that meets the minimum values for nesting-roosting habitat but were classified as foraging because of the lack of decadence features (snags, large woody debris, broken-top trees, deformities in crown structure, etc.) currently not present in the stand.

The current forest conditions limit the extent of nesting-roosting habitat, increase the risk of their loss to wildfire, and delay and hinder the development of new nesting-roosting habitat. As described in Chapter 1, the proposed treatment areas are characterized by densely stocked small diameter trees. The average QMD across LSR stands in the treatment area is less than 10 inches DBH, which indicates that the trees are smaller than necessary for spotted owl nesting and roosting. The average relative density of these stands is above the point at which competition between trees causes self-thinning (>60 percent RD) (Long and Daniel 1990, Davis and Johnson 1987). These stands have reduced tree vigor and are at increased risk of insect outbreaks and disease (Fettig et al 2007). Competition between trees slows their growth (Bennett and Main 2018, p. 4), delaying the development of nesting-roosting habitat characteristics.

All proposed Last Chance FMP commercial treatment units received field habitat evaluations during the early planning stages of the project and prior to harvest unit delineation. All LSR commercial prescriptions would promote and retain large trees, increase or maintain species diversity, maintain hardwoods, retain coarse woody material, and retain and create snags, which would improve nesting-roosting habitat in the long-term (see PDFs, Appendix B, and RMP Management Direction BLM 2016a, p.70-75).

3.3.1.6. *Environmental Consequences*

There are three Alternatives included under the Last Chance FMP, the No Action alternative and two action alternatives, which propose different intensities and amounts of commercial thinning across the planning area. The potential effects of applying each alternative to the LSR-Dry stands on stand growth and the ability of the stand to reach NR conditions as modeled with FVS are presented below by Alternative. Table 6-1 includes the acres of LSR-Dry that would be treated under each alternative.

Table 6-1. Acres of LSR-Dry by Spotted Owl Habitat Type in the Last Chance FMP.

Alternative	Nesting-Roosting	Foraging	Dispersal-Only	Capable/Non-Habitat
Alternative 2	29 acres (skips) 10 acres (ROWs)	193 acres	50 acres	9 acres
Alternative 3	7 acres (skips) 5 acres (ROWs)	53 acres	0 acres	0 acres

The results for each modeled LSR-Dry stand are included in Tables 6-2 and 6-3, including the results of modeling applying the No Action and Action Alternatives. Table 6-2 provides a unit-by-unit overview of all the LSR-Dry units for comparison of the stand metrics and what decade the stand first reaches the minimum stand metrics for NR habitat by Alternative. Additionally, Table 6-3 provides a summary of when each unit would reach the minimum NR habitat metrics under each alternative by decade to compare the time scales of the modeled growth response that would result under each alternative.

<u>Alternative 1</u>

As described in Chapter 2, the No Action alternative would not implement any aspect of the action alternatives in the treatment area. Therefore, vegetation growth rates, stand densities, fuel conditions, the ratio of open and closed forest, would continue to change based on current existing forces and disturbance, or lack thereof. Since the analysis of this issue is at the stand scale, the No Action Alternative describes the results for each modeled stand under a no treatment scenario, which includes no commercial harvest. The results for each modeled stand under the No Action alternative are presented in tables 6-2 and 6-3 below.

Alternative 2

In total, there are approximately 291 acres of LSR-Dry LUA that have been identified for commercial thinning under Alternative 2 of the Last Chance FMP. Within these 291 acres, a maximum of approximately 252 acres would be treated with commercial thinning treatments, and approximately 39 of the 291 acres either receiving no direct treatments (29 acres left untreated as skips) or minimal alteration to provide access to logging other areas (10 acres). The current NSO habitat conditions of these LSR-dry stands are listed in Table 6-1.

Under Alternative 2, the proposed action in the LSR LUA would thin non-nesting-roosting stands to a relative density (RD) of 30 +/- 10 percent and treatment would be deferred (no treatment) for LSR stands that are currently nesting-roosting habitat. There is no difference between Alternative 2 and sub-Alternative 2a regarding the proposed treatments within the LSR-Dry LUA and therefore all results presented here as alternative 2 are applicable to both Alternative 2 and sub-Alternative 2a. The treatments applied under Alternative 2 are also designed to modify, but maintain the spotted owl habitat type of the treated stand such that the stand would still provide the same level of habitat function as it did prior to treatment (e.g. foraging habitat would remain foraging habitat after treatment and would not be downgraded to a lower habitat category). The RD target for each stand is partially based on what minimum value is needed to ensure the habitat is not downgraded or removed. Given the target RD range necessary to maintain the current spotted owl habitat within each LSR-Dry treatment unit, the likelihood of setting the stand back in the development of nesting-roosting habitat is low, because moderate canopy cover, canopy layering, higher basal area, and large trees would still be present after treatment. These elements would provide the important structure for the future development of nesting-roosting habitat function. The results for each modeled stand under Alternative 2 are presented in tables 6-2 and 6-3 below.

Alternative 3

In total, there are approximately 65 acres of LSR-Dry LUA that have been identified for commercial thinning under Alternative 3 of the Last Chance FMP. Within these 65 acres, a maximum of approximately 53 acres would be treated with commercial thinning treatments, and approximately 13 of the 65 acres either receiving no direct treatments (seven acres left untreated as skips) or minimal alteration to provide access to logging other areas (five acres). The current NSO habitat conditions of these LSR-dry stands are listed in Table 6-1.

The prescriptions under Alternatives 3 would be similar to Alternative 2 for LSR-Dry LUA stands, including thinning non-nesting-roosting stands to a relative density of 40-45 percent and deferring treatments in LSR stands that are currently nesting-roosting habitat, but other elements of the prescription, such as only harvesting trees < 20” DBH are also included (see Chapter 2 proposed action summary for prescriptive differences between Action Alternatives). Similar to Alternative 2, all the treatments proposed as part of Alternative 3 would treat, but only modify the spotted owl habitat type that was originally present in the treatment stand such that the habitat would remain the same category after treatment. The results for each modeled stand under Alternative 3 are presented in tables 6-2 and 6-3 below.

3.3.1.7. *Summary of Alternatives*

Table 6-2 is designed to provide a unit-by-unit overview of all modeled LSR-Dry units, with values for the six stand metrics used to define minimum NR habitat and modeled stand attributes in the first decade the stand reaches NR habitat by alternative. This table can be used to compare the FVS modeling results for each proposed treatment unit by alternative. Table 6-2 contains six quantitative habitat metrics used to represent spotted owl habitat that are also available output metrics within the FVS modeling program. Although these habitat metrics are important measures of spotted owl habitat quality, they are not representative of other habitat measures such as canopy / stand layering, stand heterogeneity, and decadence features that provide nesting structures (broken top trees, wolf trees, platforms, etc.) and habitat for prey (snags and down wood). The FVS modeling outputs are limited to the six quantitative variables and some qualitative assessments must be made by BLM staff to interpret the modeling results in terms of the overall effect the treatments would have on the development of spotted owl habitat.

For each unit, the baseline stand metrics are presented as the current condition under the No Action Alternative and represents the stand as it is currently (at the time of field data collection). The FVS program was subsequently used to model the stand growth without treatment (no action) and the data outputs were used to determine what decade the stand would first reach the minimum threshold values for all six quantitative habitat metrics used to represent NR habitat conditions without treatment. The minimum values for each metric are presented at the top of the table. The decade the stand first reaches NR habitat requirements is presented under the no treatment row of the No Action and serves as a baseline to which to compare the results of the treatments under the Action Alternatives. To comply with the 20-year standard, the BLM would need to demonstrate that any proposed treatment would not delay or preclude the development of NR habitat by more than 20 years compared to when the no action alternative reaches NR habitat without treatment. The results of each FVS modeling run are presented for each Action Alternative, including the stand metrics one year after the prescription is applied to the current conditions, which shows how the proposed treatment would alter the habitat metrics immediately following treatment for each Alternative. Finally, a row is presented for each Action Alternative that shows the decade in which the FVS model first reached the minimum thresholds for all six quantitative habitat metrics to meet NR habitat conditions within the treated stand, and what these metrics are estimated to be at the time the stand reaches NR habitat conditions.

Table 6-2. Unit by Unit FVS Modeling Results by Action Alternative for all LSR-Dry treatments.

Unit 2-2A Foraging		**Canopy Cover (%)**	**Basal Area (ft²)**	**Overstory Mean Diameter**	**Quadratic Mean Diameter**	**Trees > 20" DBH per Acre**	**Basal Area Trees ≥ 26" DBH**
ALT	**Nesting-Roosting Target Conditions** **(Minimum Metrics)**	**≥ 60%**	**180-240 ft²**	**≥ 21"**	**≥ 15"**	**≥ 12**	**≥ 30ft²**
NO ACTION	**Current Condition** 2025	91	245	25	12	33	119
	No Treatment NR conditions met in **2055**	92	304	28	16	35	183
ALT 2	**Alternative 2** 2026 (post treatment)	76	151	26	13	20	83

		Canopy Cover (%)	Basal Area (ft²)	Overstory Mean Diameter	Quadratic Mean Diameter	Trees > 20” DBH per Acre	Basal Area Trees ≥ 26” DBH
	Alterative 2 NR conditions met in **2045**	79	180	27	15	23	112
ALT 3	**Alternative 3** 2026 (post treatment)	84	221	27	21	33	120
	Alterative 3 NR conditions met in **2026**	78	202	30	24	33	100
Unit 5-2C Foraging		**Canopy Cover (%)**	**Basal Area (ft²)**	**Overstory Mean Diameter**	**Quadratic Mean Diameter**	**Trees > 20” DBH per Acre**	**Basal Area Trees ≥ 26” DBH**
ALT	**Nesting-Roosting Target Conditions (Minimum Metrics)**	**≥ 60%**	**180-240ft²**	**≥ 21”**	**≥ 15”**	**≥ 12**	**≥ 30ft²**
NO ACTION	**Current Condition** 2025	78	403	22	11	45	97
	No Treatment NR conditions met in **2045**	77	412	22	16	58	104
ALT 2	**Alternative 2** 2026	60	248	22	12	27	66
	Alterative 2 NR conditions met in **2065**	61	290	22	16	46	85
ALT 3	**Alternative 3** 2026	51	242	24	23	45	97
	Alterative 3 NR conditions met in **2065**	53	276	25	25	69	126
Unit 15-8B Foraging		**Canopy Cover (%)**	**Basal Area (ft²)**	**Overstory Mean Diameter**	**Quadratic Mean Diameter**	**Trees > 20” DBH per Acre**	**Basal Area Trees ≥ 26” DBH**
ALT	**Nesting-Roosting Target Conditions (Minimum Metrics)**	**≥ 60%**	**180-240 ft²**	**≥ 21”**	**≥ 15”**	**≥ 12**	**≥ 30ft²**
NO ACTION	**Current Condition** 2025	83	284	20	12	28	13

	No Treatment NR conditions met in **2055**	82	340	24	16	57	43
ALT 2	**Alternative 2** 2026 (post treatment)	60	153	18	11	16	7
	Alterative 2 NR conditions met in **2065**	68	238	24	16	41	52
ALT 3	**Alternative 3** 2026 (post treatment)	69	215	20	17	28	13
	Alterative 3 NR conditions met in **2045**	71	260	21	20	46	33
Unit 25-1A Foraging / Dispersal		**Canopy Cover (%)**	**Basal Area (ft²)**	**Overstory Mean Diameter**	**Quadratic Mean Diameter**	**Trees > 20" DBH per Acre**	**Basal Area Trees ≥ 26" DBH**
ALT	**Nesting-Roosting Target Conditions (Minimum Metrics)**	**≥ 60%**	**180-240ft²**	**≥ 21"**	**≥ 15"**	**≥ 12**	**≥ 30ft²**
NO ACTION	**Current Condition** 2025	83	215	23	18	31	76
	No Treatment NR conditions met in **2025**	83	215	23	18	31	76
ALT 2	**Alternative 2** 2026	60	153	24	17	21	61
	Alterative 2 NR conditions met in **2045**	72	187	28	21	27	100
ALT 3	**Alternative 3** 2026	78	207	24	17	31	77
	Alterative 3 NR conditions met in **2026**	78	207	24	17	31	77
Unit 25-4A Foraging		**Canopy Cover (%)**	**Basal Area (ft²)**	**Overstory Mean Diameter**	**Quadratic Mean Diameter**	**Trees > 20" DBH per Acre**	**Basal Area Trees ≥ 26" DBH**

ALT	Nesting-Roosting Target Conditions (Minimum Metrics)	> 60%	180-240 ft²	> 21”	> 15”	> 12	> 30ft²
NO ACTION	**Current Condition** 2025	88	272	28	17	34	122
	No Treatment NR conditions met in **2025**	88	272	28	17	34	122
ALT 2	**Alternative 2** 2026 (post treatment)	69	167	34	15	20	98
	Alterative 2 NR conditions met in **2035**	71	181	36	16	22	109
ALT 3	**Alternative 3** 2026 (post treatment)	71	204	35	18	35	125
	Alterative 3 NR conditions met in **2026**	71	204	35	18	35	125
Unit 31-6A Dispersal		**Canopy Cover (%)**	**Basal Area (ft²)**	**Overstory Mean Diameter**	**Quadratic Mean Diameter**	**Trees > 20” DBH per Acre**	**Basal Area Trees > 26” DBH**
ALT	**Nesting-Roosting Target Conditions (Minimum Metrics)**	**> 60%**	**180-240ft²**	**> 21”**	**> 15”**	**> 12**	**> 30ft²**
NO ACTION	**Current Condition** 2025	85	268	25	15	32	100
	No Treatment NR conditions met in **2035**	85	290	25	16	38	120
ALT 2	**Alternative 2** 2026	63	151	25	12	17	70
	Alterative 2 NR conditions met in **2065**	69	203	28	16	25	108
ALT 3	**Alternative 3** 2026	69	213	26	14	32	102

	Alterative 3 NR conditions met in **2035**	70	230	27	23	38	121

3.3.1.8. *Unit Specific Comparison of Effects by Alternative – Temporal Summary*

In order to assess if the proposed LSR-Dry treatments do not preclude or delay by 20 years or more the development of a treated stand into nesting-roosting, as compared to development without treatment (USDI BLM 2016a), the BLM compared the length of time (in decades) each modeled stand required to first achieve the minimum habitat values (as shown in Table 6-2 above) of NR habitat under the various Alternatives. Table 6-3 provides a summary of the length of time it took for each modeled stand to reach NR habitat under each Alternative.

Table 6-3: Summary of the Length of Time Needed and in Which Decade Each LSR-Dry Stand Reached the Minimum Habitat Thresholds for Nesting and Roosting Habitat Conditions by Alternative.

Treatment Unit	**Minimum Nesting-Roosting Habitat Conditions Met (years post-treatment)**					
	Alternative 1 (No Action)		Alternative 2 (RD 25-45%)		Alternative 3 (RD 40-45%)	
	Year Achieved	Length of Time	Year Achieved	Length of Time	Year Achieved	Length of Time
2-2A	2055	30	2045	20	2026	0[14]
5-2C	2045	20	2065	40	2065	40
15-8B	2055	30	2065	40	2045	20
25-1A	2025	0[14]	2045	20	2026	0[14]
25-4A	2025	0[14]	2035	10	2026	0[14]
31-6A	2035	10	2065	40	2035	10

Unit 2-2A

Unit 2-2A is currently functioning as foraging habitat for spotted owls. Under the No Action Alternative, this stand was modeled to reach NR habitat after 30 years of growth without treatment. Under alternative 2, the treated stand was modeled to reach NR habitat after approximately 20 years of growth. The results from modeling Alternative 3 treatments on this stand indicate that immediately following the Alternative 3 treatment, this stand would have reached the minimum quantitative habitat metrics used for this analysis for NR habitat. It is unlikely that simply thinning a stand would result in an immediate improvement of habitat quality. In particular, the overstory mean diameter (and quadratic mean diameter) variable of the quantitative stand metrics is problematic because by simply removing the smallest trees from a stand it

[14] Modeling indicates this stand would have reached the minimum quantitative habitat metrics used for this analysis immediately after treatment.

increases the average diameter of stand, but no actual tree growth happened which is really the measure of habitat improvement of interest.

Based on the FVS modeling results, both action alternatives did not preclude or delay by 20 years or more the development of this stand into nesting-roosting habitat, as compared to development without treatment.

Unit 5-2C

Unit 5-2C is currently functioning as foraging habitat for spotted owls. Under the No Action Alternative, this stand was modeled to reach NR habitat after 20 years of growth without treatment. Both Alternative 2 and Alternative 3 reached the minimum habitat metrics for NR habitat after 40 years of modeled growth (Table 6-3). Alternative 3 modeling results indicate that the canopy cover of the treated stand would be approximately 53 percent in 2065 after 40 years of modeled growth. After evaluating the modeling outputs, the modeling program thinned through the smallest diameter classes in the stand and removed essentially all trees less than 16 inches DBH in order to implement the prescription. If Alternative 3 was to be implemented, BLM marking practices would retain more of these smaller trees (it's not standard procedure to remove all trees below 16" DBH) and the canopy cover would be expected to be higher than presented by the modeling outputs (greater than 60 percent).

Based on the FVS modeling results, both action alternatives did not preclude or delay by 20 years or more the development of this stand into nesting-roosting habitat, as compared to development without treatment.

Unit 15-8B

Unit 15-8B is currently functioning as foraging habitat for spotted owls. Under the No Action Alternative, this stand was modeled to reach NR habitat after 30 years of growth without treatment. Under alternative 2, the treated stand was modeled to reach NR habitat after approximately 40 years of growth. The results from modeling Alternative 3 treatments on this stand indicate that this stand would reach the minimum quantitative habitat metrics used for this analysis for NR habitat in 20 years.

Alternative 3 achieved NR habitat conditions 10 years faster than if the stand was left untreated (No Action), whereas Alternative 2 took 10 years longer for the stand to develop into NR habitat compared to the No Action, and 20 years longer compared to Alternative 3 (Table 6-3). However, Alternative 2 did not delay the development by more than 20 years compared to the No Action. Based on the FVS modeling results, both action alternatives did not preclude or delay by 20 years or more the development of this stand into nesting-roosting habitat, as compared to development without treatment.

Unit 25-1A

Unit 25-1A is a mixture of foraging and dispersal-only habitat for spotted owls. Under the No Action Alternative, this stand was modeled to already contain the minimum quantitative values for NR habitat. However, as discussed above, these six variables alone are not representative of other habitat measures such as canopy / stand layering, heterogeneity, and in particular, decadence features that provide nesting structures (broken top trees, wolf trees, platforms, etc.) and habitat for prey (snags and down wood). On-the-ground evaluations by wildlife staff found this stand to be lacking these features and thus it was classified as foraging habitat due to the lack of nesting structures currently present in the stand.

Under alternative 2, the treated stand was modeled to reach NR habitat after approximately 20 years of growth. The results from modeling Alternative 3 treatments on this stand indicate that immediately following the Alternative 3 treatment, this stand would have reached the minimum quantitative habitat metrics used for this analysis for NR habitat. It is unlikely that simply thinning a stand would result in an immediate improvement of habitat quality. In particular, the overstory mean diameter (and quadratic mean diameter) variable of the quantitative stand metrics is problematic because by simply removing the smallest trees from a stand it increases the average diameter of stand, but no actual tree growth happened which is really the measure of habitat improvement of interest. Additionally, nesting structures would not develop immediately following forest thinning, so the results presented for Alternative 3 don't capture this important component of spotted owl habitat.

Based on the FVS modeling results, both Action Alternatives did not preclude or delay by 20 years or more the development of this stand into nesting-roosting habitat, as compared to development without treatment.

Unit 31-6A

Unit 31-6A is currently functioning as dispersal-only habitat for spotted owls. Under the No Action Alternative, this stand was modeled to reach NR habitat after 10 years of growth without treatment (Table 6-3). Under alternative 2, the treated stand was modeled to reach NR habitat after approximately 40 years of growth. The results from modeling Alternative 3 treatments on this stand indicate that this stand would reach the minimum quantitative habitat metrics used for this analysis for NR habitat in 10 years.

Alternative 3 achieved NR habitat conditions 10 years after treatment, which was similar to the rate it would develop under the modeled No Action Alternative. However, the Alternative 2 treatment required 30 years of modeled growth to reach the minimum habitat metrics for all six variables used for this analysis to represent NR habitat. Based on the FVS modeling results, Alternative 2 would delay the development of NR habitat by 20 years or more the development of this stand into nesting-roosting habitat, as compared to development without treatment.

3.3.1.9. *Cumulative Effects*

The BLM Medford District assumes past management practices on private lands would continue. The BLM anticipates some loss of NSO habitat on private lands, but cannot predict the rate of loss, types of NSO habitat affected, or the specific location of harvest. The BLM does not track private land harvest activity. Harvest activities on state and private lands can be expected to impact NSOs located within adjacent federal lands by removing and fragmenting habitat and through disturbance activities adjacent to occupied sites during sensitive periods. The Oregon Forest Practices Act Rules (OAR 629-665-0210) protects NSO nest sites (70-acre core areas) for at least three years after the last year of occupation The Last Chance FMP would treat up to 484 acres of LSR habitat, of which 69 acres would be nesting-roosting treatment. Habitat function would be maintained for treatments in nesting-roosting habitat within LSR and, as described above, the prescriptions would put non-nesting-roosting habitat on the trajectory of developing nesting-roosting habitat in the future.

The 2016 PRMP/FEIS considered the overall net change in habitat function to NSO habitat of implementing the Proposed RMP, which also includes commercial harvest in the HLB for providing for a sustained supply of timber (USDI 2016a, pp. 928-998). When added to the present and future foreseeable actions, including commercial timber harvest on HLB, the BLM concluded in the 2016 PRMP/FEIS, to which this EA is tiered, that implementation of the Proposed RMP as a whole would contribute to a landscape that supports large blocks of NSO habitat that are capable of supporting clusters of reproducing NSO, distributed across a variety of ecological conditions and spaced to facilitate NSO movement between the blocks (BLM 2016ba, pp. 932-941). Those analyses and findings are incorporated here by reference. The U.S. Fish and Wildlife Service confirmed in their Biological Opinion (BO) on the 2016 ROD/RMP that these analyses are a reasonable approach to assessing NSO habitat change in the planning area resulting from timber harvest, in growth, and wildfire because it reflects the application of best available science and the acreages of land that would be subject to the range of management activities in the LUAs in the 2016 RMP (USFWS 2016, p. 603). All actions on the BLM Medford District in the LSR would follow 2016 ROD/RMP management direction, and therefore the overall effect of implementing the 2016 ROD/RMP has been analyzed in the 2016 PRMP/FEIS Cumulative Effects at the landscape level.

3.4. Northwestern Pond Turtle

3.4.1. Issue 7: How would timber harvest, fuels reduction, and new road and landing construction affect the northwestern pond turtle?

3.4.2. Background Information

The northwestern pond turtle (hereafter NWPT, *Actinemys marmorata*) was proposed for listing as a threatened species under the Threatened and Endangered Species Act on October 3, 2023 (FWS 2023, p. 68370) and is currently a bureau sensitive species (see Appendix B). The range of the NWPT includes portions of Washington, Oregon, Nevada, and northern and central California. NWPTs are semi-aquatic; they require aquatic and terrestrial (upland) habitats that are connected to one another or within close proximity (FWS 2023, p. 68376). Upland habitats are used for both nesting and overwintering.

Nesting habitat is characterized as either bare soil or having sparse vegetation with short grasses and forbs, and requires exposure to direct sunlight (FWS 2023, p. 68376; ODFW 2015, p. 21). Although most nesting occurs within 325 ft (99 m) of occupied aquatic habitats, the majority of nests occur within 164 ft (50 m) (ODFW 2015, p. 21).

According to one study conducted along the Trinity River in California, overwintering habitat typically occurs above the high-water elevation of aquatic habitat, with a mean of 666 ft (203 m) and up to 1640 ft (500 m) from aquatic habitat (Reese and Welsh 1997, pp. 355-356). Another study in the Sierra foothills in California indicated that approximately 623 ft (190 m) of intact core terrestrial habitat would encompass the vast majority (95%) of the turtles' terrestrial habitat (Zaragoza et al. 2015, p. 440). Therefore, terrestrial habitat needs of populations of NWPTs depend on both the aquatic and terrestrial conditions at the site (Zaragoza et al. 2015, p. 440). ODFW recommends buffering wetlands and waterbodies capable of supporting pond turtles, or to utilize seasonal "no-entry" restrictions to minimize human-related disturbances in key turtle habitats (nesting, overwintering) when buffering is not feasible (ODFW 2015, p. 19). While vegetation differs from site to site, open areas are typically avoided for overwintering, and leaf litter is present at most sites (Davis 1998, p. 19; Reese and Welsh Jr. 1997, pp. 355–356). The dispersal of NWPTs between populations is not well understood. However, genetic research suggests that most dispersal activity occurs within drainages or watersheds (Spinks and Shaffer 2005, p. 2057). Observed dispersal distances for the NWPT ranges from approximately 1.6 miles to 4.3 miles within aquatic habitat, with overland dispersal distances being slightly less (approximately three miles) under optimal conditions (Holland 1994, pp. 2–9, 7–28; Purcell et al. 2017, pp. 21, 24; Rosenberg et al. 2009, p. 21).

Adult NWPTs move to overwintering habitats (aquatic or upland) in mid to late autumn and hibernate through the winter (November-February) (ODFW 2015, p. 15). Davis (1998) found that most movement to terrestrial overwintering sites coincided with the onset of the first big storms of the season, in late November and early December; however, five turtles moved upland as early as September. NWPTs then emerge in the spring (March-April) to forage, migrate to aquatic habitats, and engage in courtship and mating activities (ODFW 2015, p. 15). Mature turtles lay their eggs in the summer, typically between May and July (Bury et al. 2012; Holland 1994; Rosenburg et al. 2009). Eggs hatch in autumn, and most hatchlings overwinter in their nests until the following spring (ODFW 2015, p. 15).

The U.S. Fish and Wildlife Service identified habitat loss and fragmentation (including latent impacts from past habitat impacts), altered hydrology, predation, competition, road impacts, collection, contaminants, disease, and the effects of climate change (including increasing temperatures, severe drought, extreme flood events, and high severity wildfire) as threats acting on individuals and populations to varying degrees across their respective ranges (FWS 2023, p. 68377). The U.S. Fish and Wildlife Service identified three key factors as most influential in driving the NWPTs current and future condition: anthropogenic impacts, predation by bullfrogs, and drought (FWS 2023, p. 68377). According to modeling efforts and other status assessments, the NWPT populations in Oregon and northern California are less likely to be subject to the extensive habitat losses and still have numerous well distributed and well-connected populations (FWS 2023, Appendix A; Gregory and McGowan 2023, entire; Thomson et al. 2016, p. 301). Populations of NWPT in Oregon are likely to withstand stochastic and catastrophic events, maintain its ecological flexibility and likely be able to adapt to changing environmental conditions and thereby still has a sufficient degree of resiliency, redundancy, and representation to sustain populations in the near term (FWS 2023, p. 68389). According to modeling completed by the U.S. Fish and Wildlife Service, the NWPT is likely to maintain populations throughout its range in the next 50 to 75 years in Oregon, Nevada, and California (FWS 2023, p. 68391). However, during this time, the species is likely to lose its adaptability to environmental conditions, have reduced reproduction, and have a low likelihood of responding to catastrophic events. The U.S. Fish and Wildlife Service concluded that the species will be limited in their ability to maintain populations in the wild in the next 50 to 75 years; therefore, the NWPT is likely to become in danger of extinction within the foreseeable future throughout all of its range (FWS 2023, p. 68391).

3.4.3. Analytical Methods and Assumptions

The Analysis Area for effects to NWPT for this project includes all federal lands within the Last Chance Quines Timber Management Project Planning Area. A habitat model for the northwestern pond turtle was developed by the Institute for Natural Resources, Oregon State University for the U.S. Forest Service and was distributed to the BLM. This model overlaps the entire Analysis Area and displays the suitability of aquatic features for use by the NWPT. Features that were categorized as high and very high probably of habitat suitability (referred to as aquatic habitat hereafter) were included for analysis. To further hone in on aquatic habitat and to reduce small slivers across the landscape that are unlikely to be used by NWPT, any polygons that were under 0.1 acre were removed. After conducting field evaluations at seven locations of aquatic habitat (according to the model), only three were found to be suitable for NWPT. The other four were found to be unsuitable because they were either not aquatic features (upland forest) or swift flowing water with a closed canopy and no solar exposure. These four features were removed from the aquatic habitat baseline used for analysis. The BLM recognizes the model is imperfect and may overestimate habitat; however, this is currently the best available tool to identify and quantify NWPT aquatic habitat at a larger landscape scale. An additional six ponds that were identified by the hydrologist—which were not present in the waterbody GIS layer and may have been missed by the model—were also included as potential aquatic habitat. Databases were reviewed and known detections of NWPT (13 in total) were included to aid in habitat determinations. Additionally, Lidar and satellite imagery were utilized to assist in classifying aquatic habitat.

Based on the literature (see Background Information), a buffer of 656 feet (ft) (200 m) from aquatic habitat was used to identify potential nesting habitat. Lidar and satellite imagery were used to determine suitability. Nesting habitat was not identified in treatment units or new construction roads.

To identify all potential NWPT overwintering habitat, a buffer of 1,640 ft (500 m) (see Background Information) from aquatic habitat was selected. To prevent grossly overestimating NWPT overwintering habitat, the Medford NSO Habitat GIS layer was identified as the best crosswalk at this time. Within the 1,640 ft buffer, NSO NRF and dispersal habitats were identified as suitable for overwintering due to the presence of canopy cover and leaf litter, while forest capable and non-habitat acres were not included because these features are less likely to be present.

Lastly, for the purposes of this analysis, short-term impacts represent 0-10 years after implementation and long-term impacts represent >10 years after implementation.

3.4.4. Cumulative Effects

Within the Analysis Area, there are two projects that have been recently implemented—Poor Windy and Upper Cow. To prevent overestimating NWPT habitat, acres that were harvested through these projects were not included in the available habitat within the Analysis Area. Approximately 942 acres from Poor Windy and 25 acres from Upper Cow were not included in the total overwintering habitat within the Analysis Area.

Additionally, in 2018, the Grave Creek fire of the Garner Complex wildfire burned through the southeast portion of the Analysis Area. The BLM routinely updates the NSO habitat GIS layer after each fire, so these changes were incorporated into analysis. Furthermore, the satellite imagery that was used to help with habitat determinations is updated annually. At this time, there are no BLM proposed future projects that overlap with the Analysis Area and non-federal lands were excluded from analysis; therefore, all cumulative effects have been accounted for within the analysis of alternatives below.

3.4.5. Affected Environment

There are approximately 274 acres of aquatic habitat across all ownerships and only 66 acres of those are on federal lands within the Analysis Area. At this time, there is no model that estimates nesting habitat at a landscape scale. However, on federal lands, there are 38 non-forest acres (based on NSO non-habitat) within 656 ft of aquatic habitat that may serve as nesting habitat. Additionally, within the Analysis Area on federal lands, there are 1,595 acres of overwintering habitat within 656 ft of aquatic habitat (including aquatic habitat adjacent to the Analysis Area) and 4,069 acres of overwintering habitat between 656 ft and 1640 ft from aquatic habitat, for a total of 5,664 acres of overwintering habitat.

3.4.6. Environmental Consequences

3.4.6.1. *No Action*

<u>Direct Effects and Indirect Effects</u>

With the no action alternative, the NWPT populations in the Analysis Area would likely maintain resiliency in the short-term (FWS 2023, p. 68389). However, in the long-term, the NWPT populations may decline due to the threats from human activities and habitat loss (non-federal lands), increased predation from non-native bullfrogs, and increased impacts from the effects of climate change (mainly drought) (FWS 2023, p. 68391).

3.4.6.2. *Alternative 2*

<u>Direct Effects</u>

Based on BLM databases, since the 1990's there have been 13 detections of NWPT within the Analysis Area. None of these observations were within proposed units for this alternative. Treatments would not occur within aquatic habitat. If culverts need to be replaced in aquatic habitat, they would be interchanged with culverts that allow for turtle passage (see Protection Measures for additional information). If nesting habitat is identified, treatments would either be dropped or modified, and seasonally restricted. To prevent direct harm to adult NWPTs in upland habitat, seasonal restrictions would be implemented in overwintering habitat within 656 ft of aquatic habitat for cutting and piling for fuels treatments and for timber treatments. For broadcast burning, only a third of a treatment area would be implemented annually within 656 ft of aquatic habitat.

Indirect Effects

Effects to Aquatic Habitat: There are no anticipated effects to NWPT aquatic habitat. Proposed new stream crossings are not in NWPT aquatic habitat.

Effects to Nesting Habitat: After a Lidar and satellite imagery review, there is likely no nesting habitat within the proposed units or new construction roads. Therefore, there are no anticipated effects to nesting habitat. If nesting habitat is located, then units would be dropped or modified, and seasonal restrictions would be applied (see Protection Measures).

Effects to Overwintering Habitat: The literature lacks discussion on how timber harvest and fuels treatments affect NWPTs. The BLM anticipates commercial thinning, selection harvest, and fuels reduction treatments would modify, but maintain overwintering habitat because important features—such as canopy cover—would be retained. However, VRH treatments, group selects, and new construction roads are estimated to be a loss of overwintering habitat because there would be a loss of canopy cover. Although some of these gaps may be small enough to not meaningfully remove NWPT overwintering habitat, the BLM decided to analyze for maximum impact. Furthermore, based on the literature (see Background Information), it is expected that the loss of overwintering habitat within 656 ft of aquatic habitat would impact the majority of NWPTs; however, the loss of overwintering habitat between 656 ft and 1,640 ft of aquatic habitat may impact some individuals. Therefore, effects up to 1,640 ft are discussed within this analysis.

Approximately 384 acres of overwintering habitat within 656 ft of aquatic habitat and 961 acres of overwintering habitat between 656 ft and 1,640 ft of aquatic habitat would be modified, but maintained due to fuels treatments. This estimate includes 522 acres of overlap with timber units. Therefore, approximately 1,345 acres (24 percent) of 5,664 acres overwintering habitat would be modified from fuels treatments within the Analysis Area. In contrast, timber treatments would modify 1,895 acres of overwintering habitat (including overlap with fuels treatments). Between fuels and timber treatments, approximately 2,718 acres (48 percent) of overwintering habitat would be modified within the Analysis Area.

At this time, it is unknown where gaps would be placed throughout the project. Placement of gaps and landings would avoid 656 ft of aquatic habitat, where operationally feasible (see Protection Measures). As the majority of NWPTs overwinter within this distance, effects would be significantly reduced. The BLM decided to include gaps within 656 ft of aquatic habitat for analysis to account for maximum impact, while realizing implementation and the resulting impacts to NWPTs would likely be less. Based on the prescriptions under Alternative 2, it is estimated there would be a loss of 168 acres of overwintering habitat within 656 ft of aquatic habitat and 367 acres between 656 ft and 1640 ft of aquatic habitat (Table 7.1). This estimate includes 43 acres of new road construction necessary for timber harvest. In total, 535 acres (nine percent) of overwintering habitat may be removed throughout the Analysis Area. Similar to the no action alternative, the NWPT populations within the Analysis Area would likely maintain resiliency in the short-term.

Table 7.1: Comparison of Alternatives—Effects to NWPT Overwintering Habitat from Timber Harvest

	Acres Modified		Acres Removed	
Alternative[15]	656 ft[16]	656-1640 ft	656 ft	656-1640 ft
2	450	1,445	168	367
2a	512	1,280	107	350
3	73	125	9	38

3.4.6.3. *Alternative 2a*

Direct Effects

The direct effects under this sub-alternative are the same as Alternative 2 (see above).

Indirect Effects

Effects to Aquatic Habitat: The effects to NWPT aquatic habitat under this sub-alternative are the same as Alternative 2.

Effects to Nesting Habitat: The effects to NWPT nesting habitat under this sub-alternative are the same as Alternative 2.

Effects to Overwintering Habitat: Effects to overwintering habitat due to fuels treatments are the same as under Alternative 2. However, timber treatments would modify 1,792 acres of potential overwintering habitat (including overlap with fuels treatments). Between fuels and timber treatments, approximately 2,615 acres (46 percent) of overwintering habitat would be modified within the Analysis Area.

Similar to Alternative 2, placement of gaps and landings would avoid 656 ft of aquatic habitat, where operationally feasible (see Protection Measures). Based on the prescriptions under Alternative 2a, it is estimated there would be a loss of 107 acres of overwintering habitat within 656 ft of aquatic habitat and 350 acres between 656 ft and 1640 ft of aquatic habitat (Table 3-17). This estimate includes 43 acres of new road construction necessary for timber harvest. In total, 457 acres (eight percent) out of 5,664 acres of NWPT overwintering habitat may be removed throughout the Analysis Area. Comparable to the no action alternative, the NWPT populations within the Analysis Area would likely maintain resiliency in the short-term.

3.4.6.4. *Alternative 3*

Direct Effects

No NWPT observations have occurred within proposed units under this alternative. The seasonal restrictions described under Alternative 2 would also apply to this alternative (see Protection Measures).

Indirect Effects

Effects to Aquatic Habitat: There are no anticipated effects to NWPT aquatic habitat. Proposed new stream crossings are not in NWPT aquatic habitat.

[15] This is the maximum estimated. If treatments are not applied to this maximum, remaining acres would be modified instead.
[16] Distances are measured from NWPT aquatic habitat as described under Analytical Methods and Assumptions section.

Effects to Nesting Habitat: After a Lidar and satellite imagery review, there is likely no nesting habitat within the proposed units. Therefore, there are no anticipated effects to nesting habitat. If nesting habitat is located, then units would be dropped or modified, and seasonal restrictions would be applied (see Protection Measures).

Effects to Overwintering Habitat: Effects to overwintering habitat due to fuels treatments are the same as Alternative 2. However, timber treatments would modify 198 acres of overwintering habitat (including 79 acres of overlap with fuels treatments). Between fuels and timber treatments, approximately 1,464 acres (26 percent) of 5,664 acres of overwintering habitat would be modified within the Analysis Area.

Similar to Alternative 2, placement of gaps and landings would avoid 656 ft of aquatic habitat, where operationally feasible (see Protection Measures). Based on the prescriptions under Alternative 3, it is estimated there would be a loss of nine acres of overwintering habitat within 656 ft of aquatic habitat and 38 acres between 656 ft and 1640 ft of aquatic habitat (Table 3-17). In total, 47 acres (less than one percent) of overwintering habitat may be removed on federal lands throughout the Analysis Area. Comparable to the other alternatives, the NWPT populations within the Analysis Area would likely maintain resiliency in the short-term.

3.4.6.5. *Protection Measures*

As discussed in Appendix C, the following protection measures would be applied to nesting habitat: 1) soil compacting activities would not occur, and 2) non-compacting activities (hand treatments and other minimal ground disturbance activities) would be seasonally restricted between May 15 and July 31. Furthermore, seasonal restrictions would be applied in overwintering habitat within 656 ft (200 m) from aquatic habitat between October 1 and March 31 for cutting and piling of fuels treatments and for timber treatments. Based on the literature (see Background Information), this buffer would encompass the majority of overwintering turtles. For broadcast burning, in overwintering habitat within 656 ft of aquatic habitat, only one third of an area would be treated annually. When feasibly possible, such as burning in a small area, closures would be utilized to prevent turtles from entering the treatment area. Additionally, placement of group selections and landings would avoid NWPT habitat within 656 ft of aquatic habitat, when operationally feasible. Lastly, for road improvements, culvert replacements in aquatic habitat would be interchanged with culverts that allow for turtle passage. In areas with known turtle populations or a high likelihood of use by turtles, berms or fencing would be installed to direct turtles to the culvert. These PDFs would minimize direct and indirect impacts to all life stages of the NWPT.

3.5. Hydrology and Water Quality

3.5.1. Issue 8: Would downstream aquatic habitats be negatively affected by increased sedimentation expected from logging activities, road renovation, hauling on existing roads, and use of rock quarries to provide materials for road construction and renovation?

This analysis will describe the potential for impacts and the effects from all proposed project activities on sediment delivery and transportation beyond the historical, existing, and ongoing conditions. The FEIS describes the effects of road construction, road renovation and road decommissioning on sediment delivery to streams. It concluded that increases in sediment yield would be less than 1.0 percent above current levels of fine sediment delivery over the next 10 years for Western Oregon (USDI/BLM, 2016a, pp. 401-408). The FEIS assumed that sedimentation at this rate is basically undetectable and undifferentiable from natural and background conditions.

Determining if potential impacts are within the regulatory framework for water quality requires consideration of the duration and timing of streamflow, water quality and suspended sediment rates from proposed actions.

3.5.1.1. *Methods for Analytical Analysis*

This analysis describes the sediment delivery rates from all activities and evaluates if these would be within the natural and background levels expected for these watersheds and sub-watersheds. Hydrology metrics for this analysis are calculated based on watershed size and location.

This analysis makes use of Geographical Information System (GIS) to quantify values for past disturbance and estimate the potential for future disturbance. The geographic scale to determine changes to water yield, potential enhancement of peak flows, estimates for road density, roaded areas for proposed haul routes on aggregate roads, road and landing construction and renovation, and other surface disturbances are calculated for the 10-digit (5th level) watersheds, 12-digit and 14-digit sub-watersheds within the Last Chance project area, depending on the parameter (Table 8.1). The temporal scale for looking at potential short-term direct and indirect impacts is 1-3 years.

Cumulative impacts are looked at based on HUC 10 Watersheds (5th level) of which there are three that have portions in the Last Chance project area: Middle Cow Creek, Upper Cow Creek, and Grave Creek. The temporal scale for looking at cumulative impacts would be when full vegetation recovery would occur (50+ years) depending on the parameter. Analysis at the 5th level watershed scale is large enough to assess the cumulative effect of actions and potential long-term impacts of action that, taken individually (site scale) may not be significant, but when combined with effects, may have a potential impact.

One metric that is calculated is the Equivalent Clearcut Area (ECA) which is the proportion of a watershed that responds hydrologically as a clearcut. For open areas, this is generally less than 30 percent canopy and it can be calculated in different ways (Winkler & Boon, 2017). For this analysis an ocular estimated based on the 2020 National Agriculture Imagery Program (NAIP) Imagery of continuous areas over 4 acres that have less than 30 percent canopy cover. For commercial harvest, this can be considered by estimating the amount of up to 4-acre group select openings that are allowed by harvest prescription. In this way the hydrologic response can be estimated and compared by alternative.

The analytical methodologies and techniques used in this analysis are based on peer reviewed science and analysis from the Final EIS for Western Oregon Volume 1&2 (USDI/BLM, 2016b, pp. 369-768).

Table 8.1: Watersheds and Subwatersheds that contain Proposed Commercial Timber Units

Watershed (5th level) (HUC 10-digit)	**Sub-watershed (6th level) (HUC 12-digit)**	**Sub-watershed (7th level) (HUC 14-digit)**
Upper Cow Creek HUC# 1710030206 (47,470 acres)	McGinnis Creek – Cow Creek HUC# 171003020603 (15,125 acres)	Snow Creek (Cow Creek) HUC# 17100302060306 (5,053 acres)
Middle Cow Creek HUC# 1710030207 (113,079 acres)	Whitehorse Creek – Cow Creek HUC# 171003020701 (21,949 acres)	Upper Whitehorse Creek, Blackhorse Creek, Upper Starveout Creek, and Booth Gulch HUC# 17100302070106, 09, 30, 33,54, & 59) (9,800 acres)
	Quines Creek – Cow Creek HUC# 171003020702 (18,331 acres)	Cow Creek below Booth Gulch, Upper Quines Creek, Tennessee Gulch, Middle Quines Creek, Upper Bull Run, Little Bull Run, Lower Bull Run, Cow Creek below Quines Creek, McCollum Creek, HUC# 17100302070203, 06, 09, 12, 15, 18, 21, 27, & 30 (17,337 acres)

Watershed (5th level) (HUC 10-digit)	Sub-watershed (6th level) (HUC 12-digit)	Sub-watershed (7th level) (HUC 14-digit)
	Fortune Branch – Cow Creek HUC# 171003020703 (13,776 acres)	Cow Creek below McCollum Creek and Woodford Creek HUC# 1710032070303 &12 (2,932 acres)
Grave Creek HUC# 1710031003 (104,494 acres)	Last Chance – Grave Creek HUC# 171003100301 (19,901 acres)	Grave above Last Chance, Last Chance Creek, Grave below Last Chance, Grave below little Boulder, Slate Creek, Grave below Slate, Baker Creek, Grave below Baker, Boulder Creek, Grave below Boulder, and Clark Creek HUC# 17100310030103, 06, 09, 12, 15, 18, 21, 24, 27, 30, & 33. (19,906 acres)
	Shanks Creek – Grave Creek HUC# 171003100302 (12,813 acres)	Grave below Clark, Eastman Gulch, Grave below Eastman, Quartz Mill Gulch, Grave below Quartz Mill, Tom East Gulch HUC# 17100310030203, 06, 09, 12, 15, & 18 (8,142 acres)
	Wolf Creek – Grave Creek HUC# 171003100304 (28,356 acres)	Wolf above Bummer, Bummer Gulch, Wolf below Bummer, Wolf below Hole in the Ground, and Coyote Creek above Post Gulch HUC# 17100310030402, 04, 06, 10, & 20 (7,062 acres)
Total: 265,043 acres	**Total: 130,251 acres**	**Total: 71,339 acres**

3.5.1.2. *Affected Environment*

The Last Chance FMP proposes forest management activities in the Middle Cow Creek, Upper Cow Creek, and Grave Creek watersheds. Cow Creek and Grave Creek are major tributaries to the Umpqua and Rogue Rivers, respectively.

The FEIS estimates 36 percent of all exiting BLM roads on BLM-administered lands are within 200-foot delivery distance (5,096 out of 14,330 miles, 35%) (USDI/BLM, 2016a, p. 402). The Last Chance project area currently has about 109 miles of roads with the 200-foot delivery distance of the 423 miles of roads on BLM administered lands, which is 26% of the total road miles in the Last Chance project area.

There are fully decommissioned roads within 200ft of streams that are barricaded or have had crossings removed and are not drivable, even some that have been surfaced with aggregate in the past on BLM administered lands within the Last Chance project area. These decommissioned roads can include roads that have been or would be closed due to a natural process (abandonment) and may be opened and maintained for future use. This project will consider roads proposed for use, with this description as road renovation. In some cases, these roads would need major work to renovate them to a design standard suitable for hauling timber.

The Last Chance project area is in the South Umpqua and Lower Rogue Subbasins. The Last Chance project area comprises about 56,843 acres; 57% of which is managed by the BLM and 40% is private, 1% Oregon State lands and 2% County Lands. The project units are located within the following watersheds Hydrologic Unit Code 10 (5th level) Watersheds: Grave Creek (56 percent), Middle Cow Creek (42 percent), and Upper Cow Creek (2 percent). Middle and Upper Cow drain into the South Umpqua and Grave Creek is tributary to the Rogue River. For a general description of the Last Chance project area see the Last Chance EA Chapter 2: *Planning Area Overview*.

Grave Creek (56% of the Last Chance project area): Elevations in the Grave Creek Watershed range from 690 feet to 5,265 feet at King Mountain. The towns of Wolf Creek and Sunny Valley are the major communities in the watershed. There are residential areas located along Grave Creek, Coyote Creek, and Wolf Creek. Grave Creek has a history of placer gold mining, which is still ongoing. Placer mining involves washing stream gravels for gold (USDI/BLM, 1999a).

Grave Creek and nine tributaries have been on the Oregon Department of Environmental Quality (ODEQ) 303(d) list for stream temperature. Maximum summer water temperatures in Grave Creek probably exceed DEQ standards because Grave Creek's width, low gradient, east-west orientation, and dark bedrock (Oregon DEQ, 2023c). Bedrock is a major component of Grave Creek's substrate; it absorbs heat during the day and radiates it to the stream at night. How much of the high-water temperatures are due to natural background conditions, or a result of historical practices such as mining and logging and loss of beavers; is difficult to sort out.

Middle Cow Creek (42% of the Last Chance project area): This watershed includes 29 stream miles of Cow Creek from Galesville Dam to the confluence with Middle Creek. The elevation ranges between 5,103 and 1,029 feet above sea level. The City of Glendale is the only incorporated city. Other population centers are the unincorporated communities of Azalea and Quines Creek. There is a small amount of agricultural, residential, and industrial land, and is limited to the lower elevation valleys around Cow Creek. Cow Creek's riparian zone is comprised of thin strips of hardwoods, whereas many of the tributary streams are primarily conifer forests (USDI/BLM, 1999b).

The dam for Galesville Reservoir regulates water for downstream irrigation, industrial uses, and municipal uses; maintaining streamflow for fish and other aquatic life; and providing flood control. As a result of flow regulation, Cow Creek stream flows are lower during the winter and higher during the summer than unregulated flow conditions.

Cow Creek and seven tributaries have been on the Oregon Department of Environmental Quality (ODEQ) 303(d) list for stream temperature. Habitat modification has been carried forward from a previous listing on the stretch from Galesville Reservoir to Starveout Creek and this same reach is currently listed for Dissolved Oxygen according to data is from the United States Geological Survey (USGS) Streamflow site near Azalea (Oregon DEQ, 2023c).

Upper Cow Creek (2% of the Last Chance project area): This watershed includes 26 stream miles of Cow Creek from the headwaters of Cow Creek to Galesville Reservoir. The elevation ranges between 1,880 feet at Galesville Reservoir and 5,104 for Cedar Spring Mountain. The Upper Cow Creek watershed is located within the Klamath Geomorphic Province and is characterized by deeply weathered and eroded sandstone (USDI BLM, 2005).

There are some private residences within the watershed as well as the Cow Creek Community. Azalea is the nearest town, approximately 6 miles southwest outside of the western border of the Upper Cow Creek watershed (USDI BLM, 2005).

The affected environment for these Watersheds in the Last Cance project area is defined by watershed characteristics shaped by the historical periods and activities described above. Most locations in the project area show evidence of the loss of beaver; eroded straightened stream channels down to bedrock; remanent ditch systems, cobble dikes, reservoirs and ponds, past skid, and road systems for timber harvesting in the uplands, roads in floodplains alongside straightened stream channels. Public land management has resulted in extensive road networks typically paved for local access and gravel roads to access timber resources in strategic locations. This same road network is currently used for access to private forest lands and to manage public lands alike.

Current Stream Sediment in the Last Chance project area: The Aquatic and Riparian Effectiveness Monitoring Program (AREMP) recently released a 25-year assessment of the Northwest Forest Plan looking at trends in watershed condition. This report described fine sediment conditions as measured in transect-based data in pools and pool-tail crests. AREMP found that sediments had decreased overall in stream data collected from multiple forested watersheds with greater than 25 percent federal ownership between 1994-2018 (USDA-PNRS, 2023, pp. 55-56).

This change in fine sediment conditions over the last 25 years has been attributed to better road management including reductions in road density, better surfacing, reducing landslides, and reductions in peak flows. These results suggest both active (e.g., road modifications) and passive (e.g., forest management) measures have contributed individually and in combination to reduce fine sediment input to streams and specifically in BLM's Medford District (USDA-PNRS, 2023, p. 64 and 158).

The physical geology of the Last Chance project area is in the Klamath lithologic province which generally accounts for high sediment yields relative to land area. Soils in the Last Chance project area that developed from metamorphic volcanic and sedimentary rock sources have been shown to be highly erosive in some locations, as documented in the WQRPs for this region. Historic mining and logging can result in chronic sediment sources such as destabilized slopes; old roadbeds and skid trails; and ditch systems and ponds. These features can also alter natural transportation and storage of sediment in stream channels.

Watershed characteristics and water quality have been evaluated in the Last Chance project area, Watershed Analysis (WA) and Water Quality Restoration Plans (WQRP) by the BLM. Relevant plans for this area are the Grave Creek WQRP (USDI BLM, 2001) and WA (USDI BLM, 1999a); Middle Cow Creek WQRP (USDI/BLM, 2004) and WA (USDI BLM, 1999b); and Upper Cow Creek WQRP (USDI BLM, 2004) and WA (USDI BLM, 2005).

Natural disturbances include fires, beavers, and intense storms, among others. Natural conditions are what these dynamic systems would have been like before European settlement. Historic and current activities in the Last Chance project area on BLM administrated land and other land ownership are considered part of the background conditions even when these activities cause changes in streamflow, accelerated erosion, and/or water quality. Combining natural and background conditions gives a baseline to evaluate impacts to sedimentation.

Changes in streamflow duration, magnitude and timing change the ability of streams to transport sediment and therefore can impact downstream sedimentation. Quantifying potential changes to stream hydrology, such as changes in water yield and the likely occurrence and magnitude of peak flows, can help determine the potential for increased sedimentation downstream.

For new temporary and permanent road construction for commercial thinning, the FEIS analysis used actual new road construction ratios derived from six years (FY2007–FY2012) for the entire analysis area (USDI/BLM, 2016a, p. 401).

Peak Flow Enhancement: Most of the sediment transport in streams occurs with peak storm events, typically in the winter and spring. Elevated precipitation and surface runoff lead to enhanced peak flows and a reduction in water storage in the uplands. These factors can interact to cause indirect changes in channel morphology by altering the streamflow timing, volume, and sediment loads (Furniss, Roelofs, & Yee, 1991). The mean response lines for ECA are a good predictor of enhanced peak flow (Grant, Lewis, Swanson, Cissel, & McDonnell, 2008). Peak flows can be analyzed regarding elevation breaks between the rain, transient snow, and the seasonal snow zones. For southern Oregon, these elevation breaks are

2,500 feet, 5,000 feet, and >5,000 feet, respectively (Jefferson, 2011). Seventy-seven percent of the Last Chance project area is in the Rain Dominated Hydro-region (Table 8.2).

Table 8.2: Rain, Transient Snow, and Seasonal Snow Zones in the Last Chance project area by Watershed.

Analysis Areas including 5th-level Watersheds (HUC 10)	Analysis Area (acres) [17]	Rainfall Dominated Acres (%)	Rain on Snow Transient Acres (%)	Snowfall Dominated Acres (%)
Last Chance Project Area	56,843	43,964 (77%)	12,654 (22%)	225 (1%)
Upper Cow Creek	1,227	386 (32%)	838 (68%)	2.2 (<1%)
Middle Cow Creek	23,658	20,337 (86%)	3,277 (14%)	44 (<1%)
Grave Creek	31,959	23,241 (73%)	8,539 (27%)	179 (<1%)

Current ECA was determined based on the 2020 National Agriculture Imagery Program (NAIP) Imagery of continuous areas over 4 acres that have less than 30 percent canopy cover. Current ECA for the project area is shown in Table 8.3. The lowest threshold is for transient snow zones and ECA would need to be 29% of the total area within this zone. The highest percent is for Middle Cow Creek, the project would need to have a percent change of 13% to change the potential for enhancing peak flows (Grant, Lewis, Swanson, Cissel, & McDonnell, 2008).

Table 8.3: Current ECA for the Last Chance Project Area for the Transient Snow Zone.

Analysis Area Name	Analysis Area (acres)	Current ECA (acres)	Percent ECA	Transient Snow (acres)	ECA in Transient Snow Zone	Percent ECA in Transient Snow Zone
Last Chance Project Area	265,249	35,543	13%	12,654	1,629	13%
Upper Cow Creek	47,507	4,647	10%	838	35	4%
Middle Cow Creek	113,166	17,813	16%	3,277	523	16%
Grave Creek	104,575	13,083	13%	8,539	1,071	13%

Road Density and Roaded Area: The haul routes for commercial timber extraction would use the existing road network when possible. In general, this road system was developed in the 1960s and 70s, and some of the infrastructure is old, inadequate, or beyond its original design life. It is likely there are crossings with culverts that are in poor condition. It is assumed that if culverts are failing and beyond load requirements, they would be replaced before hauling during renovation activities. It is also assumed that haul routes would receive typical road renovation/maintenance, which includes vegetation clearing in the road prism, repairing, or replacing drainage features and reshaping and resurfacing road surfaces. Any culvert replacements that are done in fish-bearing streams would require an Aquatic Organism Passage

[17] Portion of the 5th-level watershed within the Last Chance project area.

design and would also require the passage of a 100-year storm event with debris (USDI BLM, 2016b, p. 92). The percentage of the current roaded area for each analysis area is estimated at 5% or less (Table 8.4). All areas analyzed are well below 12%, which is the threshold that has been found to result in observable increases of peak flow in most studies (Ziemer, 1981).

Table 8.4: Road Density and Estimated Road Disturbance (Roaded Area) in the Last Chance project area.

	Last Chance project area (Acres)	**Last Chance (mi^2) [18]**	**Roads (mi)**	**Road Density (mi/mi^2)**	**Road Disturbance[19] (Acres)**	**Percent Roaded Area**
No Action	56,888	88.8	423	4.76	2,307	4.06%
Alt. 2 & 2a			451	5.08	2,459	4.33%
Alternative 3			423	4.76	2,307	4.06%

The temporal scale for looking at potential short-term direct and indirect impacts is 1-3 years. The long-term temporal scale (50+ years) is the time needed for full vegetation recovery and would be used to discuss cumulative effects such as potential changes to suspended sediment loads that would be outside natural and/or background levels. Sediment typically moves in pulses and can be stored anywhere along stream systems in banks and depositional areas and may be stabilized in place by vegetation during transportation, therefore should be considered over the long-term.

The spatial scale for this analysis is by watershed and hydrologic unit. Calculations for road density, roaded area, are shown by 12-digit (6^{th} level) sub-watersheds (Table 8.5).

Table 8.5: Road Metrics by 12-digit (6th level) Sub-watershed Clipped by the Project Boundary

Analysis Area Name[20]	**Analysis Area (mi^2)**	**Current Roads (mi)**	**Alt 2 &2a: Proposed Roads (mi)[21]**	**New Road Density (mi/mi^2)**	**New Road Disturbance (mi^2)**	**New Percent Roaded Area**
McGinnis Creek - Upper Cow	1.9	7	1.01	4.22	5.5	3.59%
Whitehorse Creek - Middle Cow	12.4	57	2.65	4.81	14.5	4.10%
Quines Creek - Middle Cow	21.1	95	4.31	4.71	23.5	4.01%
Fortune Branch - Middle Cow	3.5	15	1.51	4.72	8.3	4.02%
Last Chance – Grave Creek	25	123	12.82	5.43	69.9	4.63%
Shanks Creek - Grave Creek	8.8	38	2.81	4.64	15.3	3.95%
Rat Creek - Grave Creek	1.4	9	0.00	6.43	0.0	5.48%

[18] miles = mi
[19] Roaded Area, calculated by assuming an average disturbance width of 45 feet
[20] These are the portions of the 12-digit (6th level) sub-watershed areas within the Last Chance Project Area
[21] Roaded Area, calculated by assuming an average disturbance width of 45 feet

Wolf Creek - Grave Creek	14.8	79	2.72	5.52	14.8	4.71%

3.5.1.3. *Alternative 1 – No Action*

The No Action Alternative serves as a baseline to compare the effects of the action alternatives and describes the existing conditions with trends expected in the Last Chance project area.

Direct and Indirect Effects

Under the No Action Alternative, there would be no changes to peak flow, road density or roaded area as described in the Affected Environment section (Table 8.4). No new road construction or road renovation would occur under the No-Action Alternative. However, road use, road maintenance, silvicultural treatments, water source improvement and other activities would be expected to continue. It is likely that less road maintenance would occur under the no action alternative as compared to the action alternatives, since road renovation is being proposed in the action alternatives. Road maintenance and road renovation reduces sediment generated by roads by improving drainage, improving road surface conditions, and updating failed culverts. Issue B14 in the issues not analyzed in detail discusses the direct impact of proposed actions on sedimentation, this issue deals with the scale and scope of impacts downstream for sediment production for downstream aquatic resources.

The potential sediment from increased risk of landslides is analyzed in detail as Issue 3 of the FEIS USDI/BLM 2016a, pp. 394-400, and this analysis is incorporated here by reference. A model was developed in the RMP to evaluate the risk of landslides and the current and projected landslide density in this analysis. The RMP found that portions of the Harvest Land Base would be susceptible to sediment delivery by shallow slope failures regardless of any forest management activities. The RMP model assumed that over the next 50 years, the area of increased landslide susceptibility with the potential to deliver to streams would average no more than less than 1 percent of the harvest land base for RMP timber harvest activities including VRH.

Roads that have been or would be closed due to a natural process (abandonment) would not be opened and maintained for future use under this alternative and where hydrologic flow has been naturally restored, some of these roads have a portion within 200ft of a stream. Road renovation under the action alternatives may include rebuilding perennial stream crossings that would need to be designed and some of these are on roads planned for decommissioning. One of these crossings on Bull Run Creek is a critical stream for salmon recovery (See the Fisheries and Aquatic Habitat Issue). Under this alternative all these roads would stay barricaded and continue to recover as is under the no action alternative unless they are opened to provide access to private lands as part of reciprocal ROW agreements.

No measurable difference in sedimentation from landslides and slope failures is expected beyond what might occur under the no-action alternative. There is a small decrease in stand-replacing crown fires anticipated and a corresponding reduction in sedimentation from wildfires. But due to the multiple factors that impact this relationship, this also is unlikely to be measurable or quantifiable.

In summary, no measurable changes from current conditions are expected for fine sediment loads. However, it is likely that the trends measured in the Watershed Conditions Report over the last 25 years would continue, that is, improvement of road condition and management in forested headwaters reducing overall fine sediment loads and sedimentation downstream.

Cumulative Effects

The cumulative effects analysis area for considering effects to water resources is the 5th level watersheds with portions in the Last Chance project area. The cumulative effects analysis considers past, present, and reasonably foreseeable BLM actions, other Federal actions, and non-Federal (including private) actions. Historical and current mining and wildfires can result in impacts that can be cumulative for hydrology and water quality over the long-term. Both can increase surface runoff and lead to long-term water quality issues.

Present actions that contribute to cumulative effects include timber harvest, vegetation treatment projects, some limited mining projects and right-of-way projects for utility corridors and roads on both BLM and non-BLM lands. Many of these projects may increase ECA or roaded area and may result in peak flow enhancement or erosion. Specific direct and indirect impacts can cumulatively increase sediment loads through soil disturbance and erosion.

It is reasonable to assume timber harvest on private, State Forests and Josephine County timberlands would occur at a similar pace in the future to what is shown in the 2020 aerial National Agriculture Imagery Program (NAIP) Imagery. NAIP imagery has a 1-meter ground sample distance (GSD) and is published by the US Department of Agriculture. As timber lands are replanted, there is a point where the new vegetation offsets the contribution to the potential for enhanced peak flows or water yield. This is when the soils are stabilized, and the evapotranspiration rates approximate or exceed the pre-disturbance rates (generally 5 to 15 years after harvest).

The current road density within the Last Chance project area is approximately 4.8 mi/mi^2 (Table 8.4). This road density is likely to be the same or decrease under the no-action alternative since the basic road network is in place on both private and public lands. As harvest is completed, temporary roads are often storm proofed. Any new road construction unrelated to this project is likely to be offset by decommissioning of unused roads or be so small as to not change the overall road densities.

3.5.1.4. *Project Elements Common to All Action Alternatives*

Activity Fuels Reduction

Activity fuel loading in commercial timber units would be reduced through methods such as hand or machine pile and burn, and/or broadcast burning within 1-2 years following completion of harvest to allow fuels time to cure prior to burning.

Non-commercial Hazardous Fuels Reduction (HFR)

Hazardous fuels reduction treatments outside of the proposed commercial thinning units (3,446 acres) would be applied as needed and as funding and personnel permit to reduce the risk of stand-replacing crown fires (USDI BLM, 2016b, p. 82). These fuel treatments could include slashing, hand piling, hand pile burning, chipping, lop and scatter, biomass removal, and/or understory burning. HFR treatments are designed to treat understory vegetation (less than eight (8) inches DBH) to reduce surface fuels, ladder fuels, and to promote retention tree growth and vigor. Under-burning would involve the application of fire to understory vegetation and downed woody material when fuel moisture, soil moisture, weather, and atmospheric conditions allow for the fire to be confined to a predetermined area at a prescribed intensity to achieve the planned resource objectives. See Project Design Features, Table C-19 for more details.

Stream Restoration

The BLM is proposing individual tree cutting or tipping to provide logs for stream restoration activities (USDI/BLM 2016b, p. 76-77). Tree tipping is mechanically tipping or pulling over trees with root wads attached using an excavator or a truck mounted cable system, generally into or near a stream, to mimic natural wood recruitment (USDI/BLM 2016b, p. 315). The cut or tipped trees can be of any size and come from any zone in the Riparian Reserve LUA or from road renovation activities in the RR. Tree cutting, tipping and stream restoration actions would occur as funding and opportunities allow. Emphasis would be placed on trees which could be cut and removed via existing corridors, skid trails and roads. Snags would be created and scaled to the proportion of the thinned RR area to provide additional wood for streams over time (USDI/BLM 2016b, p. 82-86). Created snags would add down woody debris and wood in streams over time as they fall over. Where trees are cut for road construction, maintenance, and improvement in RR associated with features other than streams, cut trees would be maintained in adjacent stands as down woody material, or cut trees would be moved for placement in streams for fish habitat restoration. After consideration, cut trees in excess of the potential for these resource uses may be sold at the discretion of the BLM (USDI/BLM 2016b pp. 75-76).

3.5.1.5. *Alternative 2 – Proposed Action*

The Last Chance project includes forest management activities on approximately 11,686 acres of 32,272 acres of BLM-administered lands in the Last Chance project area. Under the Proposed Action, 3,446 acres of just hazardous fuels reduction treatment are proposed and approximately 8,240 acres of commercial harvest and thin and hazardous fuels reduction treatments would occur. Management activities are proposed within the Harvest Land Base Low Intensity Timber Area, Harvest Land Base Uneven-aged Timber Area, Late-Successional Reserve-Dry, Riparian Reserve-Moist and the Riparian Reserve-Dry in both Class I and Class III watersheds. The various areas would be treated with VRH, selection harvest, commercial and non-commercial thinning, activity fuels reduction, and fuel hazard reduction treatments.

To haul timber from the commercial harvest units 269 miles of roads will be used Alternative 2 proposes 241 miles of road renovation, 28 miles of road construction, and potential entry into 14 existing rock quarries (see Appendix D4 Watershed Analysis) that shows totals by analysis area). New Road construction would be in locations where there never a designed road. Sometimes roads will follow old jeep trails or mining roads called pioneer roads. Even after construction roads may be closed and decommissioned as per the logging plan, to put the road into long-term storage USDI/BLM 2016b, p. 311-312).

Of the 241 miles of road renovation proposed, the majority would require normal or routine maintenance such as replacing or repairing culverts, brushing, blading, and adding aggregate, these activities would generally reduce sediment loads. In addition to this typical road renovation, it is estimated based on field work that 15.8 miles of roads would need extensive renovation to bring them back to a design standard that would allow for hauling timber. This extensive renovation would include repairing and/or widening, rerouting portions of roads, improving grades, improving drainage patterns, installing new ditches, or upgrading from natural surface to aggregate surface.

Of the 241 miles of road renovation proposed, there is about 12 miles that are in the Evans Creek watershed, this is well traveled road called Ditch Creek and it access a ridge road that weaves in and out of the project area. Many of the mileage presented for this analysis will not include roads outside of the Last Chance PA, since no effects are likely other than normal road maintenance as part of the renovation that is proposed.

Of the constructed and renovated roads 50 miles would be closed to vehicles on a long-term basis after use with seasonal or limited access (20 miles) or decommissioned (30 miles). Prior to closure the road it would be left in an erosion-resistant condition by establishing cross drains, eliminating diversion potential at stream channels, and stabilizing or removing fills on unstable areas. (USDI/BLM, 2016b, p. 311-312). At a minimum, decommissioning would include leaving roads in a well-drained condition and blocking access to vehicular use with barriers such as trenches, rocks, or logs. Road decommissioning would be subject to stipulations by holders of reciprocal rights-of-way, easements, or other legal interests.

Some roads within 200 feet of streams would be renovated where there are not operationally feasible and economically viable alternatives to accomplish forest management objectives. Where trees are cut for road construction, maintenance, and improvement in the Outer Zone or in Riparian Reserves associated with features other than streams, retain cut trees in adjacent stands as down woody material, move cut trees for placement in streams for fish habitat restoration, or sell trees, at the discretion of the BLM (USDI/BLM 2016b pp. 75-76). Roads within 200 feet of streams would only be renovated where not operationally feasible and economically viable alternatives to accomplish the proposed forest management objectives.

For roads that are within the sediment delivery zone (within 200ft of a stream) there are 0.48 miles proposed for road construction and 52 miles are proposed for renovation. Of the 52 miles of road renovation, 1.8 miles are currently closed due to a natural process (abandonment). These roads may be barricaded and have had culverts removed in the past and some may have perennial crossings that need to be rebuilt.

There are 2 perennial stream crossing on proposed constructed roads and 149 crossing on roads proposed for renovation, of these 8 have been identified as potentially needing to be rebuilt. There are no site-specific designs for these potential stream crossings. New or reconstructed temporary and permanent stream crossings identified for proposed haul routes would be evaluated and site-specific measures would be employed to reduce impacts.

Direct and Indirect Effects

Of the BLM administered lands 16,828 acres within the Last Chance project area's is designated as Harvest Land Base (HLB) which are uneven-aged and low Intensity land use allocations that meet the criteria for harvest sustainability. Harvest sustainability means that these units have adequate stand composition and stocking, are feasible to log, and are accessible to existing roads; and have data collection and surveys for wildlife, botany, cultural, soil and water resources. Harvest Land Base lands are used to calculate the Annual Productive Capacity/Allowable Sale Quantity (ASQ) used in the FEIS.

In these areas thinning can be below the canopy threshold for creating an opening large enough to be considered in the ECA calculations. However, the percent change to the ECA based on estimates of openings that would be created with the proposed commercial timber harvest indicated there is no potential for enhancing peak flows (Table 8.6 and Table 8.3). Middle Cow watershed would need to see a 13% increase in ECA to change the current condition of 16% to above the 29% threshold.

Table 8.6: Change in ECA based on Commercial Timber Harvest by Alternative.

Analysis Areas including 5th-level Watersheds (10-digit)	Analysis Area (acres) *	Current ECA	ECA Alt. 1 (%)	ECA Alt. 2 (% change)	ECA Alt. 2a (%)
		(acres)	No Action	VRH	Thinning
All Three Watersheds	103,033	35,543	34%	1.45%	1.43%
Upper Cow Creek	47,507	13,083	28%	0.92%	0.96%
Middle Cow Creek	113,166	17,813	16%	0.43%	0.43%
Grave Creek	104,575	13,083	13%	0.54%	0.50%
Alternative 3 would not create any openings that would add to the ECA.					

In addition to the HLB, BLM has identified approximately 4,868 acres of forest stands within the Last Chance project area's Late-Successional Reserve-Dry land use and 6,697 acres of Riparian Reserve Dry and Moist based on field surveys that meet the criteria for being included in commercial thinning units.

These areas are generally experiencing declining forest health and diversity due to high levels of density-related competition since they are part of forest stands in the HLB or LSR. Silvicultural and fuels treatments would reduce stand densities and related competition to increase individual tree growth, which is expected

to provide stable wood to streams and reduce the risk of stand-replacing crown fires in these areas.

Objectives for treatments in Riparian Reserve land allocation are to maintain and restore natural channel dynamics, processes, and proper functioning condition of riparian areas by providing forest shade, sediment filtering, wood recruitment, stream bank and channel stability, water storage and release, vegetation diversity and provide quality water and contribute to the restoration of degraded water quality (USDI BLM, 2016b, p. 75).

Commercial Timber Thinning and VRH Treatments: This alternative would have VRH treatments for Low Intensity Timber Area units which are outside of occupied NSO sites. The stand after treatment would generally be a two-aged or multi-aged this difference in age can be dispersed through the stand or in patches.

Commercial thinning to 30 (+/- 10) percent relative density post-harvest would be the goal with up to 4-acre group selects within the HLB LUAs. No 4-acre group select areas would occur in other LUAs such as RR. Group selects are stand patches that are removed except for trees above diameter classes. Based on an analysis by our BLM Forester to determine the maximum potential acres of ECA by LUA based on prescriptions for the stands. These estimates vary by type of HLB (See Table 8.7).

Table 8.7: Last Chance Maximum Potential Acres of Equivalent Clear-cut Area for Alternative 2

Land Use Allocations	Acres of LUA within PA	Potential ECA Alt. 2	Potential ECA Alt. 2	Percentage ECA by LUA	Grave ECA[22] (acres)	Middle Cow ECA (acres)	Upper Cow ECA (acres)
HLB-MITA	146	57	6	39%	337	0	0
HLB-LITA	1,895	729	91	39%	22	28	0
HLB-UTA	14,787	1,103	1,103	7%	208	141	22
Total Acres	**16,828**	**1,908**	**1,200**	**11%**	**567**	**169**	**22**

Commercial thinning would be done in stands marked with buffers for streams (120 feet for perennial and 50 feet for intermittent streams in Class I watersheds). These buffers are designed to protect the root network of typical trees, reduce erosion, reduce direct impacts to wetlands, reduce potential impacts to hydric soils, maintain stream temperatures by maintaining the primary shade zone and avoid sedimentation. Studies have shown that "vegetation immediately adjacent to the stream channel is most important in maintaining bank integrity" (FEMAT, 1993). One study found that 95% of the erosion features from timber harvest that were at least 32.8 feet from streams channels (Rashin, Clishe, Loch, & Bell, 2006). In addition to the stabilizing effect of the tree's root networks, trees adjacent to streams dissipate energy during high or overbank flows, reducing bank erosion.

[22] This the acres of the LUA per watershed proposed for commercial thinning multiplied by the percentage ECA by LUA.

Impacts from commercial thinning can be differentiated by the type of yarding system. Yarding of the thinned timber would be done with cable suspension systems, tethered assist, helicopter yarding, or ground-based yarding using forwarder trails or traditional skid trails.

Landings shall be located along existing roads, temporary routes, and/or cable-tractor swing routes or within unit boundaries where possible. For analysis, cable and ground-based landings are estimated on average as 1/4 acre and helicopter landings as 1 acre. Project related areas of disturbances for new haul routes were estimated based on a 20-foot buffer which assumes an average disturbance width of 45 feet on proposed new or reconstructed roads. These disturbance estimates and anticipated locations were used in ECA calculations. The ECA was calculated for each of the 12-digit (6^{th} level) analysis areas to see if any exceed the 29% threshold for rain dominated watersheds (Appendix D4: Watershed Analysis).

In summary, commercial harvest and hazardous fuels reduction treatments would be conducted with PDFs that are designed to reduce or remove the potential for accelerated erosion and any increased sediment production. There is no expectation of enhancing peak-flows, water yields or changes in other hydrological conditions from commercial thinning (see Section 8.0). Although there may be increased erosion and changes to hydrology locally and over the short-term; if goals to make forest stands more resilient to catastrophic disturbance such as crown-replacing fires are achieved, long-term sedimentation rates may decrease due to Proposed Actions as compared to the no-action alternative.

Road Construction, Road Renovation, Road Closures and Decommissioning: Road density is more likely to impact peak flows on small watersheds than with larger watersheds (Gucinski, Furniss, Ziemer, & Brookes, 2001). Therefore, road density and roaded area were also calculated for all 6^{th} and 7^{th}-level subwatersheds (Appendix D4: Watershed Analysis Tables 4.1). For a definition of terms and more details about transportation planning for this project see Appendix D3: Transportation Planning.

For roads within 200ft of a stream there are 0.48 miles proposed for road construction and 51.8 miles are proposed for renovation with 1.8 miles would need major work to renovate, and there would be 7.5 miles that would be closed and decommissioned. The potential for sediment delivery is most likely 1-3 years (short-term) after construction or renovation and would be moderated by BMPs.

Management direction for hydrology is to, "Decommission roads that are no longer needed for resource management and are at risk of failure or are contributing sediment to streams, consistent with valid existing rights" (USDI BLM, 2016b, p. 93). Roads proposed for decommissioning would be closed to vehicle traffic after use. Prior to closure the road will be left in an erosion-resistant condition by establishing cross drains, clearing stream channels, and stabilizing or removing fills on unstable areas. Roads would be closed with an earthen barrier or its equivalent. This category can include roads that have been or will be closed due to a natural process (abandonment) and may be opened and maintained for future use. If barriers and decommissioning are successful (USDI/BLM 2016b, pp. 311-312) the roads would become more stable and have less sediment production and are not expected to have long term impacts on sedimentation (50 years).

The FEIS, Table 3-66, p. 403 assumed there is currently 1,738 miles of natural surface roads within 200 feet of streams on BLM administered land in Oregon, adding 0.48 miles of natural surface roads to this amount would theoretically add 6.4 tons/year of sediment production. This potential sediment load would be moderated by buffers of intact riparian in the inner zone in most cases. Based on the FEIS modeling, existing sediment yields from the Last Chance project area, with currently 156 miles of current roads in the project area within 200ft of a stream, these roads would generate an estimated 2,086 tons/year of sediment.

On BLM administered land within the Last Chance project area there is currently an estimated 132 miles of roads within 200 feet of streams. Less than ½ mile of proposed constructed roads within 200 ft of streams under Alternative 2 and this represents an increase of about 0.3 % increase in roads on BLM administered lands. The predicted increase of sediment would also be 0.3 % over the first two years (See Table 8.8).

Table 8.8: Existing and Proposed Roads within 200 feet of Streams.

Analysis Area	Road Surface Category	Existing Roads within 200ft		Alternative 2 & 2a Proposed Roads within 200ft of a Stream				Alternative 3 Proposed Roads within 200ft of a Stream	
		BLM (miles)	**Other (miles)**	**Renovated (miles)**	**Constructed (miles)**	**Total (miles)**	**% Increase**	**BLM (miles)**	**Total (miles)**
Last Chance Project Area	Natural	70.8	21.0	6.20	0.48	92.3	0.5%	0	91.8
	Aggregate	52.4	0.5	36.60	0.00	52.9	0.0%	0	52.9
	Paved	9.0	2.4	9.02	0.00	11.4	-	0	11.4
	Total	**132.2**	**23.9**	**51.8**	**0.5**	**156.6**	**0.3%**	**0**	**156.1**
Upper Cow Creek Watershed	Natural	1.1	0.0	0.43	0.04	1.2	-	0	1.1
	Aggregate	0.2	0.0	0.01	0.00	0.2	-	0	0.2
	Paved	0.0	0.0	0.00	0.00	0.0	-	0	0.0
	Total	**1.4**	**0.0**	**0.4**	**0.0**	**1.4**	-		**1.4**
Middle Cow Creek Watershed	Natural	28.3	2.8	0.51	0.14	31.2	0.4%	0	31.1
	Aggregate	18.4	0.2	12.06	0.10	18.7	0.5%	0	18.6
	Paved	3.3	1.4	3.23	0.00	4.7	-	0	4.7
	Total	**50.0**	**4.4**	**15.8**	**0.2**	**54.6**	**0.4%**		**54.4**
Grave Creek Watershed	Natural	41.4	1.8	3.31	0.30	43.5	0.7%	0	43.2
	Aggregate	33.8	1.2	24.52	0.00	35.0	-	0	35.0
	Paved	5.7	1.3	5.78	0.00	7.0	-	0	7.0
	Total	**80.8**	**4.4**	**33.6**	**0.3**	**85.5**	**0.4%**	**0**	**85.2**

The FEIS for Western Oregon described how road construction and decommissioning might affect soil disturbance and create sources of fine sediment that are delivered to stream channels. It is incorporated here by reference (USDI/BLM 2016b pp.401-403). Decommissioning includes a variety of practices, ranging from simply blocking access to the road being fully decommissioned, which may include re-establishing drainage by removing culvers and re-contouring and planting the roadbed. The FEIS used a sediment model WARSEM and modeled sediment delivery assuming a 200-foot sediment delivery distance to streams. The FEIS assumes a 1% increase in road construction and estimated the increased potential fine sediment delivery into the future and sedimentation rates at this level would be inconsequential in comparison to existing sediment delivery.

The FEIS assumes there would be less not more roads within the RR over time and that roads within the riparian reserve would be temporary and reclaimed after use. This analysis was based on assumptions described on page 407 of the FEIS it says, "Under the action alternatives and the Proposed RMP, the BLM would not thin the inner zone of the Riparian Reserve, which would substantially reduce the need for road construction in the sediment delivery distance and ensure that the Riparian Reserve would maintain an effective sediment filtration area along streams."

For any new road that is proposed within 200ft of a stream there should be no other reasonable route as per the riparian management direction. The proposed action includes renovating a road along an unnamed tributary to Grave Creek in T33S R04W Section 15. Both routes reach the bottom end of units that cannot be reached by the road system above. The Grave Creek tributary road re-builds a road that was decommissioned after removing a crossing on Grave Creek that provided access into Section 15.

The FEIS assumes 13.26 tons per mile per year for natural surface roads (USDI/BLM, 2016a, p. 403). Based on this estimate road construction (0.48 miles) with 200ft of streams, construction of these road segments would result in about 6.4 tons of fine sediment per year downstream. Some of this sediment would be stored within stream channels along the way but likely there would be some increase in fine sediment into Cow Creek and Grave Creek. Likely this sediment would be transported during peak storm events and would result in impacts to fish habitat and water quality downstream but would be indistinguishable from background conditions since it would be less than a 1% increase.

New or Renovated Stream Crossings: There are 2 perennial stream crossing on proposed constructed roads and 149 crossing on roads proposed for renovation, of these 8 have been identified as potentially needing to be rebuilt. When constructing new crossings in streams containing native migratory fish the crossing would meet ODFW, ARBO II and USDI FWS fish passage criteria (See Appendix C, R17). On abandonment of a crossing (i.e., removal of a culvert without replacement) in streams containing native migratory fish, the natural stream grade would be restored, unless a lessor gradient is required for fish passage. New or reconstructed temporary and permanent stream crossings identified for proposed haul routes include a temporary crossing on Bull Run Creek. There are two new crossings planned on perennial streams, these crossings would need to be designed for a 100-year flood event, including allowance for bed load and anticipated floatable debris (USDI/BLM, 2016b, p. 92).

Road Renovation: Road renovation includes maintenance for current roads that are already at their design standard would occur within the existing road prisms for all haul routes (241 miles). These activities would include grubbing, blading, cleaning ditches and culverts, replacing undersized or failing culverts and other routine action. However, there are also roads that are barricaded have been decommissioned and would need new crossings, culvert installation and potentially reconstruction, this is estimated to be 15.8 miles.

Roads that only need routine maintenance such as brushing, blading, culvert replacement, ditch maintenance and surfacing will likely benefit from these actions and will result in less sediment generation over time. Impacts from the use of these routes and spurs can be expected during hauling and would include erosion and some increase in sedimentation. Minor elevated surface runoff and sedimentation could occur during the short term (1-2 years). Due to vegetation buffers, BMPs and PDFs to address hydrologically connected units or roads elevated runoff is likely to infiltrate and sediment is likely to be deposited in the uplands.

Seasonal Use of Roads and Dry Condition Requirements: Hydrologically connected disturbance from roads, trails, landings, and logging corridors have the potential for adverse effects, including sedimentation (Furniss, Flanagan, & McFadin, 2000). Haul route crossings on perennial stream have been evaluated to determine which road segments may be hydrologically connected to perennial streams (Table C-20). Of the proposed haul routes, there are about 123 perennial stream crossings on natural surface and aggregate roads that are hydrologically connected to streams and about 92 miles of roads within 200 feet of a stream. Proper road renovation, BMPs and PDFs (Appendix B), and good project administration would reduce the risk of this source being above background conditions for sediment delivery to surface waters.

Dry condition requirements for ground-based activities, road renovation, construction and use of temporary routes, skid trails, and tractor swing trails, and/or hauling would reduce direct and indirect impacts to sediment loads that could occur during in wet conditions. This BMP and other project design measures accomplish the management direction for hydrology to select and implement site-level BMPs (Appendix C) to maintain water quality for BLM actions (including, but not limited to, road construction, road renovation, silvicultural treatments, recreation management, prescribed burning, and wildfire management actions/activities) and discretionary actions of others crossing BLM-administered lands (USDI BLM, 2016b, p. 92).

Use of Existing Developed Rock Quarries: The BLM has identified fourteen potential rock quarries in the Last Chance planning area (see Table D-1) to be used for road aggregate. Quarry entries include the removal of and/or processing of quarry rock for use in road renovation activities. Each entry would primarily provide crushed rock. The quarries could also provide oversized boulders for use in road repairs, or armoring, within the planning area. Stormwater containment would be required for the working surface of quarries which if effective should keep all fine sediment contained on the quarries. There may be some increase in fine particulate matter that is aerosolized during blasting the crushing that is transported offsite, but this should be temporary and small in volume.

In Summary, based on the data analyzed, the risk of peak flow enhancement from roads alone would be low. All roads in the Last Chance project area occupy less than 4.5% of the land base. Statistically significant increases in peak flows have been shown to occur only when roads occupy at least 12% of the watershed, based on an extensive review of the literature of peak flows in western Oregon (Harr, 1976). Landings, yarding corridors, skidding trails and other new disturbance would be minimized with BMPs.

Roaded area would increase 0.3% under alternative 2, but still be well under 12% where a perceptible increase in peak flows would be expected (See Tables 8.4). The proposed conversion of decommissioned roads to permanent roads near streams could have impacts on fine sediment loads over the long term. Sediment generation from project activities (6.4 tons per year for 1-2 years following activities) would be indistinguishable from background conditions (less than 1% increase) and would not impact aquatic habitats downstream.

Cumulative Effects

For this Alternative 2, no cumulatively measurable or significant alterations to the hydrologic function or quality of waters in Upper Cow Creek, Middle Cow Creek and Grave Creek or their major tributaries are expected beyond what has been described in the Affected Environment. Sediment generation from project activities (6.4 tons per year for 1-2 years following activities and diminished after that) would be indistinguishable from background conditions (less than 1% increase). Cumulative impacts from other activities in this watershed as described in Alternative 1and would be the same under this alternative.

3.5.1.6. *Sub Alternative 2a – Thinning instead of VRH*

This alternative proposes commercial harvest activities, consisting of commercial thinning or selection harvest only, on approximately 1,059 acres and non-commercial hazardous fuels reduction treatment on 11,686 acres (of which, 1,059 acres overlap with commercial harvest treatments).

Direct and Indirect Effects

Instead of the group select openings that occur with VRH these stands would be commercially thinned or have selection harvest. Assuming the volume of haul would be similar and timber harvest methods would be comparable, the big difference is that there would not be an increase in ECA and therefore any impacts described for Alternative A resulting in increased potential for peak flow conditions would not occur under this sub-alternative. No changes in proposed new construction or increases in renovation of haul roads were described or anticipated for this alternative.

Cumulative Effects

For Sub-Alternative 2a, no cumulatively measurable or significant alterations to the hydrologic function or quality of waters in Upper Cow Creek, Middle Cow Creek and Grave Creek or their major tributaries are expected beyond what has been described for Alternative 2.

3.5.1.7. *Alternative 3*

Alternative 3 proposes no road construction. This alternative proposes 53 miles of road renovation and potential entry into 6 existing rock quarries. Like Alternative 2, previously decommissioned roads, or roads placed in a long-term closure status, are proposed to be renovated for the project and may be closed upon project completion (USDI/BLM 2016b p. 311, 312). This alternative would eliminate commercial timber harvest in occupied owl nest sites, and includes silvicultural treatments designed to increase tree retention with diameter limits for harvest.

Direct and Indirect Effects

This alternative would not include group select openings to plant new stands of trees. This means it can be assumed that there would be no contribution to ECA under this alternative, the broadcast burning described would be less likely since there would not be a need to prepare the sites for planting, and only activity piles would be burned. However, hazardous fuels reduction projects would be the same. Therefore, potential enhancement of peak flows would be similar to impacts described for the No-Action Alternative because no additional acres of ECA would be created by harvest methods (Appendix D4: Watershed Analysis).

Road Construction, Road Renovation, Road Closures and Decommissioning Alternative 3 does not propose road construction. Alternative 3 proposes 51 miles of road renovation, 2 new stream crossings and 7 perennial stream crossings that may need to be rebuilt. Of this, 51 miles of road renovation there are about 3.3 miles of road that will be closed to vehicle traffic seasonally with limited access (1.7 miles) and decommissioned (1.4 miles) after use, and about 2.4 miles of roads that were decommissioned and may need to be rebuilt during renovation. This category can include roads that have been or will be closed due to a natural process (abandonment) and may be opened and maintained for future use.

For roads within 200ft of a stream, there are 12 miles would be renovated, while 0.25 miles would need major work during renovation. There would be 0.43 miles that would be closed and decommissioned.

The potential for sediment delivery is most likely 1-3 years (short-term) after construction or renovation and would be moderated by BMPs. If barriers and decommissioning are successful (USDI/BLM 2016b, pp. 311-312) the roads would become more stable and have less sediment production and are not expected to have long term impacts on sedimentation (over 50 years).

Commercial Harvest: This alternative would have commercial thinning to retain 40-45 percent relative density/acre in all treatment areas and no hazardous fuels reduction maintenance, only understory reduction treatments. This type of thinning is likely to be less economical in some areas depending on the yarding method and therefore there would be 1,097 less acres of commercial harvest considered under this alterative. Some areas with old growth characteristics in Alternative 2 were not considered under this alternative. Impacts would be reduced.c***Use of Existing Developed Rock Quarries***: The BLM has identified potential entry into 6 existing rock quarries in the Last Chance planning area (see Table D-1) that would be used under this alternative. Impacts would be similar to those described in Alternative 2, but at about half the rate.

In summary, commercial harvest would be conducted with BMPs and PDFs that are designed to reduce or remove the potential for accelerated erosion and any increased sediment production because of actions. Also, there is no expectation of enhancing peak-flows, water yields or changes in other hydrological conditions from commercial thinning that would increase sediment transportation rates above background conditions (see Section 8.0). Although there may be increased erosion locally and over the short-term; if the goal is to make forest stands more resilient to catastrophic disturbance such as crown-replacing fires are achieved, long-term sedimentation rates may decrease.

Cumulative Effects

For Alternative 3, it was determined that little to no sediment loads would be produced from individual units, landings, or crossings along haul routes. No treatment buffers, BMPs, and specific associated PDFs identified in Appendix C would result in no measurable sedimentation downstream above natural background levels described for the no-action alternative. Therefore, water quality and aquatic habitat downstream would not be negatively affected. There would also be no changes to current slope stability, the risk of slope failure and the risk of periodic slope failures are still within the range of natural variability.

Just as with the Alternative 2, some short-term direct and indirect effects to water quality were identified due to pulses in sediment and turbidity from road work, generally during the first significant storm event of the wet season. While these effects from sediment could potentially occur, it would remain within acceptable water quality limits for turbidity, and sediment loads would be more likely to occur during peak flows and therefore would be difficult to distinguish from background levels.

3.6. Fisheries and Aquatic Habitat

3.6.1. Issue 9: How would timber hauling, road related activities, and decommissioning affect Southern Oregon/Northern California Coast (SONCC) Coho Salmon and Oregon Coast (OC) Coho Salmon species and their habitat? Methodology

3.6.2. Methodology

- The fisheries analysis used data regarding distribution and fish presence/absence from Oregon Department of Fish and Wildlife, BLM ORWA corporate fish distribution database, and StreamNet.
- Field visits to proposed haul routes, riparian treatments, and other proposed project activities provided site-specific information.
- The Last Chance Forest Management Project as proposed and analyzed, is using relevant BMPs and PDFs, would have insignificant effects to SONCC and OC Coho Salmon, their Critical Habitat (CH), and Essential Fish Habitat (EFH), and would be consulted on with NOAA Fisheries under the Programmatic Forest Management Biological Opinion for Western Oregon (FOMBO).

3.6.3. Assumptions

- Fish distribution, presence, and absence data are from Oregon Department of Fish and Wildlife, BLM ORWA corporate fish distribution database, and StreamNet; these sources are considered the best and most current available data.

- Paved roads do not contribute sediment to streams.
- Coho Critical Habitat and Essential Fish Habitat are not going to be degraded due to the application of Riparian buffers on the Inner, Middle, and Outer Riparian Zones, along with the implementation of BMPs and PDFs.

3.6.4. Affected Environment

Special Status Species, Critical Habitat, and Essential Fish Habitat

The project area contains 7 Class I subwatersheds; they contain habitat for special status species. Three of the subwatersheds contain habitat for the threatened and endangered (T&E) Oregon Coast (OC) Coho Salmon. Four of the subwatersheds contain habitat for the T&E species Southern Oregon/Northern California Coast (SONCC) Coho Salmon. Salmon are listed under the Endangered Species Act (ESA) by evolutionarily significant units (ESU).

On June 20, 2011, the National Oceanic and Atmospheric Administration (NOAA) Fisheries Service published a final determination to retain OC Coho Salmon as a threatened species under ESA (Federal Register Vol. 76, No. 118). Designation of Critical Habitat became effective on February 11, 2008, (Federal Register Vol. 73, No. 28). The southernmost extent of the federally listed threatened OC Coho Salmon is the Umpqua Basin.

On June 28, 2005, the National Oceanic and Atmospheric Administration (NOAA) Fisheries Service published a final determination to retain SONCC Coho Salmon as a threatened species under ESA (Federal Register Vol. 70, No. 123). This ESA Listing status was updated on April 14, 2014 (Federal Register Vol. 79, No. 71). Designation of Critical Habitat became effective on May 5, 1999 (Federal Register Vol. 64, No. 86). The northernmost extent of the federally listed threatened SONCC Coho Salmon is the Rogue Basin

Streams and habitat currently or historically accessible to Chinook and coho salmon are considered Essential Fish Habitat (EFH), designated for fish species of commercial importance by the Magnuson-Stevens Fishery Conservation and Management Act of 1996 50 CFR, Part 600, Subsection J, EFH.

Many commercial treatments are adjacent to Coho Critical Habitat (CH) and EFH with a buffer of 120 feet, and many non-commercial treatments are adjacent with a buffer of 60 feet. Most treatment units are found further away from CH.

Riparian Reserves

The RMP established Riparian Reserves as part of the land use allocation designation process. Riparian Reserves are the federally administered lands in which the primary objectives are to maintain and restore riparian functions, maintain water quality, and contribute toward the conservation and recovery of ESA-listed fish species (USDI/BLM 2016b, p. 75).

For the Last Chance Forest Management Project, using the RMP Management Direction, fish-bearing and perennial streams were given a 120-foot buffer, while intermittent streams were given a 50-foot buffer. Many units contained perennial stream buffers and CH.

3.6.5. Environmental Effects

3.6.5.1. *No Action Alternative*

While activities associated with the proposed action would not occur under the No Action Alternative, other activities which are not associated with the proposed action may occur and are discussed below.

Direct/Indirect Effects

These projects would follow all provisions of the Clean Water Act (40 CFR Subchapter D) and Department of Environmental Quality's (DEQ's) provisions for maintenance of water quality standards. These projects would apply Riparian Reserve buffers when in proximity to streams and CH and apply PDFs and BMPs such as ones that minimize ground disturbance within the Riparian Reserves, limit expansions of landings or new landings within Riparian Reserves, minimize shade removal and sediment inputs, and maintain levels of large woody debris in order to minimize effects to listed species and their habitat. Projects associated with private lands would comply with the Oregon Forest Practices Act and are designed to protect aquatic resources.

Under the No Action Alternative, there would be no project-related road renovation activities. Road renovation activities improve the function of system roads and decrease non-point source pollution that may emanate from unmaintained roads. Thus, under the No Action Alternative, there would be no decrease to non-point source pollution within the project area. Additionally, under the No Action Alternative, riparian thinning of Middle Zones of intermittent streams would not occur.

Cumulative Effects

BLM approved projects would apply Riparian Reserve buffers when in proximity to streams and CH and apply PDFs and BMPs. Projects associated with private lands would comply with Oregon Forest Practices Act and are designed to protect aquatic resources. Because there are no anticipated direct or indirect effects from other projects within the project area there are no anticipated cumulative effects to fish species and their habitat within the Last Chance project area.

3.6.5.2. *Alternative 2 and Sub-Alternative 2a*

Direct/Indirect Effects

Timber hauling, road related activities, such as renovation, construction, and decommissioning, and stream crossing renovation would affect both SONCC and OC Coho Salmon and their CH, but project activities are not expected to have significant effects to either fish species or their critical habitat.

Timber Haul

The Last Chance haul road segments and road-related activities intersect 27 stream segments containing SSS, CH, and EFH. Because some crossings occur on bituminous (paved) surface type and erosion from paved roads is not expected, they are dropped from further analysis. Of the 27 crossings listed, only one crossing is proposed for renovation: the crossing at Bull Run Creek which contains OC CH. Sediment would not be expected to enter CH as a measurable quantity because BMPs and PDFs such as completing construction during the in-stream work window and installing sediment barriers, where needed, would prevent measurable sediment delivery into CH streams. Project activities would follow all provisions of the Clean Water Act (40 CFR Subchapter D) and Department of Environmental Quality's provisions for maintenance of water quality standards. In addition, Project Design Criteria (PDCs) from the FOMBO would be implemented and work would be in compliance with this Biological Opinion.

Last Chance haul routes intersect perennial stream systems throughout the project area. There are 27 haul routes that cross over CH (Table C-21, Appx. C.). The term 'crossings' refers to permanent structures, either culverts or bridges associated with roads. The term 'low water stream ford' refers to stream crossings which do not have permanent structures such as culverts and bridges. Vehicles would access the areas by traveling through the low water stream channel within the in-stream work window.

Road Renovation/Decommissioning

Road renovation, specifically culvert and cross-drain replacements within the RRs, and the implementation of BMPs, would help protect stream shade, maintain stream temperature, and reduce sedimentation. Minimizing the width of the crossings and placing the crossing perpendicular to the stream requires the removal of fewer overstory trees. There would still likely be some crossing replacements and additions on streams that could decrease stream shade, however, the effects are likely to be minor. This is because only a small amount of overstory vegetation would be removed, and the vegetation would recover over time. In addition, there would be a spatial and temporal separation of culvert replacements across the project area which would prevent an aggregation of increases in stream temperature and overall sedimentation within the project area. Following installation, there may be a short term and localized pulse of sediment during the first rain event of the wet season. The replacement of culverts and cross drains would have long-term benefits and reduce the potential for future road failures.

Temporary roads on BLM-administered lands would be decommissioned after use. Permanent roads would not be decommissioned. Road decommissioning can ameliorate the effect of increases in drainage network caused by new road construction by disconnecting runoff from temporary roads to streams. Road decommissioning would include blocking the road, out-sloping and adding water bars for drainage control, ripping and sub-soiling the roadbed, culvert removal, and replanting the roadbed. Roads that receive full decommissioning (ripping and sub-soiling) would have the most beneficial effect of reducing runoff to streams and decreasing the drainage network. The fully decommissioned roads would provide a long-term benefit of decreasing the drainage network by disconnecting these roads from the stream.

Bridge/Ford Construction

BLM proposes to cross Bull Run Creek at the 32-5-25.6 road using either a temporary bridge or an armored low water ford. This creek contains Critical Habitat (CH) for OC, other SSS, and EFH for coho salmon. The site is an existing crossing where the culvert had been previously removed. Minimal overstory removal would be required for construction because it is an existing crossing. The bridge or ford would be located perpendicular to the streamflow as the stream allows. Placing the structure perpendicular to the stream ensures that the smallest amount of vegetation would need to be removed.

Bridge or ford construction would follow General Aquatic Conservation Measures from the Fisheries Consultation and BMPs from the RMP which includes measures such as conducting activities during the ODFW in-stream work window when fish species are mobile; any material used during construction activities such as riprap would not be placed within the bankfull width of the stream; and the work area would be isolated from flows.

While there would be a pulse of sediment released during construction activities, it is expected to be short-term and localized. Because activities would occur during the ODFW in-stream work window, mobile fish would likely move from the area during construction activities. To ensure that fish are not present, the work area would be isolated and any remaining fish would be removed (BLM fish specialists have the necessary permits to perform fish relocation during construction activities). Construction and use would all be in one season and would happen between July 1 and September 15. After use, the crossing would be removed and the road blocked. Hauling would consist of approximately 30 trips and would be completed within one season.

Both placing a temporary bridge and constructing an armored low water ford would require large equipment to enter the channel. Construction would occur during the in-stream work window. The existing crossing would need minor improvements to be used during temporary bridge placement. Because the crossing is existing, few trees are likely to be removed during either bridge placement or ford construction. Spawning substrate within Bull Run Creek may be negatively affected during construction and associated road activities, such as hauling. These impacts from machinery within the creek are expected to be limited in scope and duration due to BMPs, and PDFs such as completing the work during the in-stream work window. Sediment delivery from rocked approaches on an armored ford would be minimized. Instream disturbance of the wetted channel as vehicles cross would likely create a noticeable burst of turbidity that would be of low intensity and short duration, dissipating rapidly.

During installation of the temporary bridge, there would be a short-term impact to spawning substrate, pool quality, and gravels. Once the temporary bridge is installed there would be no impact to spawning substrate, pool quality and gravels. The same temporary impact would be expected when the temporary bridge is removed.

Conclusion

The Last Chance project is proposed in the Umpqua and Rogue Basins, and within the range of the federally threatened Oregon Coast (OC) and Southern Oregon/Northern California Coast (SONCC) Coho Salmon, respectively, and would have effects on coho and critical habitat. Consultation for the Endangered Species Act and Essential Fish Habitat for the Magnuson-Stevens Fishery Conservation and Management Act with the National Marine Fisheries Service is covered under the *Endangered Species Act Section 7(a) (2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat for the Programmatic Forest Management Program for Western Oregon* (WCR-2017-7574; *aka*: FOMBO).

Habitat access would remain unaltered under Alternative 2 and Sub-Alternative 2a. Fish passage barrier culverts or bridges are not proposed to be replaced or upgraded under this project. Sediment production and delivery to streams would be minimized through the implementation of BMPs and PDFs and would not have more than negligible discountable effects on spawning substrate and rearing habitat such as pools. This project incorporates BMPs, PDFs, and project design criteria and conservation recommendations from the FOMBO. Project activities as analyzed and consulted upon are not likely to jeopardize the continued existence of OC or SONCC Coho Salmon.

Cumulative Effects

Within the project area, other anticipated projects include vegetation management projects such as timber sales, and fuel reduction projects, along with miscellaneous projects.

As stated above, the projects listed under the No Action Alternative are reasonably foreseeable to occur. Those projects, in association with the activities described in the proposed action, are not expected to have detrimental environmental effects.

Vegetation management projects and/or timber sales would apply RR buffers when in proximity to streams and Critical Habitat. The PDFs and BMPs such as ones that minimize ground disturbance within the RR, limit expansions of landings or new landings within RR, minimize shade removal and sediment inputs, and maintain levels of large woody debris, would be applied in order to minimize effects to listed species and their habitat.

Foreseeable private forest harvest within the project area would comply with Oregon Forest Practices Act. The BLM does not regulate harvest on private land. The requirements of the Oregon Forest Practices Act are intended to protect fish, wildlife, and water quality when forest management activities occur near waters of the state and within riparian management areas. Normally, cumulative impacts to waters of the state and aquatic resources would not be expected because BLM actions and private land harvest are implemented under state and federal laws and regulations.

Miscellaneous projects would either be located outside RR so that the effect to listed species would be negligible or would apply BMPs and PDFs that minimize effects to listed species and their habitat. Road renovation activities that benefit hydrologic function within the project area would also benefit habitat for fish and aquatic species.

Under Action Alternative 2 and Sub-Alternative 2a, there would be project-related road renovation. Road renovation improves the function of system roads and decreases non-point source pollution that may emanate from unmaintained roads. In-stream restoration is expected to positively affect the watershed. Under Alternative 2 and Sub-Alternative 2a, there would be a decrease in non-point source pollution within the project area associated with project activities. Additionally, under Alternative 2 and Sub-Alternative 2a, riparian thinning would occur. This would be a benefit to fisheries objectives or SSS associated with this alternative because it would reduce the likelihood of stand-replacing crown fire. With the implementation of the BMPs, PDFs, stream buffers, and seasonality of ground disturbance, there would be insignificant direct and indirect effects from Alternative 2 and Sub-Alternative 2a. Therefore, this project is not anticipated to cumulatively affect fish species and habitat within the Last Chance project area.

3.6.5.3. *Alternative 3*

Under this alternative, there would be fewer acres of treatment because all the Northern Spotted Owl (NSO) sites would be dropped. There would be no new permanent road construction. However, renovation of existing roads would occur, though none of the new or renovated roads proposed under this alternative would be within 200 feet of a stream. There would be an installation of either a temporary bridge or an armored low water ford on Bull Run Creek at the 32-5-25.6 road. The temporary bridge would be removed and the road blocked upon completion of all harvest operations. All installation and removal work would be completed within the in-stream work period. The temporary bridge would provide all season access.

Under this alternative, treatment units would retain greater levels of relative density, would apply diameter caps to the reserve land use allocation, and would require thinning only on the Low Intensity Timber Area. Therefore, some treatment acres, roads/haul routes, and logging systems were reduced. Because of this reduction in acres, the effects of this alternative from road related activities would be much less than those described in Alternative 2 and Sub-Alternative 2a.

During installation of the temporary bridge, there would be a short-term impact to spawning substrate, pool quality, and gravels. Once the temporary bridge is installed there would be no impact to spawning substrate, pool quality and gravels. The same temporary impact would be expected when the temporary bridge is removed.

Alternative 3 would have similar effects to Alternative 2 and Sub-Alternative 2a qualitatively because the necessary BMPs, PDFs, and General Aquatic Conservation Measures would be applied. Because some of the treatment units drop and roads and haul routes decrease, there may be less hauling and road renovation required under this alternative.

With the implementation of the BMPs, PDFs, stream buffers, and seasonality of ground disturbance, there would be insignificant direct and indirect effects from Alternative 3. Therefore, this project is not anticipated to cumulatively affect fish species and habitat within the Last Chance project area.

3.6.6. Conclusions for the Fisheries and Aquatic Habitat Analysis

All alternatives analyzed under the Fisheries and Aquatic Habitat analysis include the implementation of BMPs, PDFs, and General Aquatic Conservation Measures. Alternative 3 project activities would affect SSS, SONCC Coho Salmon and their CH, and have a minor localized effect on OC Coho and their CH but are not expected to have significant effects to fish species, their critical habitat, or jeopardize their continued existence.

The BLM is minimizing adverse effects on freshwater EFH quantity and quality, including spawning habitat areas of particular concern by implementing EFH Conservation Recommendations Terms and Conditions #1 and #2 from Section 2.8.4 of the FOMBO.

Under Alternative 2, Sub-Alternative 2a, and Alternative 3, there would be a temporary short-term impact to spawning substrate, pool quality, and gravels. Large wood and access would not change under this alternative.

Therefore, all alternatives are consistent with the RMP and consultation requirements.

3.7. Soil Resources

3.7.1. Issue 10: Would proposed actions such as timber harvest road and landing construction and use, yarding, ground-based logging, road and landing decommissioning and reclamation, or other soil disturbing activities detrimentally impact soil resources on the BLM-administered land and exceed the RMP threshold for 20% detrimental soil disturbance in harvest units?

3.7.1.1. *Affected Environment*

The Last Chance project area falls within the Inland Siskiyous ecoregion of the Klamath Mountains, which is characterized by steep, rugged mountains, narrow river valleys, and a mix of mixed evergreen and broadleaf trees (Douglas-fir, ponderosa pine, oak, and madrone) (Thorson et al., 2003, Whittaker, 1960). The elevation of this area ranges from 1,200 to 5,000 feet and has an annual average precipitation of 30 to 70 inches. The mountains are made up of altered volcanic and sedimentary rock and intrusive igneous rock. Granite and peridotite intrusions are present, and in some cases, the peridotite altered to serpentinite, which is the metamorphic derivative of ultramafic rocks and form soils usually low in Calcium and high in Magnesium, Chromium, and Nickle. This unusual nutrient distribution creates conditions favorable for a small population of plants that are slower growing and where macro-nutrients and water availability are low (Whittaker, 1960; Wright, 2007). The marine influence on climate is mild here due to the orographic effects of the Coastal and Klamath Mountains and the location of drainages are less connected to the Rogue River, which provides a conduit for microclimate humidity. Precipitation generally occurs in the fall, winter, and early spring, while the summers are very hot and dry. Most soils in the project area are Inceptisols and Ultisols that are dry for long periods of the year. Smaller areas of Alfisols and Mollisols also exist in the project area.

Soils are the foundation of forest health: they provide a growth medium for plants, habitat for organisms, water storage, and nutrient cycling that underpins tree growth and forest ecological function. Soil protection is, therefore, fundamental for sustainable forest management. Mechanized timber harvest, fuel reduction treatments, and road building physically impact soil functions at the micro-scale (e.g., soil pore spaces) and macro-scale (e.g., hillslope stability). While these activities have the potential to immediately reduce soil quality and stability (via compaction and removal of organic matter, for example), they also result in above-ground forest structure and composition that have long-term positive effects on soils in the absence of natural disturbances and in the face of climate change. Extensive drought and high-intensity wildfires may result in severely negative effects on soil function and stability, therefore, creating above-ground forest structure and composition resilient to these events creates a long-term positive effect for soil resources.

The natural history of this area can be characterized by impacts to soils In terms of pre-European (pre-1850's) and post-European (1850's to late 1900's and 1980's to present). Regardless of human activity, fire has always been a dominant disturbance across this landscape during the extended hot and dry summers, but the frequency and intensity of fire changed markedly during these periods. Fires were common in the pre-European era and were generally low and moderate intensity and high frequency, whereas during post-European settlement fires were suppressed as much as possible given the terrain and weather conditions (Hessburb, et al., 2005). Within the project area based on BLM GIS data for mapped fire perimeters for fires greater than 10 acres, modern fire history shows that a total of 18,304 acres burned since 1900 (32% of the Last Chance project area), which can be further described as 11,583 acres burned in 1914 (20%), 5,540 (10%) acres burned between 1936-1964, less than one percent burned in 1987 (503 acres), and 678 acres (1.2%) burned in 2018. Fire history data before 1900 is not currently available.

Current and historic logging is the other dominant disturbance to forest soils in the Last Chance project area. On private, county, and state-owned lands, which encompasses 43% of the project area, VRH (clear-cutting) continues as it has since logging practices began in the late 1800's. On BLM land and since the adoption of the Northwest Forest Plan in 1994, these practices have shifted from clear-cutting to variable density thinning and incorporation of skips and gaps that mimic natural forest structure and species distribution to protect critical habitat for the northern spotted owl. These forest practices also have a less negative impact on soil function because less of the treatment areas would have direct ground disturbance from logging operations. Harvest, mechanical, revegetation, and fuels treatments have been conducted throughout most BLM lands within the project area. Approximately 21,000 acres were treated with some form of commercial harvest, approximately 57% of area were clear-cut (regeneration) harvests conducted between the 1950 to 1980. After the 1980's, only 11% of the area was treated with harvest and all were variable density thinning treatments. Remnants of past logging activity was captured with legacy soil disturbance, described in the Data Collection (Section 5).

Lastly, past mining activity in the project area equate to 862 acres (1.5%) of the project area and likely maintain reduced soil function. Placer and hydro mining were a common gold mining practices and involved separating cobbles and boulders from finer texture soils and sediment, which may have been lost to the system or concentrated in ponds. These practices left behind fragile slopes, old roadbeds, ditch systems, and ponds that have both reduced soil function (biological, chemical, and physical) and reduced hillslope stability. These areas may also be more prone to erosion.

The project area is estimated at 56,843 acres and encompasses portions of Josephine, Jackson, and Douglas counties in the Medford BLM District. Because soils are expected to be impacted where management activities occur on the ground, this report focuses on soils within the proposed commercial harvest units, fuels units, and road building only, as summarized in areal extent by (Appendix D4: Watershed Analysis: Table D4.2 Soils Disturbance Summary). Soils within each alternative are further described in Appendix D4: Watershed Analysis: Table D4.3 Soil Survey Summary).

Regulatory Framework

The BLM's mission of multiple-use and sustained yield of timber coincides with soil resource protection under an adaptive management framework for assessing, quantifying, monitoring, and minimizing impacts on soil quality and stability (USDI/BLM , 2016b, pp. 109-151). Soil management objectives are to maintain or enhance inherent soil functions and provide for landscapes that stay within the natural soil stability failure rates during and after management activities. These objectives are achieved through application of best management practices (BMPs), which are listed specifically for this project in protection of soil resources in the Design Criteria (section 10) of this report, limiting detrimental soil disturbance to < 20% of the harvest unit area, avoiding road construction on unstable slopes, and avoiding tilling where soils may become unstable after saturation (USDI/BLM , 2016b, p. 109). Soil resources are balanced with the BLM’s multiple-use and sustained timber yield by reinforcing these management objectives and direction.

Data Collection

The soil specialist used on-site investigations to verify or edit Soil Survey and TPCC mapping in spring 2019. The soil specialist clipped these data to the project area to produce the related tables on page 1 and 2. On-site soil descriptions follow the USDA-NRCS methods (Schoeneberger et al. 2012). Prior to field work, the soil specialist reviewed LiDAR slope derivatives, Soil Survey, and TPCC mapping to target investigation locations. The soil specialist visited all areas each category of non-suitable TPCC within planned ground-based yarding areas. In areas with problematic TPCC, for example, a landslide from 2011 south of unit 20B, on-site data, historic aerial photos, and LiDAR were used to update TPCC lines. Pre-harvest monitoring was completed by the soil specialist using the USFS method on August 2^{2n}d, 2019 (Page-Dumroese et al. 2009).

3.7.1.2. *Environmental Effects (Direct, Indirect, Cumulative)*

Analytical Assumptions

Detrimental soil disturbance (DSD) was calculated by combining disturbances caused in the past that are still present on the landscape and those assumed to be caused by the proposed forest management actions. Legacy soil disturbance (historic disturbance) was derived from LIDAR imagery by tracing obvious topographic features that matched that of a skid trails or roads not incorporated into the transportation data (not a BLM or private road). Productive treatment unit area (that which may grow vegetation) was calculated using the proposed treatments and subtracting buffered BLM roads existing within that footprint (to 45-ft width) in order to affirm the assumption that the treatment unit area is productive and well-functioning soil. These features were buffered to 12 feet in included within the proposed timber harvest and fuels treatment units. The DSD caused by forest management activities should be no more than 35% for ground-based harvesting, 12% for cable-yarding, and 6% for aerial harvesting (USDI/BLM, 2016b, p. 746). In total, the legacy and new DSD would be less than 20% of the treatment unit area (USDI/BLM, 2016a, p. 32 and 109). An example of logging systems was provided for a subset of commercial harvest units in the proposed alternatives, which was used to extrapolate the potentially impacted area. Cable corridors were buffered to a width of 8 feet, 50 feet for landings, 12 feet for skid trails, and 45 feet for temporary and permanent roads (USDI/BLM, 2016b, pp. 745-768). The DSD model predicts the maximum impact of forest harvest activities, an over-estimate on a landscape scale, and may be altered in the future with site-specific data from the field office monitoring program. The results of this model are presented in Appendix E: Watershed Analysis: Table D4.4 Soils Disturbance Summary and identify that, with projected logging systems included, 12% of the total impacted area (commercial timber harvest, fuels units, and roads) would be detrimentally impacted in Alternative 2 and only 6% DSD would result from Alternative 3.

Analytical Methodologies and Techniques

The area used for soils analysis includes the proposed commercial harvest units, fuels treatment units, and buffered road construction and reconstruction (45-ft width), which is the total area expected for potential ground disturbance that may affect soil resources for each alternative. The temporal scale of this data reflects the current condition of the soil and forested landscape because no changes are expected to have occurred to soil morphology since the NRCS mapping, LiDAR data acquisition, and after field visits conducted from 2020 to 2022. Previous projects (mechanical, burning, and harvest) were incorporated into potential effects through site visits.

Analysis for soil resources included proposed project spatial data, DOGAMI landslide data (DOGAMI, 2011), NRCS soil survey data including soil types, erosion hazard ratings, hydric soils, and internal BLM soil information from TPCC and previous soil scientists on the Medford District. Field review was conducted from 2020 to 2022 of DDR-TPCC areas, LIDAR-identified soil anomalies indicative of mass movement potential, previous hillside failures, or areas with high detrimental soil disturbance from past forest management activities. Detrimental soil disturbance for each alternative was determined by combining legacy disturbance with projected impacts from logging and extrapolating impact areas to each alternative. These analyses were conducted using ArcGIS products, aerial photos, historic records, and satellite imagery.

3.7.1.3. *No Action Alternative Direct and Indirect Effects*

This alternative would result in no change to the affected environment. No disturbance due to harvest, road building, or fuels treatments would occur. Existing roads require regular maintenance to reduce road surface erosion and maintain the functionality of the road. Short-term impacts to soils would be avoided other than naturally occurring erosion and landslides. Indirectly, without the reduction of high-risk wildfire fuel loadings, a high intensity wildfire could negatively impact soil function and slope stability by removing vegetation, burning soil organic matter, and reducing soil structure strength.

3.7.1.4. *No Action Alternative Cumulative Effects*

There are no other ongoing or reasonably foreseeable future timber harvests, road construction, or fuels reduction actions within the project area. Soils would maintain carbon and other nutrient levels, bulk density, soil structure, biota, and root count as compared to harvested forests (Cambi et al. 2015, James and Harrison 2016, Busse et al. 2017). Therefore, there are no expected cumulative effects of other projects to consider in relation to the direct and indirect effects of the Last Chance timber management described above.

3.7.1.5. *Alternative 2 Direct and Indirect Effects*

To haul timber from the commercial harvest units Alternative 2 proposes 241 miles of road renovation, 28 miles of road construction, and potential entry into 14 existing rock quarries. It is estimated that 15.8 miles of the renovated roads would need major work such as rebuilding stream crossings, reconstructing the road prism, and in some case rerouting the road.

This alternative would close 13.2 miles of constructed or renovated roads upon project completion (USDI/BLM 2016b p. 311, 312). The BLM assumed that road construction would result on average in detrimental soil disturbance across a 45-foot width from upper cutbank to the lower toe of fill. Road construction is a long-term impact on soils since it removes the organic layer, cuts deep into the soil horizon, and produces a compacted surface. Road construction results in detrimental soil disturbance, which decommissioning can potentially ameliorate.

Road construction and motorized travel were analyzed in the FEIS (USDI/BLM 2016a pp. 752-755 and 762-763). The FEIS form the SWO RMP also looked at how timber harvest and fuel reduction treatments would affect soil quality (USDI/BLM 2016a pp. 752-762). The combination of all these impacts were described in Issue 5 in the FEIS and this analysis for soil resources is incorporated here by reference. In the FEIS, the BLM compared the combined amount of detrimental soil disturbance to a threshold of 20 percent. This 20 percent threshold only provides an approximate analytical threshold at this scale of analysis, the relevant scale for evaluating detrimental soil disturbance and determining the need for mitigation is at the site sale such as an individual timber harvest unit or individual treatment area.

Alternative 2 would impact soil resources within the range of effects analyzed under the 2016 Southwest Oregon RMP in terms of soil disturbance, soil erosion, and soil stability. Projected logging systems and legacy disturbance is below the 20% threshold for detrimental soil disturbance and post-harvest monitoring would be conducted to ensure adherence to this threshold. Alternative 2 includes 144 acres of legacy disturbance and a total of 478 acres of potential DSD from temporary and permanent road construction, legacy soil disturbance, and projected logging systems. The background legacy soil disturbance covers 6% of the area with proposed commercial harvest, road building, and fuels treatments and projected logging systems are expected to double that value to 12% total DSD (standard error of 1%) across the proposed project area in Alternative 2, which is under the 20% DSD threshold.

The only timber unit that has the potential to exceed an 20% DSD is an access unit, 24-08 under alternative 2, where a permanent road is proposed and, because this road is permanent, it would be removed from potentially productive soil. This would be reevaluated for the decision record and might result in unutilized a different approach to stay below the 20% DSD threshold or if Alternative 2a or 3 is selected this unit would not have the potential to exceed the threshold as per RMP direction.

A total of 300 acres of TPCC non-suitable fragile soils for nutrient limitations (243 acres FN-N), slope gradient (44 acres FN-G), and ground water (12 acres FN-W) exist in Alternative 2 treatment areas and 360 acres of non-suitable for reforestation issues exist in this area (RN-K, surface rock). All TPCC fragile non-suitable soils are located on sites where productivity for commercial harvest (20 cubic feet per acre per year) is expected to be reduced even if special harvest or restrictive measures are applied. However, these are classified as non-suitable woodland and are withdrawn from the harvest land base and replanting would not be required. Fragile withdrawn soils were reviewed and excluded from the unit pool if management activity would severely impact soil functions beyond the natural range of variability or pose a risk for stability failures beyond the natural failure rates (USDI/BLM , 2016b, p. 109) No non-suitable fragile soils with mass movement (FP category) or surface erosion (FE category) exist within the footprint of road, harvest unit, or fuels treatment boundaries (Appendix D4: Watershed Analysis: Table D4.5 Soils TPCC Summary). Furthermore, because these soils exist within the DDR-TPCC, they are not managed for sustained timber production, and, therefore, TPCC designations are not considered for timber production (see Tables D4.6 -D4.8). Management areas identified as unsuitable for sustained yield, including fragile non-suitable forested areas, can be managed for other uses compatible with the BLM land use allocation (USDI/BLM , 2016b, p. 55).

Fuels treatments are proposed on 3,446 acres in the project area outside of commercial timber units and would incorporate small diameter thinning, hand piling, and broadcast burning. The appropriate PDFs are listed in the Design Criteria (Section 10) to ensure low burn intensity and reduce additional detrimental soil disturbance. The anticipated burn severity would not likely kill shallow roots of shrubs and forbs or detrimentally reduce soil biota, it would add charcoal as organic matter, and add a short-term flush of nutrients to the forest soil (Busse et al. 2014, Pingree and DeLuca 2017, Pingree and

Kobziar 2019). Burning of hand piled, small-diameter fuels and broadcast burning do not result in DSD for the purposes of BLM project planning if the PDFs listed in Section 10 are followed and the analysis of machine-pile landings was incorporated into the DSD calculations for this alternative. Therefore, the fuels treatments remain below the 20% DSD threshold for Alternative 2.

3.7.1.6. *Alternative 2: Cumulative Effects*

In Alternative 2, harvesting operations and road construction is expected to compact soil, remove organic matter, and reduce soil productivity overall for a short time and PDFs are in place (see section 10) to limit that disturbance, reduce the impacts of ground-based operations, and decommission roads, which would help ensure a minimum timeframe for this expected impact (Cambi et al. 2015). Historic soil disturbance was included with the field-based analysis and incorporating legacy disturbance into the analysis of this alternative. With the PDFs in place, no long-term impacts to soils are expected to exceed the threshold of

20% detrimental disturbance. No concurrent or expected impacts from non-BLM actions are expected to detrimentally impact soil resources on the BLM-administered land within Alternative 2 project area.

3.7.1.7. *Sub Alternative 2a – Thinning instead of VRH*

This alternative proposes commercial harvest activities, consisting of commercial thinning or selection harvest only, on approximately 1,059 acres and non-commercial hazardous fuels reduction treatment on 11,686 acres (of which, 1,059 acres overlap with commercial harvest treatments).

<u>Direct and Indirect Effects</u>

Instead of the group select openings that occur with VRH these stands would be commercially thinned or have selection harvest. Assuming the volume of haul would be similar and timber harvest methods would be comparable under this sub-alternative. No changes in proposed new construction or increases in renovation were described or anticipated for this alternative. With the PDFs in place, no long-term impacts to soils are expected to exceed the threshold of 20% detrimental disturbance. No concurrent or expected impacts from non-BLM actions are expected to detrimentally impact soil resources on the BLM-administered land within Alternative 2a.

<u>Cumulative Effects</u>

In Alternative 2a, harvesting operations and road construction is expected to compact soil, remove organic matter, and reduce soil productivity overall for a short time and PDFs are in place to limit disturbance, reduce the impacts of ground-based operations, and decommission roads. Effects would be almost identical to those described for alternative 2.

3.7.1.8. *Alternative 3 Direct and Indirect Effects*

Alternative 3 proposes no road construction, 53 miles of road renovation and potential entry into 6 existing rock quarries. Like Alternative 2, some of the previously decommissioned roads would be closed upon project completion (USDI/BLM 2016b p. 311, 312). New road construction is a permanent disturbance to soils that would be avoided under this alternative.

This alternative includes less proposed commercial harvest area and road construction than Alternative 2, but the same acres of fuels treatment units. In this Alternative, 1,118 acres of commercial units are proposed and 8 acres of temporary road construction. In Alternative 3, a total of 6% of the proposed treatment areas would have detrimental effects on soils, which is below the 20% threshold analyzed in the SWO/RMP. Fuels treatment units are expected to undergo the same impacts as described in Alternative 2 and also remain under 20% DSD. Non-suitable fragile soils included for treatment in this alternative include 73 acres of low nutrient soils and 2 acres of high-water table soils. Harvest treatments and fuels treatments are expected to help restore forest structure and provide conditions that emulate historic fire regimes, therefore, having a long-term positive effect on soil function.

3.7.1.9. *Alternative 3 Cumulative Effects*

Cumulative effects to soils for Alternative 3 would be similar to Alternative 2 but with decreased DSD from harvest operations, road building, and fuel treatments and below the 20% threshold outlined in the RMP and these impacts are expected to decrease over time. With the PDFs in place, no long-term impacts to soils are expected to exceed the threshold of 20% detrimental disturbance. No concurrent or expected impacts from non-BLM actions are expected to detrimentally impact soil resources on the BLM-administered land within the project area for Alternative 3.

3.8. Recreation

3.8.1. Issue 11: How would vegetation management affect recreation opportunities, objectives and Recreation Setting Characteristics of the following Special Recreation Management Areas (SRMA) within the Last Chance Project Area? (King Mountain Trail SRMA, and Burma Pond Campground and Trailhead SRMA).

3.8.1.1. *Background*

The BLM developed this issue to evaluate the potential changes in the Recreation Setting Characteristics (RSC) and recreation objectives and opportunities of the Special Recreation Management Areas within the project planning area. The BLM examined impacts to both the current recreation opportunities and objectives within the SRMAs, as well as impacts to the proposed RSC designation for each SRMA.

As part of the RMP, the BLM designated certain areas of the landscape as either SRMAs or ERMAs, (Extensive Recreation Management Areas). Within each of these designated areas, the BLM established recreation and visitor service objectives and identified supporting management actions and allowable uses (BLM 2016b p. 259). The Recreation Management Area (RMA) Frameworks includes descriptions of ERMAs and SRMAs (discussed below) including recreation objectives, allowable management actions, and use restrictions (USDI/BLM, 2016d).

Special Recreation Management Areas (SRMAs) are administrative units where the existing or proposed recreation opportunities and recreation setting characteristics are recognized for their unique value, importance, and/or distinctiveness, especially as compared to other areas used for recreation. The BLM manages SRMAs to protect and enhance a targeted set of activities, experiences, benefits, and recreation setting characteristics. Within SRMAs, recreation and visitor services management is recognized as the predominant land use plan focus, where specific recreation opportunities and recreation setting characteristics are managed and protected on a long-term basis. (USDI/BLM 2016b p. 259).

Extensive Recreation Management Areas (ERMAs) are administrative units that require specific management consideration to address recreation use, demand, or recreation and visitor services program investments. The BLM manages ERMAs to support and sustain the principal recreation activities and the associated qualities and conditions of the ERMA. Management of ERMAs is commensurate with the management of other resources and resource uses (BLM 2016b. p. 259).

Within the project planning area there are two SRMA's: King Mountain Trail SRMA, and Burma Pond Campground and Trailhead SRMA. There are no other Recreation Management Areas within the project area.

3.8.1.2. *Methodologies*

Recreation Setting Characteristics

The BLM identifies desired recreation setting characteristics for RMAs to complement the desired recreation opportunities and activities within those RMAs.

The BLM categorizes the type of recreation setting characteristic desired in a particular area through its Recreation Setting Classification System. The BLM bases the Recreation Setting Classification System on a combination of physical, social, and operational components.

Remoteness and Naturalness Characteristics

With the exception of the characteristics of remoteness and naturalness, the BLM discusses effects on all the recreation setting characteristics through analysis of RMAs, recreation opportunities, and recreation demand. The PRMP/FEIS (BLM 2016a, pp. 556-559) used remoteness and naturalness characteristics to identify and categorize recreation setting characteristics through Recreation Opportunity Spectrum (ROS) classes. These classes range on the spectrum from Primitive to Urban.

The distance criteria used to determine the recreation opportunity spectrum class for remoteness is displayed below in Table 9.1. The term "remoteness" refers to an area's proximity to human modifications associated with roads or trails. The BLM established the recreation opportunity spectrum class for remoteness by applying its functional road classification system to assign road types based on the recreation opportunity spectrum class and identifying distance criteria. These criteria were selected with consideration for the topography, vegetation, and road type within the project area. The road types consist of arterial, collector, local, and resource roads (USDI/BLM 2016a, 556).

Table 9.1: Distance criteria for each recreation opportunity spectrum class

Recreation Opportunity Spectrum Class	Distance Criteria
Primitive	Greater than 1 mile from any class of road, excluding those that are permanently closed or decommissioned
Backcountry	0.25 to 1 mile from any class of road, excluding those that are permanently closed or decommissioned
Middle Country	Within 0.25 mile of local* or resource† roads
Front Country	Within 0.25 mile of collector‡ roads
Rural	Within 0.25 mile of arterial roads or highways
Urban	Within 0.25 mile of arterial roads or highways

* **Local roads.** Roads that normally serve smaller areas than collector roads, accommodate fewer uses, have lower traffic volumes, and connect with collector roads or State and County road systems.
† **Resource roads.** Roads that provide point access to public lands, typically exist for a single use, carry very low traffic volumes, and connect with local or collector roads.
‡ **Collector roads.** Roads that primarily provide access to large blocks of public land, accommodate multiple uses, have BLM's highest traffic volumes, and connect with State and County road systems.

Naturalness is defined by the level of an area's influence by human modifications other than roads and trails. Such modifications can include areas of development, utilities, rights-of-way, livestock, structures, fences, habitat treatments, or landscape alternations. The level of naturalness considers the presence of these modifications and potential impact on the visitor experience. In this planning process, management considerations would predominately address landscape alternations through forest and habitat management actions. As such, the BLM's analysis of naturalness uses forest structural stage classes as a proxy to measure changes in recreation opportunity spectrum classes for naturalness. Figure 9.1 shows a visual representation of forest structural stage classifications for naturalness for the five recreation opportunity spectrum classes with forest stand proxies.

Figure 9.1: Stand visualizations for recreations setting classifications.

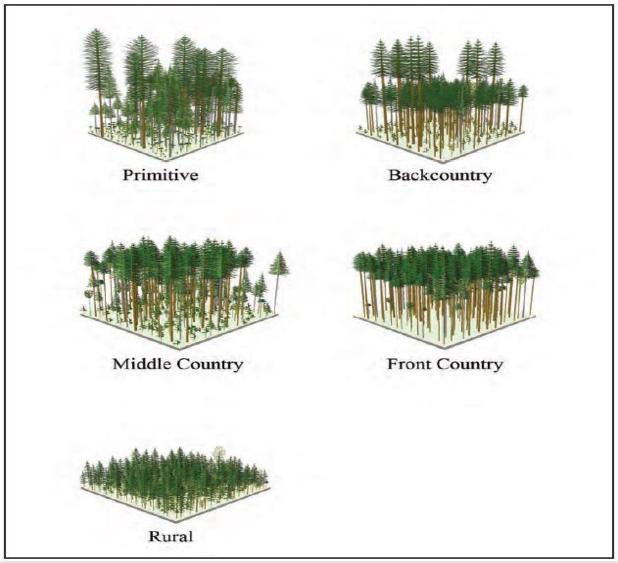


Table 9.2: Level of human modification and forest structural stage class proxies by recreation opportunity spectrum class for naturalness.

Recreation Opportunity Spectrum Class	Level of Human Modification and BLM Forest Structural Stage Class Proxies
Primitive	• Undisturbed natural landscape • Structurally-complex with Existing Old or Very Old Forest
Backcountry	• Natural-appearing landscape having modifications not readily noticeable • Mature Single- or Multi-layered Canopy
Middle Country	• Natural-appearing landscape having modifications that do not overpower natural features • Young High Density with Structural Legacies, or Young Low Density with or without Structural Legacies
Front Country	• Partially modified landscape with more noticeable modifications • Young High Density without Structural Legacies
Rural	• Substantially modified natural landscape • Stand Establishment with or without Structural Legacies
Urban	• Urbanized developments dominate the landscape

The BLM used the amount of timber harvest by type and acres that would occur over the next 10 years to analyze the effects to recreation opportunity spectrum classes for naturalness. For example, timber harvest that involves thinning dense, young stands would shift the naturalness of an area from the Front Country to the Middle Country setting. In contrast, the VRH of older stands would modify the naturalness of an area from Primitive to Rural. These actions would influence the distribution of recreation for visitors who prefer these different settings.

3.8.1.3. *Assumptions*

In preparing this analysis, the BLM has made several analytical assumptions that provide the framework to the analysis of the issue below:

• The analysis area for recreation objectives and opportunities is related to the RMAs only where the proposed treatment units are within an RMA.

• The RMAs may be developed in the future based on the objectives of the Recreation Planning Framework and any plan maintenance to that framework.

• Forest stand structural stage classes are utilized as a proxy to determine effects to Naturalness, similar to the analysis completed in the 2016 PRMP/FEIS (p. 557).

• The PDFs included in the EA (Appendix C, Table C-20) would be adhered to during the implementation of the proposed project.

3.8.1.4. *Affected Environment*

Burma Pond Campground and Trailhead SRMA

Burma Pond Campground and Trailhead SRMA is 9 acres in size and consists of a vault toilet, trash can, signs, a few natural surface parking spots, and a primitive trail circling a small pond. It receives low to moderate seasonal visitation, with the primary activities being fishing, camping, and walking.

Under the Recreation Management Area Framework, timber harvest is allowable in the Burma Pond SRMA if compatible with meeting recreation objectives, not interfering with recreation opportunities, and maintaining setting characteristics. Fuels treatments and other vegetation modifications are allowable if compatible with meeting recreation objectives, not interfering with recreation opportunities, and maintaining setting characteristics. There is no proposed timber harvest in the Burma Pond SRMA under any alternative. There is no road construction or temp road construction in this SRMA under any alternative. Maintenance fuels treatments (hand pile/burn or broadcast) are proposed in this SRMA under alternatives 2 and 3.

King Mountain Trail SRMA

The King Mountain Trail SRMA is 6 acres in size and consists of a natural surface parking area, trail signs, and a short primitive trail to a rock outcropping. It receives low seasonal visitation, with the primary activity being hiking and camping at the trailhead.

Under the Recreation Management Area Framework, King Mountain Trail SRMA is closed to timber harvest. This SRMA also overlaps with the King Mountain Rock Garden ACEC which has sensitive serpentine soils and plant communities. This King Mountain Trail SRMA is within the project planning are, however, there are no proposed forest management activities, timber harvest, road construction, or fuels treatments in the SRMA under any alternative.

Both SRMAs have a proposed middle country recreation setting characteristic. Human modification is allowed in the Middle Country setting. Noticeable modifications that do not overpower natural features and allow for a natural-appearing landscape are acceptable (FEIS, p. 559). Characteristic of a middle country setting include: Within ¼ mile of local or resource roads, natural appearing landscapes having modifications that do not overpower natural features, and forest structural stage class proxies of young high density with structural legacies, or young low density with or without structural legacies. Field observations confirm that both SRMAs currently have RSCs that are consistent with the above description of a middle country setting.

3.8.1.5. *Environmental Consequences*

No Action Alternative

Under the No Action Alternative, there would be no forest management activities, timber harvest, road construction, or fuels treatments in either SRMA located in the project planning area. There would be no direct effect to the SRMAs, and the current situation would remain the same.

Indirectly, under the No Action alternative, vegetation in the Burma Pond SRMA could become more dense and homogenous over time. Without proposed forest management (fuels maintenance), the RSCs at Burma Pond may shift from the desired Middle Country setting towards more of a less desirable setting. This would also lead to an increase in hazardous understory fuels buildup, which would be accompanied with increased fire risk.

The King Mountain Trail SRMA consists of a short trail, most of which is rocky, open and not heavily forested. Under the No Action alternative, the RSCs of King Mountain Trail would remain the same.

Alternative 2

There is no proposed timber harvest in the Burma Pond Campground and Trailhead SRMA. The only proposed action in this SRMA is maintenance fuels treatments (hand pile/burn or broadcast) which is allowed under the Recreation Management Area Frameworks (USDI/BLM 2016d. p. 34). The area was treated previously in 2005, and this type of treatment is typical of the characteristic landscape in this SRMA. The fuels treatments would not change the setting characteristics or interfere with meeting recreation objectives of this SRMA because it would not increase the road network and because the fuel treatments would not change the stand structure in the RMAs. In the long term, fuels maintenance of understory vegetation would help maintain the desired RSCs of this SRMA, and hazardous fuels reduction would decrease the overall potential for high intensity/severity fires in the SRMA which would change the stand structure. The fuels treatments would not interfere with recreation opportunities beyond active implementation where there may be very short closures for public health and safety. These short-term impacts would be brief and recreation displacement would be easily absorbed by other near-by opportunities. The proposed fuels treatments in this SRMA would not impact the proposed outcome objectives of this SRMA for future development of recreation facilities, including visitor activities, visitor experiences, and visitor benefits as outlined in the RMA framework. The proposed activities within the Burma Pond SRMA are consistent with proposed recreation setting characteristics, meeting recreation objectives, and not interfering with recreation opportunities for this SRMA.

There are no proposed actions in the King Mountain Trail SRMA. There would be no effect to this SRMA, and the current situation would remain the same.

For timber harvest activities outside of the SRMAs, there are BMP/PDFs to ensure that access roads are open for public access to designated recreation sites on weekends, holidays, and at least intermittently during the week.

Sub-Alternative 2a

Under this alternative, the proposed actions (if any) in both SRMAs are the same as in Alternative 2.

There are no proposed actions in the King Mountain Trail SRMA. The only proposed action in the Burma Pond Campground and Trailhead SRMA is maintenance fuels treatments (hand pile/burn or broadcast).

Effects to the SRMAs from Sub-alternative 2a would be the same as in Alternative 2, described above.

Alternative 3

Under this alternative, the proposed actions (if any) in both SRMAs are the same as in Alternative 2.

There are no proposed actions in the King Mountain Trail SRMA. The only proposed action in the Burma Pond Campground and Trailhead SRMA is maintenance fuels treatments (hand pile/burn or broadcast).

Effects to the SRMAs from Alternative 3 would be the same as in Alternative 2, described above.

3.8.1.6. *Cumulative Impacts*

Although there are no current plans to further develop or expand either the King Mountain Trail SRMA or the Burma Pond Campground and Trailhead SRMA, there is some potential for future recreation developments in the area such as improvements to existing parking areas, or future trail development. If increased demand for recreation facilities precipitates the need for further recreation development, there may be an increase in visitation to these SRMAs, including more use on access roads and non-motorized trail use. It can reasonably be anticipated that forest management activities would continue to occur on surrounding BLM lands as well as on adjacent privately owned timber lands into the future. The recreation related PDFs (Appendix C) would continue to be used for forest management activities within Recreation Management Areas.

CHAPTER 4. CONSULTATION AND COORDINATION

4.1. U.S. Fish and Wildlife Service

In accordance with regulations pursuant to Section 7 of the Endangered Species Act of 1973, as amended, consultation concerning the potential impacts of the proposed action upon the northern spotted owl and Franklin's bumble bee have been completed within the Biological Assessment for Medford BLM FY23 Batch of Projects on April 21, 2023. The BLM received a Biological Opinion (BO) for the Biological Assessment for Medford BLM FY23 Batch of Projects from the U.S. Fish and Wildlife Service on July 3, 2023.

The proposed action for this project has been reviewed and is in compliance with the Biological Assessment of activities that may affect the federally listed plant species Gentner's Fritillary and Cook's Lomatium, on the Medford District BLM (2020) and associated Letter of Concurrence from the U.S. Fish and Wildlife Service dated November 10, 2020.

4.2. National Marine Fisheries Service

The Last Chance project is within the Rogue and Umpqua Basins, which are in the range of the federally threatened Southern Oregon/Northern California Coast (SONCC) and Oregon Coast (OC) Coho Salmon. Consultation for the Endangered Species Act and Essential Fish Habitat for the Magnuson-Stevens Fishery Conservation and Management Act with the National Marine Fisheries Service is covered under the *Endangered Species Act Section 7(a) (2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat for the Programmatic Forest Management Program for Western Oregon* (WCR-2017-7574; *aka*: FOMBO). The BLM complied with the use of the FOMBO and applied design criteria for this project, including transmittal of a Project Notification Form to the National Marine Fisheries Service. The alternatives are consistent with the appropriate management direction and Best Management Practices described as project design criteria for the FOMBO. Therefore, the Last Chance project is appropriate for inclusion under the opinion. The BLM is anticipating verification from the National Marine Fisheries Service on July XX 2024, that would state that the Last Chance project is consistent with the effects analysis and conclusions of the National Marine Fisheries Service FOMBO dated March 9, 2018.

4.3. Tribal Consultation

The Confederated Tribes of the Siletz Indians, the Confederated Tribes of Grand Ronde, and the Cow Creek Band of Umpqua Tribe of Indians were notified of the Last Chance Forest Management Project on

February 22, 2023, and invited to provide input or formally consult with the BLM. The Tribes did not request consultation.

4.4. State Historic Preservation Office Consultation

The BLM Medford District consulted with the State Historic Preservation Office (SHPO) per Section 106 of the National Historic Preservation Act. After completing background research and field survey, the BLM determined the proposed action would not adversely affect any historic properties. The BLM submitted this finding along with a report detailing the results of the inventory to SHPO in March 2023. The SHPO did not respond to this submittal within 30 days. To date, SHPO has not responded to this submittal. Per the 2015 State Protocol between BLM and SHPO, if BLM does not receive a response from SHPO within 30 days of submitting a no adverse effect determination, BLM assumes SHPO concurrence with their determination of effect.

4.5. Local Agency Coordination

The Josephine County Board Commissioners, the Josephine County Planning Department, and the Public Works Department were sent scoping letters requesting input on the Last Chance Forest Management Project proposal. They will be sent EA release letters requesting comments.

CHAPTER 5. LIST OF PREPARERS

This section lists the BLM staff involved in the development of the Last Chance Project and the preparation of this document.

Table 10.1: List of Preparers

Interdisciplinary Team Members	Title
Anthony Saunders	Archeologist
Amanda Snodgrass	Botanist
Erica Freeman	Roads Engineer and Rights-of-Way Specialist
Jon Raybourn	Fish Biologist
Jena Volpe and Aaron Schuh	Fuels Specialist
Shawn Thornton	Geographic Information Systems (GIS)
Bob Lange	Hydrologist
Kevin Massey & Valda Lockie	Planning and Environmental Specialist
Ron Rhatigan	Silviculturist & Port-Orford-Cedar Specialist
Shawn Stapleton	Outdoor Recreation Planner
Melissa Pingree & Bob Lange	Soil Scientist and Soils Specialist
Sarah Queen-Foster	Timber Forester
Marlin Pose, Jason Reilly, and Samantha Langley	Wildlife Biologist

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APPENDIX B: ISSUES CONSIDERED BUT NOT ANALYZED IN DETAIL

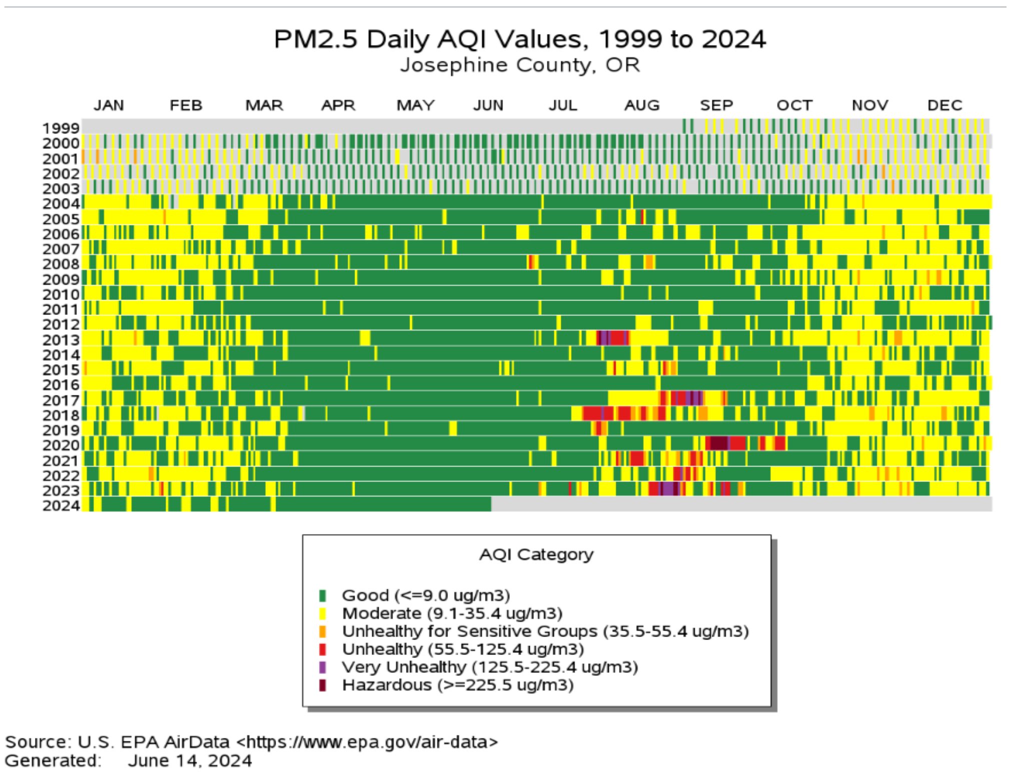
The following questions, concerns, or comments were raised by the public and/or the interdisciplinary team during the development of this project. The BLM considered these issues but did not analyze them in further detail, often because the effect of project activities would not be detectable and/or the project's design with the implementation of Best Management Practices (BMPs) in the form of Project Design Features (PDFs) would eliminate or reduce effects to the resource. In some cases, issues raised by the public or the interdisciplinary team were not considered in greater detail as they were determined to be beyond the scope of this project. These issues, along with a rationale for not analyzing them further in this EA, are discussed below. The issues are listed in alphabetical order.

Air Quality - Smoke Management - Polyethylene Sheeting - Burning of PE Sheeting

Issue B1: How would smoke created from prescribed burning activities affect air quality?

Background: The combination of weather patterns and topography of the Rogue basin contribute to regional air quality problems. The American Lung Association has ranked the Medford / Grants Pass metropolitan area as 8th in their annual State of the Air report, Report Cards of U.S. Cities Most Polluted U.S cities by year-round particle pollution (Annual PM2.5; ALA 2024). Poor air quality can develop when a major polluting activity or event combines with temperature inversions and strong high-pressure systems that create stagnant air. Valleys can trap and concentrate pollutants, exacerbating the effects of stagnant air. Sources of pollutants may be chronic, such as from a factory or homes heating with wood during the winter, or transient, such as from prescribed burning or wildfires. Wildfires tend to be the primary contributor to air quality concerns within the Medford District, particularly in July and August (USDI BLM 2016a, pp. 155- 157) and into October in some recent years. The EPA daily air quality index for Jackson County indicates that daily emissions (PM 2.5) have been increasing during summer months over the past 20 years (Figure B-1).

Figure B-1.1. EPA Daily Air Quality Index in Josephine County (2000-2024).



Air quality during the period from November through March is characterized mostly as moderate. Most emissions during this period are attributed to residential heating with wood, which is frequently trapped beneath temperature inversions. Summer month (July – September) air quality has been mixed from good to hazardous, emissions during this period are attributed to wildfire smoke. Notable large wildfire years in southwest Oregon are evident in the record (2002, 2013, 2015, 2017, 2018, 2020, 2021, and 2023). Air quality from April to June is characterized as mostly good. This timeframe typically coincides with favorable conditions for implementation of prescribed under burning.

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The Oregon Department of Environmental Quality (ODEQ) Air Quality Division implements the U.S. Environmental Protection Agency's air quality regulation standards. The ODEQ has delegated prescribed fire smoke management responsibilities to the ODF. For all prescribed burning activities, the Medford District is required to comply with the Oregon Smoke Management Plan (ODF 2019, OAR 629-048) as outlined in the PMRP/FEIS (USDI BLM 2016a, pp. 146-151).

The Oregon Smoke Management Plan outlines best burn practices in the Emission Reduction Techniques section (629-048-0210). The practices are designed to minimize emissions from prescribed burning, and "ensure the most rapid and complete combustion of forest fuels while nearby, "non-target" fuels are prevented from burning. These best burn practices include, "covering of piles sufficient to facilitate ignition and complete combustion, and then burning them at times of the year when all other fuels are damp, when it is raining or there is snow on the ground." The section continues, stating that "when piles are covered as a best burn practice and the covers are to be removed before burning, any effective materials may be used, as long as they are removed for re-use or properly disposed of. When covers would not be removed and thus would be burned along with the piled forest fuels," the covers must consist of approved materials, which includes polyethylene (PE) sheeting (ODF 2019, 629-048-0210).

Removal of PE sheeting from piles in advance of burning increases safety risks, operational cost, particulate emissions, and reduces the pace and scale of hazardous fuel reduction.

Piles are often burned during colder and wetter periods, punctuated by wet, icy, and snowy conditions. Removal of PE sheeting from piles in advance of burning would increase risk and exposure of field personnel to injury and illness from additional hours of driving, hiking steep terrain, rolling debris from deconstructed piles, and inclement weather. As shown in a case study on the Klamath National Forest, the additional time devoted to PE removal (up to 20 minutes per pile) and disposal resulted in a 60 percent reduction of acres burned (Pers. Comm., Klamath National Forest 2021). This reduces production, increases per unit cost, and leaves more acres of hand piles on the landscape, increasing the probability of those piles burning intensely in a wildfire. Piles from which PE sheeting has been removed become vulnerable to wetting rains and wetting of fuels, prior to ignition. Wrobel and Reinhart (2003) examined the use of PE sheeting to enhance combustion efficiency of piles, and found that uncovered piles have increased fuel moisture, reduced combustion efficiency, and require more accelerants (up to three gallons of fuel) to achieve sustained pile ignition, compared with PE covered piles, this finding is consistent with local knowledge and experience. The polyethylene ensures low moisture content of the wood and facilitates rapid and efficient ignition and consumption of fuels to minimize residual smoke (Aurell et al. 2016).

Use of Kraft paper as a substitute for PE sheeting would contribute toward decrease burning efficiency because environmental conditions in the region quickly deteriorate the material. An extensive review by Worbel and Reinhardt (2003) found Kraft paper less effective at minimizing moisture intrusion into piled wood (also consistent with local knowledge and experience), resulting in similar conditions as uncovered piles. The additional weight of Kraft paper also contributes to decreased production and increased per unit cost of covering piles. While combustion studies examining the difference in pyrolysis of polyethylene vs. lignocellulosic materials (kraft paper) have found that emission from kraft paper combustion were lower than polyethylene, both materials produce many of the same substances (Garcia et al. 2003). Additionally, Kraft paper is often coated with paraffin wax (a derivative of petroleum) or polyethylene to improve water resistance properties. Current scientific literature does not disprove that burning PE sheeting would produce unique chemicals or classes of chemicals that are not also found in emissions from burning wood debris (Worbel and Reinhardt, 2003; Aurell et al. 2016).

Ultimately, combustion of wet piles results in more particulate emissions (smoke) than dry piles (NWCG 2020). Comparisons of post-harvest slash machine pile burning indicate that dry piles covered with polyethylene sheets have significantly lower emissions than uncovered wet piles (Aurell et al. 2016). Additionally, initial entry fuel reduction treatments (i.e., thin and hand pile burn) provide the opportunity for follow-up treatment, via maintenance under-burning, which eliminates the need for piles and thus PE sheeting.

The Oregon Smoke Management Plan designates SSRA (Smoke Sensitive Receptor Areas), which are areas designated for the highest level of protection under the smoke management plan, as described and listed in OAR 629048-0140. The SSRAs within the Medford District are Grants Pass and the Bear Creek Valley, as described in OAR 629-048-0160 (USDI BLM 2016a, Map 3-1, p. 149). The objective of the Smoke Management Plan is to minimize smoke from prescribed burning from entering the SSRAs. Medford District is also required to comply with the Oregon Visibility Protection Plan (OAR 340-200-0040, Section 5.2) which mandates that prescribed burning does not affect the visibility of Class I areas.

Local Class I areas include Crater Lake National Park, Kalmiopsis Wilderness, and Rogue Wilderness (USDI BLM 2016a, Map 3-1, p. 149). The Planning Area is not within a Class I area.

Prior to conducting prescribed burning activities, the BLM must register prescribed burn locations with Oregon Department of Forestry in compliance with Oregon's administration of the Clean Air Act.

The specific location, size of the burn, fuel loadings, ignition source, time, and duration of ignition are reported prior to ignition. The timing of all prescribed burning would be dependent on weather and wind conditions to help reduce the amount of residual smoke to the local communities. The day before each planned burn, ODF meteorologists evaluate this information along with the forecasted weather for the next day to determine whether smoke from a given burn is likely to affect an SSRA or Class I area. This information is used to determine the appropriate time to conduct the planned prescribed burn, to minimize smoke emissions from prescribed fire. The BLM must follow these instructions in compliance with Oregon's administration of the Clean Air Act, including the Best Burn Practices; Emission Reduction Techniques section (629-048-0210) of the Oregon Smoke Management Plan and the Oregon State Implementation Plan for Air Quality (ODEQ 2021). Additionally, all prescribed burn plans must also comply with the Interagency Prescribed Fire Planning and Implementation Procedures Guide (NWCG 2017).

Smoke from prescribed fire and wildfire produces carbon monoxide, particulates, and other air toxins. The main criteria pollutant of concern for BLM management activities is particulate matter (PM10 and PM2.5) (ODEQ 2021); in addition to posing a human health risk due to their small size, particulate matter from wildland fuels are excellent at scattering light, thereby reducing visibility. Carbon monoxide, on the other hand, while a substantial human health risk, dilutes rapidly, making it a hazard to firefighters only. As such the BLM analyzed effects of particulate matter emissions and visibility in the PMRP/FEIS (pp. 145 – 163). That analysis, incorporated here by reference, examined emissions (PM10 and PM2.5) from prescribed fire treatment of both natural hazardous fuels and activity fuels. The PRMP/FEIS concluded that the SWO ROD/RMP would result in an approximate 7 percent increase, over current conditions, of particulate emissions (PM10 and PM2.5) created from prescribed fire actions implemented across the Western Oregon Decision Area. On the Medford District, implementation of the SWO ROD/RMP would produce an expected 690 PM2.5 tons per year (USDI BLM 2016a, p. 161 Figure 3-12), over the 50-year analytic period. However, adherence to the requirements of the Oregon Smoke Management Plan would continue to limit impacts to human health and visibility from prescribed fires.

Rationale: This issue was considered but not analyzed in detail because 1) this analysis tiers to the PRMP/FEIS analysis, which estimated the effects on air quality based on the magnitude of treatments on this landscape and disclosed those activities PRMP/FEIS (USDI BLM 2016a, pp. 4-9); and 2) The Medford District projected 10,977/annual acres of activity fuels treatments for this project, coupled with other projects, would constitute only 8,240 acres of this annual amount, which is below the levels projected in the FEIS.

There is no potential for significant effects from this EA beyond the magnitude of treatments analyzed in the PRMP/FEIS, because anticipated effects under any Alternative would not exceed those analyzed in the PRMP/FEIS. Additionally, there are no new circumstances or information at the site-specific level that would change the effects anticipated for this EA.

The proposed prescribe fire actions are common to all alternatives and would be consistent with the actions analyzed in the PRMP/FEIS. Additionally, DEQ and ODF established and required reporting measures and BMPs described above would apply to all action alternatives to meet the Oregon State Implementation Plan of the Clean Air Act and the EPA's Interim Air Quality Policy on Wildland and Prescribed Fires. Common to all action alternatives, the BLM also has the discretion to haul away, as biomass, or sell, as firewood, whole trees, or treetops yarded to landings as well as the limbs removed and piled at the landings that would result in less smoke emissions than prescribed burning. However, prescribed fire may be necessary to meet ecological objectives and complete and maintain proposed actions in most instances.

Proposed actions are expected to reduce the likelihood of stand-replacing fire (Issue #3) and could result in reduced smoke production, when interacting with future wildfires (Liu et al. 2017; Long et al. 2017). The PMRP/FEIS suggests future climate impacts could create more smoke production from wildfires than historic levels (USDI BLM 2016a, p. 163), due to longer fire seasons and more severe burning conditions, which would lead to more acres burned and increased fire severity. However, as wildfires interact with areas treated to result in fire-resistant structure, smoke emissions may be reduced, as less forest fuel (e.g.,tree canopy fuel) would be consumed by wildfire (see Issue #3 effects). With the available information, it is uncertain how these future cumulative effects may interact in timing and synergy.

For the above reasons, further analysis of this issue is not necessary for making a reasoned choice among alternatives in that it would not inform the decision maker how the alternatives respond to the purpose and need. Additionally, further analysis of this issue is not necessary to determine that there is no substantial question regarding the potential for significant effects, in particular, that there is no potential for significant effects beyond those analyzed and disclosed in the PMRP/FEIS. A second, project specific EIS is not necessary to determine whether to implement the RMP as directed, to determine air effects from the project alternatives will not cause significant air effects, or how to design the alternatives to maintain project-caused smoke effects within requirements of the Oregon State Implementation Plan of the Clean Air Act and RMP management direction.

Best Management Practices (BMPs) and Project Design Features (PDFs)

Issue B 2: Are Best Management Practices and Project Design Features effective in preventing or reducing the amount of pollution generated by non-point sources?

Background Information: A Best Management Practice (BMP) is a practice or combination of practices that have been determined to be effective and practicable in preventing or reducing the amount of pollution generated by non-point sources to a level compatible with water quality goals (40 CFR 130.2(m)) (RMP, p. 163). When the Grants Pass Field Office applies BMPs to site specific locations they are Project Design Features (PDFs) which, as indicated by the name, are site and project specific.

The BLM utilizes site-specific BMPs to comply with the Clean Water Act of 1972 (as amended), State of Oregon water quality legislation, and the O&C Act (RMP, p. 163). The BLM has designed and would implement BMPs in a manner that is consistent with the ODEQ Memorandum of Understanding (MOU). The MOU requires monitoring to ensure that practices are properly designed and applied, to determine the effectiveness of practices in meeting water quality standards, and to provide for adjustments of BMPs to make them more effective (USDI BLM, 2017). In addition to future monitoring, BLM professionals have a long history of implementing PDFs through timber sale contracts and apply professional experience to mitigate on the ground impacts. The SWO RMP states that the implementation of BMPs is an iterative process that includes the monitoring and modification of BMPs, where needed, to achieve water quality goals (USDI/BLM, 2016b, p. 137).

The proper implementation of Best Management Practices (BMPs) listed in Appendix C of (USDI/BLM, 2016b) and Project Design Features (PDFs) would reduce erosion, sedimentation and protect riparian areas. Timber harvest BMPs have been evaluated to determine their effectiveness at achieving water quality standards pertain to sediment related effects and found them very effective when they included stream buffers (Rashin, et al., 2006).

The Society of American Foresters defines best management practices as “a practice or usually a combination of practices that are determined by a state or a designated planning agency to be the most effective and practicable means. Neither the most complex/costly techniques nor the total elimination of pollutants is required or expected with BMP use. Or in other words implementing BMPs is an art not a science and requires feedback from monitoring the effectiveness of their application on the ground and adaptive management to hone the implementation and redress any unexpected impacts that often occur in natural and highly variable landscapes such as the forestlands managed by the BLM (Edwards, et al., 2016).

Rationale: This issue was considered but not analyzed in further detail because the 2016 RMP identified BMPs as the most effective and practical method for the BLM to comply with the Clean Water Act. A project's design features (BMPs implemented site specifically) would eliminate or reduce pollution generated by non-point sources from Proposed Actions. Project monitoring of BMP implementation is part of the RMP and should ensure the PDFs are successfully applied.

Botanical Species (Rare Plants, Fungi, and Invasive Species)

Issue B 3: How would the Proposed Action including ground disturbance, decreases in woody vegetation cover, and fuel treatments affect the introduction of invasive species and prevent the spread of existing invasive plants?

Background: Ground disturbance associated with timber harvest activities, including: 1) haul road and skid trail construction, 2) landing construction, 3) timber extraction, 4) log hauling, and 5) use of heavy machinery, increases the risk of invasion by non-native invasive plant species by disrupting existing plant communities and exposing bare mineral soil which creates a favorable environment for colonization by invasive species (USDA/USFS, 2013).

A noxious weed risk assessment has been completed in accordance with guidance in the Medford District BLM Integrated Invasive Plant Management Revised EA (2018) which requires the completion of a noxious weed risk assessment when ground disturbing activities may occur that have the possibility of introduction or spreading non-native invasive species. Risk levels are defined in the BLM Manual 9015, Integrated Weed Management Manual (1992). The risk assessment identified that the existing risk for the spread and introduction of weed infestations is moderate because of the following factors:

Non-native invasive weed species located immediately adjacent to or within the project area. Project activities are likely to result in some area becoming infested with noxious weed species even when preventative management actions are followed. Control measures are essential to prevent the spread of noxious weeds within the project area.

Possible adverse effects on site and possible expansion of infestation within project. Cumulative effects on native plant community are likely but limited.

The recommended course of action for a project identified as moderate risk is to develop preventative management measure for the proposed project to reduce the risk of introduction or spread of non-native invasive species into the area. Preventative management measures should include modifying the project to include seeding the area to occupy disturbed sites with desirable species and monitoring of the area for at minimum 3 consecutive years post implementation to provide control for newly established populations and follow-up treatment for previously treated infestations (BLM, 1992).

Tables B-3.1 through B-3.3 provide a summary of non-native invasive plant species within the project area by proposed activity. These numbers are estimated based on existing data in the BLM VMAP database, treatment history records, and pre-project surveys.

Table B-3.1. Noxious Weeds Species within the Last Chance Project Area Commercial Units

Species and Common Name	Code	Category	Net Acres
Russian Knapweed (*Acroptilon repens*)	ACRE3	B	.25
False Brome (*Brachypodium sylvaticum*)	BRSY	B	.02

Meadow Knapweed (*Centaurea spp.*)	CEDE5	B	28.5
Spotted Knapweed (*Centaurea stroebe*)	CEST8	B, T	15
Rush Skeletonweed (*Chondrilla juncea)*	CHJU	B, T	1.6
Canada Thistle (*Cirsium arvense*)	CIAR4	B	1.7
Bull Thistle (*Cirsium vulgare*)	CIVU	B	1
Scotch Broom (*Cytisus scoparius*)	CYSC4	B	12.4
English Ivy (*Hedera helix*)	HEHE	B	<.01
St. Johns Wort (*Hypericum perforatum*)	HYPE	B	1.5
Perennial Pea (*Lathyrus latifolius*)	LALA4	B	3.6
Himalayan Blackberry (*Rubus armeniacus*)	RUAR9	B	8.3
Tansy Ragwort (*Senecio jacobaea*)	SEJA	B, T	<.01
Spanish Broom (*Spartium junceum*)	SPJU2	B	<.01
Medusahead (*Taeniatherum caput-medusae*)	TACA8	B	<.01
Ventenata (*Ventenata dubia*)	VEDU	B	<.01
		TOTAL	74.25

Table B-3.2. Noxious Weeds Species within the Last Chance Project Area Fuels Units

Species and Common Name	**Code**	**Category**	**Net Acres**
Meadow Knapweed (*Centaurea spp.*)	CEDE5	B	6.7
Diffuse Knapweed (*Centaurea diffusa*)	CEDI	B	.2
Spotted Knapweed (*Centaurea stroebe*)	CEST8	B, T	15.1
Rush Skeletonweed (*Chondrilla juncea)*	CHJU	B, T	4
Canada Thistle (*Cirsium arvense*)	CIAR4	B	2.9
Bull Thistle (*Cirsium vulgare*)	CIVU	B	1.9
Scotch Broom (*Cytisus scoparius*)	CYSC4	B	16.1
English Ivy (*Hedera helix*)	HEHE	B	2.5
St. Johns Wort (*Hypericum perforatum*)	HYPE	B	1.2
Perennial Pea (*Lathyrus latifolius*)	LALA4	B	.04
Himalayan Blackberry (*Rubus armeniacus*)	RUAR9	B	8.6
Spanish Broom (*Spartium junceum*)	SPJU2	B	<.01
Medusahead (*Taeniatherum caput-medusae*)	TACA8	B	<.01
Ventenata (*Ventenata dubia*)	VEDU	B	<.01
		TOTAL	59.5

Table B-3.3. Noxious Weeds Species within the Last Chance Project Area where Permanent and Temporary Road Construction and Renovation is Proposed

Species and Common Name	**Miles Perm Construction**	**Miles Perm Renovation**	**Miles Temp Construction**	**Miles Temp Renovation**
Meadow Knapweed (*Centaurea spp.*)	.7	1.2	.06	.3
Spotted Knapweed (*Centaurea spp.*)	.4	.6	0	0
Canada Thistle (*Cirsium arvense*)	0	0	.06	.7
Bull Thistle (*Cirsium vulgare*)	.8	.06	.25	.1
Scotch Broom (*Cytisus scoparius*)	0	.5	0	0
English Ivy (*Hedera helix*)	0	.2	0	0
St. Johns Wort (*Hypericum perforatum*)	.25	.6	.4	.3
Perennial Pea (*Lathyrus latifolius*)	0	.2	0	.6
Himalayan Blackberry (*Rubus armeniacus*)	1.8	2.7	.5	.9
TOTAL	3.7	3.6	.9	2.25
			Total Miles	**10.5**

Non-native invasive species typically outcompete native plants and quickly colonize disturbed areas. They can create substantial seed banks in the soil which require long term treatment to control, and sometimes release chemicals into the soil to reduce the plant growth of competing species (BLM, 2019 and ODA, 2024).

A summary of species profiles will not be summarized here but can be found by species at the Oregon Department of Agriculture, Noxious Weed Profiles webpage: https://www.oregon.gov/oda/programs/Weeds/OregonNoxiousWeeds/Pages/AboutOregonWeeds.aspx

A diverse toolbox of Project Design Features will be required to reduce the likelihood of introduction and spread of non-native invasive species. Project Design Features are discussed below and are drawn from a host of reference materials including the 2018 BLM Integrated Invasive Plant Management Revised EA.

Treatments on existing populations will occur prior to implementation but may not eliminate populations entirely due to challenges regarding resources and existing seed bank in the soil requiring ongoing and long-term treatment. Due to this, weed populations with risk of invading disturbed areas will be flagged for avoidance. By limiting activity and disturbance in and directly adjacent to the population, the chance of seed dispersal would be reduced.

Washing of equipment will be required before entering the project area to reduce the likelihood of introducing non-native species. Weed washing is a recommended design feature (BLM, 2018, p.44) and when done properly and for a minimum of 6 minutes per vehicle, has been shown to be 77% effective at reducing the debris introduced to disturbance sites (Montana State University, 2011).

In areas where work may occur in or adjacent to an invasive plant population, such as in the event of a quarry with a persistent seed bank, preventative treatments may include activities like scraping and piling the soil surface, burying soil surfaces with weed-free material, or tarping the soil surface to prevent contact with infested soil. These methods, as they apply to rock quarries and roads, are outlined in the Western Oregon BLM Considerations when applying crushed rock in western Oregon (NW Oregon District, Coos Bay District, Roseburg District, Medford District, Klamath Falls Field Office of Lakeview District) draft guidance (2023).

Where avoidance is not possible washing on site will be required prior to moving equipment to other areas to consolidate seed sources where they already exist in the soil and reduce spread while increasing feasibility of future treatment (USDA, 2001).

All sources of mulch, rock, or imported materials will be required to be weed free and sourced from approved sources to avoid introduction of non-native species. Areas that are disturbed that have historic or adjacent non-native species populations will require seeding with certified weed free native seed post disturbance (BLM, 2018).

Rationale: This issue was considered but not analyzed in detail because a noxious weed risk assessment was performed and determined the risk level for the proposed project is moderate. Project Design Features have been assigned to mitigate increasing the risk level in accordance with direction in BLM manual 9015. In addition, this project is subject to Early Detection, Rapid Response (EDRR) as a requirement for the Medford District non-native invasive plant program. With the incorporation and proper adherence to required project design features, the proposed action complies with management direction in the 2016 SWO RMP and 2018 the Medford District BLM Integrated Invasive Plant Management Revised EA and would be unlikely to effect the introduction or spread of non-native invasive plant species above the thresholds set in regulation documents.

Issue B 4: Would there be effects on public health from herbicide use within the Project Area and how would herbicide use be determined to be the appropriate treatment method?

There are no anticipated effects on public health from herbicide use within the Project Area. Herbicide treatment is proposed for the management of non-native invasive plant species as part of an integrated invasive weed management program and is utilized when it is determined as the most effective tool, while considering all impacts on human and environmental health, as well as a cost benefit analysis. A PDF has been assigned to address compliance with human health direction. All herbicide use is analyzed and in compliance with the 2018 Medford District BLM Integrated Invasive Plant Management Revised EA (2018) and Annual Treatment Plan Determination of NEPA Adequacy.

Issue B 5: How would the King Mountain ACEC be managed to preserve sensitive plant and soil resources?

Background: There are no proposed activities within the King Mountain ACEC, so there would not be any impacts to sensitive plant and soil resources.

Rationale: The King Mountain ACEC was excluded from any ground impacting activities related to timber harvest, fuel reduction treatments, and road construction or reconstruction under the prosed action, therefore, no impacts are expected from the proposed project for sensitive plant or soils resources.

Issue B 6: What would be the potential impacts from the proposed activities to Gentner's Fritillary and its habitat?

Background: There is no designated critical habitat within the project area, but a portion of the project is within the range of *Fritillaria gentneri*. *Fritillaria gentneri* is known to inhabit a wide variety of habitat types (16 different plant communities) and soil types (25) ranging from 600-5000 feet in elevation. The species prefers at least partial light, often at the edges of grasslands, chaparral, and partially open mixed evergreen woodland, especially in transitional areas and along ridgelines and aspect changes (BLM, 2020). *Fritillaria gentneri* is rarely found in dense or closed-canopy stands and is not a late-successional species. There is no evidence to support a preference for disturbed habitat; however, the species exists in stands with historically frequent fire return intervals indicating it may be a fire adapted species (BLM, 2020).

Surveys have been completed on all proposed activity units within the range of *Fritillaria gentneri* in compliance with the Biological Assessment of activities that may affect the federally listed plant species, Gentner's Fritillary and Cook's Lomatium, on the Medford District BLM (BLM, 2020). The two-year survey protocol examined vegetative (indeterminate) fritillary leaves in one location which was not within an area of high habitat suitability. Second-year surveys were conducted but no flowering plants were located so the survey area is considered cleared for project implementation (BLM, 2020).

The treatments proposed for commercial extraction, non-commercial extraction, and fuels treatments would increase canopy openings, reduce the relative density index, allow increased light and moisture to reach the soil surface, and remove fuel loads which could contribute to stand replacing wildfire. Extraction would not occur in open or meadow areas due to the absence of desirable vegetation for harvest. The remaining tree cover in harvest land base would maintain 25-40% relative density index, which would provide open to moderate mottled shade in extraction units. Based on existing data, partial light (40-60%) is optimal for Gentner's Fritillary (BLM, 2020). Given these outcomes, it is possible that the thinning and removal of vegetation from mixed conifer stands to manage for a reduction in canopy cover and reduced risk of severe wildfire could improve the habitat suitability for *Fritillaria gentneri*.

Rationale: This issue was considered but not analyzed in because surveys have been completed following established protocols in the Biological Assessment of activities that may affect the federally listed plant species, Gentner's Fritillary and Cook's Lomatium, on the Medford District BLM and subsequent Letter of Concurrence from the USFWS (2020), there are no populations of Fritillaria gentneri within the proposed activity area, and project design criteria have been developed in the event an incidental population is identified post implementation. Due to these factors the proposed activity would be not likely to effect *Fritillaria gentneri* or it's habitat.

Issue B 7: How would the proposed actions affect Special Status plant species and their habitat?

Background: The activities proposed (commercial thinning, non-commercial thinning, fuels treatments, and permanent and temporary road construction) have the potential to impact Bureau Sensitive Species and their habitat. Changes in light, humidity, and moisture availability associated with thinning activities can impact special status plant habitat by reducing high crown densities, increasing light levels, and removing vegetative competition for moisture and nutrients within the soil matrix. Thinning activities can also change fire behavior. The ground disturbance associated with these activities can be detrimental to individuals or populations of existing sensitive species and increase the risk for introduction or spread of non-native invasive plants that can outcompete native species and degrade habitat suitability (BLM, 2018). For some species, there may be long-term beneficial effects from timber thinning projects by restoring suitable habitat for sensitive species. Removal of over story canopy cover that changes temperature, moisture, and light, can have positive impacts on populations and habitat depending on species requirements and site suitability. The potential for species and habitat impacts are addressed below by species for the proposed activities. Mitigation summaries are addressed by species and included in Appendix C. Project Design Features.

For the following analysis, a "population" is defined as a unique group of individuals of the same species that exist within a local geographic area more than 300 feet apart (BLM, 2018). In cases where there are scattered distributions of patches of plants within suitable habitat, buffers may be delineated as separate or aggregated depending on the site characteristics and species. Patches more than 150 feet apart will typically be buffered separately unless the use of heavy machinery is proposed (BLM, 2018).

The project area has been reviewed for known occurrences of Bureau Sensitive Species. Surveys for Bureau Sensitive Species have been completed in all activity areas proposed for commercial and non-commercial timber harvest and road renovation within the last ten years in compliance with the SWO RMP (p. 106). Surveys have been completed in most activity area proposed for fuels treatments only; however, some units have not been surveyed within the last 10 years due to limitation in resources and unsuitable habitat. These remaining proposed fuels only activity units will require survey prior to implementation to follow the 2016 SWO RMP direction, and a project design feature has been assigned to dictate this. A list of Bureau Sensitive Species populations within different proposed activity types can be found in Tables B-7.1 through B-7.4.

Table B-7.1. Bureau Sensitive Plant Species within Commercial Treatment Units

Scientific Name	**Common Name**	**Rating**	**# of Current Populations**	**Historic Populations**
Camassia howellii	Howells Camas	OR-SEN	17	1
Cypripedium fasciculatum	Clustered Lady Slipper	OR-SEN	0	2
Epilobium oreganum	Oregon Willow-herb	OR-SEN	2	0
Phymatoceros phymatodes	Hornwort	OR-SEN	1	0
Silene hookeri ssp. bolanderi	Bolander's Catchfly	OR-SEN	8	11
		Total	28	14*

*Historic populations, not located in recent surveys.

Table B-7.2. Known Bureau Sensitive Plant Species within Fuels Only Activity Units

Scientific Name	**Common Name**	**Rating**	**# of Populations**	**Historic Populations**
Allium bolanderi var. bolanderi	Bolander's Onion	OR-SEN	0	1
Camassia howellii	Howells Camas	OR-SEN	7	10
Cypripedium fasciculatum	Clustered Lady Slipper	OR-SEN	0	1
Silene hookeri ssp. bolanderi	Bolander's Catchfly	OR-SEN	1	2
Solanum parishii	Parish's Nightshade	OR-SEN	0	1
		Total	14	15*

*Historic populations, not located in recent surveys.

Table B-7.3. Bureau Sensitive Plant Species and Permanent or Temporary Road Construction

Scientific Name	**Common Name**	**Rating**	**# of Populations**	**Historic Populations**
Camassia howellii	Howells Camas	OR-SEN	2	0

		Total	1	0

Table B-7.4. Bureau Sensitive Plant Species and Road Renovation

Scientific Name	**Common Name**	**Rating**	**# of Populations**	**Historic Populations**
Camassia howellii	Howells Camas	OR-SEN	6	0
Eucephalus vialis	Wayside Aster	OR-SEN	0	1
Silene hookeri ssp. bolanderi	Bolander's Catchfly	OR-SEN	5	0
		Total	11	1*

*One population has not located in recent surveys.

Bolander's Onion (*Allium bolanderi var. bolanderi*) is an onion native to Northern California and Southern Oregon. It grows in rocky and clay serpentine soils (Mullens et al., 2018). No plants were observed at the recorded site during surveys in 2021. This one historic population is located in an area proposed for fuels treatments only and is not proposed for commercial timber treatments. Although it is likely that Bolander's Onion is fire adapted due to its native habitat on the landscape, the direct impact of fire on Bolander's Onion is not known. Due to this uncertainty this historic population will be buffered and protected with PDF's that allow for broadcast burning within a seasonal restriction to the dormant period and restrict pile placement to outside of the population. Pile restrictions are recommended because pile burning has been shown to penetrate the soil by several centimeters, altering both the seed bank viability and soil microorganisms (Haskins and Gehring, 2004).

Howells Camas (*Camassia howellii*) is a lily native to Josephine County, Oregon. It grows in grassy wet meadows, swampy areas, and transitional zones between meadow and woodland between 600-2200 feet in elevation (Oregon Flora, 2019). This species is the most common special status botanical species within the project area. Populations within the project area range from 0-5000+ individuals per population and were observed occurring in partial to full sun. Not all historically known populations were located during surveys within the last 10 years. Populations that were located during recent surveys, summarized in Tables B 7.1 through B 7.4, will be prescribed a no-activity buffer of 100' for ground based commercial activities due to the use of heavy equipment. A limited-activity buffer of 100' for full suspension commercial activities will restrict tree removal within the 100' buffer to no ground disturbance, requiring hand felling directionally away from the population boundary and full-suspension helicopter removal. Fuels activities will be buffered as follows: 1) broadcast/ underburning will be allowed within the population restricted to the dormant season (October-March), and 2) small diameter fuels reduction is restricted to the dormant period and piles may not be placed with the plant populations, or within a 25' buffer of plant populations due to the possibility that the concentrated heat from pile burning may alter the seed bank or soil community directly under the piles (Haskins and Gehring, 2004).

Clustered Lady Slipper (*Cypripedium fasciculatum*) is a native orchid found in dry to moist coniferous forests across 8 western states, including Oregon. It prefers canopy cover greater than 60% (IAE, 2012). It is often associated with late-seral Douglas fir forest types. The two documented populations are historic, contained only 2 individuals, and were not relocated in most recent surveys indicating the populations may no longer exist. The extinction of small populations of *Cypripedium fasciculatum* that have long survey re-visit intervals has been documented across the Medford district (IAE, 2012). Additionally, this species is documented to typically occur in small pockets of 1-20 individuals (IAE, 2012) and seeds may grow underground for 3 or more years prior to presenting above ground (Brown, 2024). Given that this species prefers mostly to fully closed canopies, removal of overstory and increases in sunlight may not improve the habitat for the species. Cypripedium is also documented to have a relationship with mycorrhiza in the soil, which can be disrupted by soil disturbing activities. To preserve the habitat and potential existence in the seedbank, these populations are protected with a no-activity avoidance buffer of 100' for all proposed activities.

Oregon Willow Herb (*Epilobium oreganum*) was historically a federally listed species, removed from federal listing in 1996. This plant is known only to exist in Josephine County, Oregon and Trinity County, California. It grows only in wetland bogs and fens (Calflora, 2023). There are only 33 known occurrences of this species in Oregon, the majority of which occur only on the Rogue River Siskiyou National Forest and the Medford District BLM (BLM, 2018). *Epilobium oreganum* occurs in serpentine fens and serpentine rocky areas (Mullens et al., 2018). Located in one location in 2021, the known population of this species contains an estimated 25 individuals. This population is located within a unit proposed for commercial treatment. Commercial timber harvest activities will require a no-activity buffer of 100' for this population regardless of logging system or proposed prescription. Fuels maintenance activities may still occur within the population buffer, with mitigations including pile exclusion and seasonal restrictions, as prescribed fire is expected to benefit the habitat for this species (BLM, 2018). The no-activity exclusion for this population is aimed to comply with the 2016 SWO RMP and existing conservation strategy (2018) for *Epilobium oreganum*.

Wayside Aster (*Eucephalus vialis*) occurs on a range of habitat types in relatively open areas from conifer forest to deciduous woodland. It occurs in the understory of mixed conifer/hardwood forests, along roadsides, and on open slopes. The open habitat preferred by this species is expected to have been historically maintained by fire regimes (IAE, 2010). This species shows increased health and vigor in open, high light environments and lower vitality in closed canopy conditions (Oregon Department of Agriculture, 2023). There is one historic population documented within the project area in and adjacent to a proposed temp route reconstruction. The population historically contained approximately 300 individuals but has not been relocated since 2005, indicating that the population may be extinct or dormant. *Eucephalus vialis* demonstrates very low recruitment, low to no reproduction, and stunted plants in environments with no disturbance and lower light penetration. Canopy thinning has shown to increase light availability leading to greater plant height, increased probability of flowering, and increased seed set (IAE, 2010) Additionally, seed germination for this species has been shown to be higher when duff is removed and bare mineral soil is exposed (IAE, 2010). This evidence suggests that the disturbance and bare soil created by road construction may create a favorable environment to reinvigorate the population or create habitat for seed germination. Mitigations are not prescribed for this population given that the population has not been located in in recent visits and the potential exists for the creation of more favorable habitat characteristics for the species as outlined above.

Phymatoceros phymatodes is a special status bryophyte. Two individuals were found in one location during surveys in 2017 and this is considered the one population within the Last Chance project. This population is located adjacent to an area proposed for commercial treatment. The population was found growing in full shade (BLM survey records, 2017) and the species is known to grow in mid-successional forest openings on a thin soiled rock substrate (NatureServe, 2017). Due to the low number of individuals in the population, changes in canopy cover, soil moisture, or soil disturbance could damage the individual plants and eradicate the population at this location. To avoid damage to this population, and changes to the habitat surrounding the population, a 100' no-activity buffer is required for all proposed activities.

Bolander's Catchfly (*Silene hookeri ssp. Bolanderi*) occurs in serpentine and non-serpentine soils in oak and Douglas fir woodlands under 3200 feet in Oregon and California (Jepson, 2023). Bolander's Catchfly also occurs in forest openings and open slopes (Mullens et al., 2018). Nine current existing populations, ranging from 3-150 individuals per site were found in part sun to full sun in locations adjacent to and in proposed activity areas. Some populations have overlapping proposed actions identified within them. To prevent damage to individual plants and populations, populations will be marked and treated as avoidance areas, except where populations exist adjacent to an existing road prism that will be renovated. No timber harvest activities are permitted within population boundaries. Anywhere heavy equipment is proposed for use, populations will be buffered by a 100' to prevent damage to plants, soil, or habitat. In cases where timber harvest can be accomplished without ground disturbance, hand felling and full suspension will be permitted within the 100' buffer only. Treatment and tree harvest within the buffer is permitted because all documented populations in the project area are occurring in sites that receive part to full sun and thinning without ground disturbance could lead to better habitat suitability for this species.

Parish's Nightshade (*Solanum parishii*) is found in dry chaparral, oak/pine woodland, and pine forest (Jepson, 2023). Only one population has been documented within surveyed proposed activity units and was last detected in 2006 with 25 individuals. This population occurs within a unit proposed for fuels treatments only. Previous studies have indicated that fire may benefit this species; however, a report from the Institute for Applied Ecology (2014) showed that prescribed fire did not have an impact on plant survival or reproduction. The study also showed that two years after a burn, there was no different in plant size. Fire has been found to have no effect on this species (IAE, 2014). There is a link between fire and increased presence of non-native invasive plants, so the intentional application of prescribed fire to to this species, may not be beneficial enough to outweigh potential consequences (IAE, 2014). Since no concrete evidence exists yet to suggest a benefit to this species regarding fuels treatments, populations of this species will be a no-activity area with a 25' no activity buffer that restricts broadcast burning, brush removal, and pile construction.

Road renovation activities include road maintenance and improvement activities, within the road prism, to bring existing roads up to standard for safe vehicle travel and timber haul. There are 11 populations of bureau sensitive species located adjacent to roads proposed for renovation. Negative impacts to these populations are not anticipated since renovation occurs on existing roads; however, if use of heavy equipment will leave the road prism, a botanist will need to review the proposed activity to ensure no sensitive botanical species are put in undue jeopardy. This is the same methodology prescribed for *Fritillaria gentneri* (2020).

There may be limited case by case scenarios where the above discussed mitigations may be waived, after review by the project botanist. There are two currently identified scenarios where a mitigation waiver has been approved to allow for ground disturbing activity within a Bureau Sensitive plant population.

There is a 545' segment of permanent road construction proposed within a population of *Camassia howellii*. The documented population spans 23.7 acres and contains more than 500 individuals, occurring in full sun, and being uncommonly encountered across the population distribution. The road construction will permanently impact 1.12 acres within the population (4.7% of the population area). Although it is difficult to determine the exact number of plants that may be impacted by this action, it is reasonable to assume that given the distribution of the plants and the area to be disturbed, no more than 5% of the individuals within the population would be damaged. The remaining portion of the population is protected as a no-activity area.

A 63' segment of permanent road is proposed for construction across a corner of another population of *Camassia howellii*. The construction will permanently impact approximately .07 acres at the periphery of the population. The population impacted by this segment spans 9.4 acres and was last documented to contain over 20,000 individuals occurring in full sun. Since population boundaries are typically removed from the nearest plant by sight distance to ensure all plants are accounted for, it is anticipated that less than 1% of the individuals in this population would be impacted by this action.

The proposed timber harvest treatment adjacent to these populations are expected to increase light availability at the site and may possibly increase habitat suitability in the 82 acre area surrounding the populations. Given the small number of individuals expected to be impacted and the potential for possible habitat expansion, the risks and benefits are anticipated to be equivalent and not risk trending the species towards a higher level of listing, consistent with the direction in the SWO RMP (2016).

It is expected that additional situations may arise during implementation that require review and potential waiver from the project design features proposed. These will be addressed on a case-by-case basis to ensure that the proposed action is feasible and human life and safety is protected, and the health and long-term viability of all bureau sensitive plant species and their suitable habitat is protected in accordance with agency direction.

Rationale: This issue was considered but not analyzed in detail. After surveys, a review of existing populations, habitat, and proposed treatments, project design features have been established to ensure the protection of Bureau sensitive plant species and their habitat where impacts area anticipated. Given the review and project design features, it has been determined that the proposed activities in the Last Chance project would not adversely affect and trend any Bureau Sensitive botanical species towards a higher listing status and the proposed action follows the guidance set forth in the SWO RMP (2016), BLM Manual 6840, and the Interagency Special Status/Sensitive Species Program (ISSSSP).

Carbon Storage and Greenhouse Gas Emissions

Issue B 8: What are the effects of proposed project actions on greenhouse gas emissions, carbon storage, climate change, and the social cost of carbon?

Background Information: The effects of the proposed action of the Last Chance FMP on carbon storage and greenhouse gas emissions, including estimates of their social cost, is not analyzed in detail, because, regardless of project-specific or site-specific information, there would be no reasonably foreseeable significant effects of the proposed action beyond those disclosed in the 2016 Final Environmental Impact Statement.

Rationale: 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 FEIS also analyzed the estimated future values associated with carbon storage and greenhouse gas emissions, using methods developed at that time by the Interagency Working Group on Social Cost of Carbon, United States Government (2016),

The effects of the action Alternatives on carbon storage and greenhouse gas emissions, and their associated values, tiers to the analysis in the FEIS. As described below, the proposed action is consistent with the SWO ROD/RMP. 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 for timber resources based on high quality and detailed information (FEIS, pp. 165-180; 1295-1304; 598-600; 621, 653; 657). 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 their associated values, and thus cannot reveal any fundamentally different effects than that broader analysis.

The FEIS upon which the 2016 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 2016 FEIS analyses include (FEIS, p. 165; 590):

- 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.

Social Cost of Carbon is calculated using a non-market based valuation for the storage of carbon as a good or service and greenhouse emissions expected to result from the alternatives. The analysis finds that the value would increase from current (2012) valuation of $85 million per year to a value of $159 million per year under the RMP. The FEIS concluded that the approved RMPs support the state of Oregon's interim strategy for reducing greenhouse gas emissions (FEIS, 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. Neither the state of Oregon nor the federal government have established specific carbon storage goals so quantifying BLM's contribution to that goal is not possible. 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 (FEIS, p.169).

The FEIS estimated the effects of implementing actions consistent with the Southwestern Oregon RMP as follows in Table B-3:

Table B 8.1: Carbon Storage, Greenhouse Gas Emissions and Net Carbon Storage

Table B 8.1: Carbon Storage, Greenhouse Gas Emissions and Net Carbon Storage	Current	2033	2063
Carbon Storage	336 Tg C	404 Tg C	482 Tg C
Greenhouse Gas Emissions	123,032 Mg CO2e/yr	256,643 Mg CO2e/yr	230,759 Mg CO2e/yr
Net Carbon Storage	$ 85 Million	$159 Million-average/year 2013-2022	

The carbon storage and greenhouse gas emissions analysis was 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 Harvest Land Base and 73 MMbf from non-ASQ related harvest) over the entire decision area (FEIS, p. 307). The expected annual harvest for the Medford District for 2024 is 51 MMbf (37 MMbf from the HLB and 14 MMbf from non-ASQ related harvest). Which has been reduced in 2024 to allow BLM to focus on forest health due to Douglas Fir mortality within the District. Projected harvest levels from the Last Chance FMP, when added to projected harvest levels from other projects on the BLM Medford District, fall within the FEIS analysis.

Table B 8.2: Planned Project Acres

Sale	NEPA	ASQ(MMBF)	Non-ASQ	Total Sale Vol.
Late Mungers	IVM EA	0.0	5.1	5.1
Penn Butte	IVM EA	0.0	6.6	6.6
Sugar Hill	South Clark EA	8.0	0.0	8.0
Santiam Select	South Clark EA	4.8	0.1	4.9
Paul's Payoff	Last Chance EA	7.2	1.8	9.0

Dead Antelope Salvage	Cat EX	2.4	0.2	2.6
Forest Creek Salvage	Cat EX	1.4	0.0	1.4
Boaz Salvage	Cat EX	2.6	0.1	2.7
Lost Rio Salvage	Cat EX	1.1	0.0	1.1
TOTALS		**27.5**	**13.9**	**41.4**

The harvest levels remain within the range of that analyzed in the FEIS (Table 17).

Table B 8.3: Medford District Offered Harvest by Volume 2018-2022 (source: BLM Facts website)

Year	FEIS MMBF Projected for Harvest for Medford District	MMBF Offered by Medford District	% Offered Harvest of FEIS Annual Harvest Level
2018	51	23.4	46%
2019	51	37	72.5%
2020	51	41.3	81%
2021	51	35.4	69%
2022	51	34.8	68%
2023	51		

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 Medford District, the expected decadal average activity fuels program covers 25,221 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 (FEIS, p. 270). Approximately 121,219 acres of prescribed burning associated with non-commercial natural hazardous fuels treatment is expected to occur on average each decade across the planning area (FEIS, p. 270). For the Medford District is approximately 62,497 acres of hand pile burn prescribed fire and approximately 22,064 acres of underburning, totaling and expected 84,561 acres per decade on average is expected associated with natural hazardous fuels treatments.

Table B 8.4: Prescribed Burning Treated by Year in the BLM Medford District (GeoCortex Public Webmap)

Year	FEIS Analysis for Annual Medford District Prescribed Fire (acres)	Total Prescribed Fire Implemented by BLM Medford District (Acres)	Percent Fuels Treated of FEIS Analysis Annual Prescribed Fire Levels
2016	10,977	561	1%
2017	10,977	2,420	3%

2018	10,977	2,299	5%
2019	10,977	2,086	7%
2020	10,977	872	8%
2021	10,977	1,861	9%
2022	10,977	1,299	10%
2023	10,977	3,007	13%
Last Chance		11,686	24%

The FEIS modeling thus estimated the total prescribed burning program (natural and activity fuel combined) for the Medford District to be approximately 109,772 acres per decade. If all 11,686 acres analyzed in the EA would be treated with prescribed fire, they would fall within the District decadal average. The acres of prescribed burning and tonnage consumed remains within the range analyzed in the FEIS (Table 18).

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 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 (FEIS, p. 174).

There is no new information or changed circumstances that would substantially change the effects anticipated in the 2016 FEIS. This is because the harvest levels remain within the range of that analyzed in the 2016 PRMP/FEIS and the acres of activity fuels prescribed burning and expected tonnage consumed remains within the range analyzed in the 2016 PRMP/FEIS.

Cultural Resources

Issue B 9: How would ground disturbance from the proposed project activities affect cultural resources such as archaeological and historical sites, artifacts, and features?

Background: Proposed project activities including the construction of temporary and permanent roads, tree felling, yarding, and decking have the potential to affect cultural resources by causing ground disturbance and modifying the landscape. These activities may cause a significant impact by affecting the physical integrity of cultural artifacts and features and their setting where “significant impacts” is defined as those that adversely affect any of the elements of a cultural resource that contribute to its NRHP eligibility. This could include actions affecting the physical integrity of cultural artifacts and features as well as actions that affect their setting.

The Grants Pass Field Office archaeologist conducted archival and background research, and a consultant conducted field surveys, to identify cultural resources located within the project area. The results of the field surveys are detailed in a cultural resource inventory report contained in the Administrative Project Record and submitted to the SHPO. This report discusses all cultural resources identified in the project area and assesses them in terms of their NRHP eligibility. Section 106 of the NHPA requires that federal agencies take into account the effects of their undertakings on historic properties that are included in, or eligible for inclusion in, the NRHP. Therefore, non-eligible sites and isolated finds do not require further consideration. However, historic properties (cultural resources that are eligible for the NRHP) and unevaluated cultural resources (which per the 2015 BLM-SHPO Protocol must be treated as historic properties) must be taken into consideration.

Rationale: This issue was considered but not analyzed in further detail as the project was specifically designed to avoid significant impacts to historic properties. The project avoids historic properties whenever possible. In areas where historic properties could not be avoided, project features were designed to avoid impacting those elements of a historic property that contribute to NRHP eligibility. In cases where the BLM proposes to implement treatments within cultural resources that are unevaluated or eligible for the NRHP, PDFs were developed (See PDFs, Appendix C, Table C-12, PDFs 17-21) to ensure that the project does not adversely affect those resources. Concurrence was sought from SHPO on their determination of "no adverse effect to historic properties" for the project.

The BLM considered this issue but did not analyze it in detail because it does not address the purpose and need and is not associated with significant impacts (NEPA handbook, p. 41) beyond those analyzed in the FEIS. The BLM considered this issue but did not analyze it in detail because it does not address the purpose and need and is not associated with significant impacts (NEPA handbook, p. 41) beyond those analyzed in the FEIS.

Issue B 10: How would the project affect traditional cultural properties or properties of religious significance, either through ground disturbing activities or altering accessibility or use?

Background: Several Federally recognized Tribes have cultural and/or religious connections to the project area. Project activities would have the potential to disrupt or negatively impact these properties, either by inadvertently impacting the property, or limiting access to said property depending on the nature of the property. To prevent this, tribal consultation was undertaken to identify places of traditional religious or cultural significance to tribes who take an interest in the project area. This consultation did not result in the identification of any sites of concern to tribes.

Rationale: The BLM considered this issue but did not analyze it in detail because it does not address the purpose and need and is not associated with significant impacts (NEPA handbook, p. 41) beyond those analyzed in the FEIS. Consultation with the tribe identified no sites of traditional cultural or religious significance to Tribes within the project area.

Fire and Fuels

Issue B 11: How would the Last Chance forest management actions affect wildfire risk to communities?

Background: This issue evaluates how proposed actions would affect wildfire risk near communities. This issue expands on the Fire Resistance and Hazard detailed analysis, which analyzed relative stand-level resistance to replacement fire (or fire hazard). Fire hazard is a component of wildfire risk, which refers to the ease of ignition and potential fire behavior of the fuel complex, defined by the volume and arrangement of fuel layers, including surface, ladder, and canopy fuels (Calkin et al. 2010). Fire behavior has a direct effect on fire severity, mortality, suppression tactics, and the initiation of crown fire, which presents the greatest resistance to control and the largest potential to threaten wildland urban interfaces (WUI) (Graham et al. 2004) (USDI/BLM 2016a, p. 254). Wildland fire risk describes the likelihood of wildfire, intensity of wildfire (aka hazard), and susceptibility of human values (e.g., communities, homes, infrastructure, resources, etc.) to adverse wildfire effects Wildfire likelihood is high in southwest Oregon and fires have occurred with regularity within the project area (Appendix D.5). In this issue, the BLM considers effects to the human value of a focused area around communities.

In terms of community wildfire risk, reducing loss of homes to wildfire is best achieved by reducing the susceptibility of homes to ignition and reducing the probability of home exposure to wildfire (Caulkin et al. 2014). Home material construction (i.e., fire resistant) and home ignition zone (100-200 feet circumference of vegetation around home), managed by the homeowner, influence home ignition susceptibility (Cohen 2008). The probability of home (or community) exposure to wildfire is influenced by production of embers and large wildfire growth. Treatments that reduce the probability of torching (or increase stand-level fire resistance) and limit ember production or provide effective opportunities to limit large wildfire growth and limit wildfire hazard and likelihood (Caulkin et al. 2014, Finney 2007), or probability of exposure. Additionally, Prichard et al. 2021 recently examined several of these same topics and conclude that only focusing treatments within the home ignition zone, which is critically important, ignores broader interconnected social and ecological issues, such as smoke from wildfire emissions, ecosystem service impacts, such as clean water, and impacts to other HVRAs that occur beyond the home ignition zone, such as forests providing wildlife habitat and banking carbon stores that can slow negative climate-fire feedback loops.

This analysis tiers to the PRMP/FEIS analysis of the effects of the temporary increase in risk from residual activity fuels (e.g., live and dead tree branches and tops accumulated following timber harvest) (USDI/BLM 2016a, pp. 264-270) and the effects of relative stand-level fire hazard within close proximity to Wildland Development Areas (WDA) (USDI/BLM 2016a, pp. 253-264), used as a surrogate for Wildland Urban Interface in the PRMP/FEIS. Much of the Last Chance planning area lies within a quarter mile of Communities at Risk (CaR), a locally identified focused area within the Wildland Urban Interface (WUI) (CWPP 2019; Metlen et al. 2017). Approximately 15% of the maximum proposed action extent (1,620 acres) is within the CaR (Appendix D.5) and 43% of proposed action acreage is within the WDA (Appendix D.5 Affected Environment).

The analysis for temporary increase from residual activity fuels, which is incorporated here by reference, concluded that immediately following commercial harvest, residual activity fuels left on the forest floor (e.g., tree tops and limbs) would increase surface fuel loadings and have the potential to increase surface fire behavior and pose a risk to the residual stand and other values, if not adequately treated (USDI/BLM 2016a, p. 269; Martinson and Omi 2013; Weatherspoon and Skinner 1995; Fule et al. 2001). The analysis in the PRMP/FEIS provided an estimate of potential future work needed to reduce the risk associated with activity fuels and concluded that in the interior/south, implementation of the SWO ROD/RMP would result in an average of approximately 72,000 acres/decade of very high and high risk from activity fuels on dry forest sites (USDI/BLM 2016a, pp. 268-269). The PRMP/FEIS also identified that a variety of follow-up treatments (e.g., prescribed fire, biomass removal, and mechanical manipulation, etc.) can reduce surface fuels and reduce the risk associated with activity fuels (USDI/BLM 2016a, pp. 266, 269). Proposed actions within this EA would treat activity fuels within 1-2 years following harvest similarly among alternatives (See Proposed Action 1.4). Activity fuels would be treated to reduce surface fuels to below a level that would result in expected flame lengths less than 4 feet under typical fire weather conditions. Activity fuel treatment type would be based on the remaining surface fuel loading and unit location (e.g. aspect, slope, access, and proximity to other values, such as communities). Any increase in surface fuel loading from residual activity fuels would be temporary (1-2 years). The effects of the temporary increase in risk from residual activity fuels are within the scope of those effects analyzed for in the FEIS (USDI/BLM 2016a, pp. 260 and 263, Figure 3-380) (see Issue 3). In this analysis, the BLM tiers to the FEIS assumptions (BLM 2016 p. 265-266), to assess the relative amount of residual surface activity fuel immediately following harvest, to assess the temporary increase in surface fuel loading. In that analysis, the BLM determined a relative weighting of residual activity fuel that would remain following timber management activities (BLM 2016 p. 266, Table 3-37), based on the management type and intensity, where harvest prescriptions that remove greater basal area from stands leave more surface fuels. The BLM followed this same weighting and applied it to acres of proposed harvest types in this project, where small-diameter thinning and commercial thinning and selection harvest would generate low loads of residual activity fuels and variable retention harvest would generate moderate loads (see Appendix D.5 Methods and Assumptions sections). As discussed in Issue 3 and the FEIS, variable retention harvest will generate higher loads of activity fuels. Alternative 2 is the only alternative that proposes variable retention harvest, of which 156 acres are within the WDA (Table B 11.1).

Table B 11.1 Action Alternative 2 proposed variable retention harvest acreage relative to the WDA.

Row Labels	Inside WDA	Outside WDA	Grand Total
Regeneration Harvest 15-30% BA	156	574	730
Regeneration Harvest 5-15% BA		57	57
Grand Total	**156**	**631**	**787**

In the 2016 PRMP/FEIS, the BLM analyzed in detail how the alternatives would affect fire hazard within WDAs (USDI/BLM 2016a, pp. 253-264). In that analysis, the BLM assigned forest structural stages (USDI/BLM 2016a, pp. 1203-1206) to a relative ranking of stand-level fire hazard using the same methodology as in analysis of relative stand-level resistance to replacement fire in the dry forest (USDI/BLM 2016a, Table 3-32, p. 243 and Table 3-34, p. 254). The BLM conducted detailed analysis of relative stand-level resistance to replacement fire (or fire hazard) in Issue 3 of this EA, which tiered to PRMP/FEIS analysis, and concluded that "[u]nder all action alternatives, combined direct effects from proposed forest management actions would reduce (surface, ladder, and canopy fuels), reduce fuel profile continuity, and increase heterogeneity, over the No Action Alternative. These changes to the fuel profile would indirectly increase wildfire resistance or reduce wildfire hazard in the short-term (up to 20 years). In the cumulative effects discussion of Issue 3, the BLM indicates that stands would need maintenance treatments to sustain low-moderate surface fuel loading and discusses this in Issue 3 and maintenance needs would vary by alternative, for example more open conditions would require more frequent maintenance to sustain low-moderate fuel loading.

Rationale: This issue was considered but not analyzed in detail because 1) this analysis tiers to the PRMP/FEIS analysis, which estimated the effects of residual activity fuel hazard following on hazard (USDI/BLM 2016a, pp. 264-270) and relative stand-level fire hazard within close proximity to Wildland Development Areas (WDA) (USDI/BLM 2016a, pp. 253-264); and 2) there is no potential for significant effects from this EA beyond the magnitude of treatments analyzed in the PMRP/FEIS, because anticipated effects under any Alternative would not exceed those analyzed in the PRMP/FEIS. Additionally, there are no new circumstances or information at the site-specific level that would change the effects disclosed in the FEIS as stepped down to this project and this EA. At this time, nothing has changed relevant to the FEIS analysis and no new information has been determined that would change the outcome of the 2016 FEIS analytical conclusions.

The BLM analyzed in detail the alternative effects on stand-level fire resistance to stand replacement fire (or crown fire) and fire hazard (Fire Resistance and Fire Hazard Issue). Crown fire produces the most ember production and spot fires and presents the greatest resistance to control among fire behavior types. The BLM concluded that all Action Alternative increased short-term resistance to stand-level replacement over the No Action Alternative. Additionally, as described in the FEIS stand-replacement fire (e.g., crown fire) presents the greatest fire hazard or resistance to control and poses the greatest risk to human constructed assets and has the largest immediate and long-term ecological effects (USDI BLM 2016a). Any increase in surface fuel loading would be temporary (1-2 years) and treatments of residual harvest activity fuels by burning or removal of slash would reduce horizontal and vertical fuel loading and connectivity and thus the temporary increase in surface fuel hazard (Fire Resistance Issue assumptions).

For the above reasons, further analysis of this issue is not necessary for making a reasoned choice among alternatives, in that it would not inform the decision maker how the alternatives respond to the purpose and need beyond detailed analysis conducted in Issue 3. Additionally, effects among all alternatives would be within those analyzed in the PMRP/FEIS, therefore, this Issue was not carried forward for further analysis.

Issue B 12: How would road building contribute to human caused fire ignitions?

Background: Road corridors have been found to be correlated with human ignitions (Narayanaraj and Wimberly, 2011, and Syphard et al. 2007), however roads may also contribute toward wildfire containment and limiting fire spread (Price & Bradstock, 2010; Syphard et al. 2007), particularly if aligned with an operationally strategic location that could aid in wildfire containment and limit large fire growth. Studies have shown mixed results, regarding the influence that road density and road proximity to populated areas have on wildfire ignitions. Narayanaraj and Wimberly (2011) did not find a correlation between road proximity to population density and human caused ignitions, while Romero-Calcerrada and others (2008) and Syphard and others (2007) found positive relationships. Between 2000 and 2021, human caused wildfire ignitions within the Last Chance FMP Planning Area accounted for 65 percent of all wildfires. Across the BLM Medford District between 1984 and 2013, the vast majority (91 percent) of all human caused fire ignitions occurred within one mile of Wildland Developed Areas (or where people live) (USDI/BLM 2016a, Figures 3-22 p. 227 and 3-34 p. 254).Within the project area, human caused wildfire ignitions that occurred within 50 feet of an existing road within the WDA, accounted for 21 percent of all human caused ignitions (2000-2022). During this time the majority (50 percent) of human caused ignitions that occurred within the planning area, started within the WDA beyond 50 feet of an existing road.

Table B 12.1 Human caused wildfire ignitions (2000-2022) and location relative to existing roads and the Wildland Developed Area (BLM 2016) in the project planning area. Data is from Oregon Department of Forestry (ODF).

Location relative to existing roads	**Inside WDA**		**Outside WDA**	
	Number of Fires	**Percent of total**	**Number of Fires**	**Percent of total**
Within 50ft of a road	14	21%	5	8%
Beyond 50ft of a road	33	50%	14	21%
Grand Total	47	71%	19	29%

Rationale: The local data illustrates human actions have an influence on wildfire ignition patterns within the BLM Medford District and Last Chance FMP planning area, particularly within proximity to populated areas, however based on studies reviewed, there is mixed evidence on road density influence on human caused ignitions, ranging from no detectable evidence to a positive correlation. While the proposed permanent and temporary road construction and road opening, renovation and long-term closures vary among action alternatives, temporary roads would be decommissioned after use common to all action alternatives. In alternative 2 there are 19.8 miles of permanent road construction proposed. Of the 19.8 miles of permanent road construction, 1.88 miles are behind a BLM locked gate and 1.88 miles are also on a parcel of BLM-administered lands, surrounded by private lands. There are 16 miles of Permanent Road Reconstruction proposed. These are roads that were not available for the public to travel previously. Additionally, as fire season increases in severity, land management agencies impose restrictions pertaining to public and work-related activities to prevent fire ignitions; in extreme fire weather conditions, restrictions can include public land closures, which is intended to limit access and reduce potential human caused ignitions. As stated in the background, roads may also contribute toward wildfire containment and limiting fire spread and approximately 2.16 miles of the proposed permanent road construction, behind a BLM locked gate, coincide with identified Potential wildfire Operational Delineation (POD) boundaries as described by Thompson and others (2016) and Stratton (2020), which represent geographic features that could aid in wildfire containment and limit large fire growth. Additionally, long-term decommissioned roads could be easily opened for use in wildfire containment, particularly those located on ridgetops, landscape locations that would need little infrastructure (e.g., cross drains) to reduce erosion or sediment delivery to streams.

For the reasons above, the alternatives do not present the potential for significant effects from roads to human caused fire ignitions, and further analysis of this issue is not necessary for making a reasoned choice among alternatives.

Fish and Aquatic Habitat

Issue B 13: How would timber harvest actions (ground-based, skyline-cable, tethered, and helicopter yarding) affect federally listed and native fish species and their habitats (aquatic habitat)?

Background Information: Ground-disturbing activities in or near stream channels have the greatest potential to impact federally listed and native fish species and their habitat (aquatic habitat) by increasing erosion and sediment transport to, and storage in, stream channels. The following proposed project elements have the potential to contribute sediment to streams: skid trails and skyline corridors.

Aquatic habitat character and quality are directly related to sediment. Sediment can increase embeddedness and accumulate in pools, reducing depths. These effects reduce spawning and rearing habitat quality and quantity. Increased sediment production and delivery to stream channels is the primary mechanism for potential impacts to aquatic habitats. The potential impacts to aquatic habitats from these activities would be minimized or eliminated through project designs and implementation, including the use of Best Management Practices, Project Design Features, and Riparian Zone buffers.

Rationale: This issue was considered but not analyzed in further detail because the activities described in the proposed actions would not be implemented in fish-bearing streams. This is achieved through the implementation of Best Management Practices, Project Design Features, and Riparian Zone buffers.

Proposed skyline corridors would have no hydrologic connection to stream channels, and no causal mechanism would exist for input of sediment into streams because of practices such as full suspension over streams and spacing of corridors (see TH03, Appendix. C). Additionally, the activities described in the proposed actions would not affect aquatic habitat because of the distance to fish-bearing streams (the nearest action is approximately 120 feet from fish-bearing streams). In a few cases, a skid trail would cross an intermittent non-fish bearing stream in the dry season. Best Management Practices, such as constructing water bars, using erosion-control techniques on skid trails, and limiting landing construction to the dry season, would minimize the potential for sediment delivery into streams to levels indistinguishable from background levels. No measurable effects to federally listed and native fish species and their habitats (aquatic habitat) are expected due to the implementation of PDFs and BMPs.

See Issues B-14 through B-23 below and the Hydrology and Sedimentation Analysis for more information on how effects to water quality were considered in this EA.

Hydrology and Water Quality

Issue B 14: What are the effects of the proposed project activities (i.e., creation and use of skid trails/yarding corridors, roadwork, and log hauling) on sediment delivery to streams within the project area?

Background: Potential changes to sediment delivery are possible in Oregon streams through project activities (i.e., creation and use of skid trails/yarding corridors, roadwork, and log hauling). Hydrologic connectivity is the ability to convey sediment to water features, either seasonally or chronically. The proposed project activities with potential to cause sediment delivery to streams include the creation and use of skid trails and skyline yarding corridors for logging, roadwork (road and landing construction, renovation, and decommissioning), and road use (primarily from timber haul).

The FEIS for Western Oregon found modern road construction practices produce less sediment from forest roads than older road construction practices that have been known to contribute 90% of sediment generated from overland flow to the road (USDI/BLM, 2016a, p. 401). The distance that sediment travels along roadways depends upon several factors, including underlying geology, age of road since construction, road gradient, road drainage, and ground cover. Roads have three primary effects on hydrologic processes: (1) they intercept rainfall directly on the road surface and road cutbanks and affect subsurface water moving down the hill slope; (2) they concentrate flow, either on the surface or in an adjacent ditch or channel; and (3) they divert or reroute water from paths it otherwise would take were the road not present (Gucinski, et al., 2001).

Surface runoff during storm events from ground disturbing activities, such as construction or road renovation would mobilize sediment. Natural-surface temporary roads and resource roads are more likely than surfaced roads (rocked or paved) to contribute sediment to streams. Intercepted surface runoff would become concentrated in drainage ditches that transport sediment to streams if hydrologically connected. Timber hauling can also mobilize sediment on poorly maintained roads. Properly maintained roads and wet conditions restrictions may reduce this to background sediment yield conditions. Observations of forest roads in the Oregon Coast Range, highlighted that properly maintained roads and wet condition management did not show a greater sediment yield with normal levels of active timber hauling (Luce & Black, 2001).

Because no thinning would be allowed in inner zones of RRs, most skid trails in the Treatment Area would be located away from streams. Only in very limited circumstances would a skidding trail cross a stream (e.g., a cable yarding corridor may cross a stream if it is the only feasible means to yard felled timber to a landing), and in these instances cable yarding might be applied with full suspension. Other PDFs that would help to limit sediment delivery to streams while creating and using skid trails include using designated skid trails, installing water bars, and using other erosion control techniques such as scattering tree limbs and other fine material on skid trails (Appendix C).

Rationale: This issue was considered but not analyzed in further detail since the proposed forest management activities have been designed to reduce sediment delivery rates. Over the long-term, road renovation on haul routes would reduce road-related sediment inputs where the BLM adds rock to depleted areas on natural surface roads, replaces or adds drainage culverts, cleans culverts and ditches and other road renovation activities.

The FEIS for Western Oregon described the effects of road construction and road decommissioning on sediment delivery to streams and concluded that increases in sediment would be less than 1.0 percent above current levels of fine sediment delivery over the next 10-years (USDI/BLM 2016b pp. 401-408), this would be minor and undetectable from background levels.

There would be no potential for effects on sediment delivery beyond those analyzed in the FEIS for Western Oregon (USDI/BLM, 2016a, pp. 401-408) to which this EA tiers, with proper implementation of road maintenance BMPs. These BMPs would be monitored and, where necessary, modified to ensure compliance with Oregon Water Quality Standards (USDI/BLM 2016b, p. 165). Improvements to road infrastructure and maintenance of existing infrastructure proposed in this project such as disconnecting hydrologically connected drainage ditches and upsizing culverts to pass higher streamflows, would over the long-term reduce existing, background levels of sediment mobilization and transport of sediment to aquatic habitats.

Under all alternatives, roadwork and use would occur at levels similar to or less than levels described in the FEIS, and therefore affects to sediment would fall within this range (i.e. less than 1% difference). This amount of change does not represent a substantial difference in comparison to the existing sediment delivery (USDI/BLM, 2016a, pp. 405-410).

Issue B 15: Would timber harvest, fuel treatments and road construction, road renovation, and use under the Proposed Action affect annual water yields, summer low flows, streamflow magnitude-intensity-duration and/or timing of peak or low base flow conditions?

Background: Annual water yield, low summer flows, streamflow, and duration were considered but not analyzed in detail in the FEIS (USDI/BLM, 2016a, pp. 408-409). The potential impact of timber harvest and road construction on peak stream flows was analyzed in detail for snow dominated hydro-regions as Issue 2 in the FEIS (USDI/BLM, 2016a, pp. 384-394). This analysis is incorporated here by reference.

Tree removal, temporary road construction and use, landing construction and use, changes in public access, vegetation removal, timber hauling, soil compaction, road and landing decommissioning and reclamation have the potential to alter surface hydrology and change shallow subsurface flows where the disturbance occurs.

Water Yield: Forest harvesting generally increases the fraction of precipitation that is available to become streamflow (Moore & Wondzell, 2005). On a catchment scale, the ECA and the roaded area may be evaluated to analyze potential impacts to streamflows (See the Hydrology and Sedimentation Issue analyzed in detail, Chapter 3). The FEIS for Western Oregon found that "timber harvest with the alternatives and proposed actions would produce an inconsequential change in annual water yield." This analysis is incorporated here by reference FEIS (USDI/BLM, 2016a, pp. 408).

A general conclusion drawn from watershed studies that reviewed literature on catchment studies worldwide is that deforestation (e.g., harvesting urbanization, land cover change, wildfire, and insect infestation) can increase annual runoff. Most watersheds evaluated in one literature review shows that forest cover loss can increase annual runoff. Forest dominated mixed watersheds tend to be hydrologically resilient to forest cover change, and the sensitivity of annual runoff to forest cover change varies across spatial scales (Zhang, et al., 2017). Studies using modeling and compared to recently burned basins in Oregon have also show that wildfires can increase peak flows and annual water yield with higher precent change predicted for headwater watersheds (Wamplet, et al., 2023).

Annual water yield is the total surface water output for a given watershed per year. Studies have shown an increase in water yield in the first few years after timber harvest (Perry & Jones, 2016). Removal of trees and canopy cover shows a linear relationship to increased water yield during the first years after harvest (Harr, 1976). Reductions in forest cover above 20% can increase annual water yields to a detectable level, but reductions below 20% are not likely to result in measurable changes in annual streamflow yields (Stednick, 1996).

Summer Low Base-flow Conditions: Long-term paired watershed experiments indicate that the conversion of mature and old-growth conifer forests to plantations produced persistent summer streamflow deficit of up to 50% at about 25 to 45 years after planting (Perry & Jones, 2016). Most paired watershed studies used in baseline research did not employ timber harvest practices commonly used today for the mixed land ownership patterns that exist. However, these studies can provide a reasonable frame of reference for interpreting the potential effects of forest management (Grant, et al., 2008).

An analysis of daily streamflow from paired watershed studies found summer flow deficits in basins with clear-cuts replanted with young Douglas-fir (i.e., plantations). Higher evapotranspiration rates from June to September for young Douglas-fir trees are likely the primary driver of low summer flows (Segura, et al., 2020). Persistent summer deficits also tend to correspond with winter surpluses. Paired watershed studies have shown large initial summer surpluses and persistent summer deficits with patches of 20 acres or more (Perry & Jones, 2016). These winter surpluses often occur in the same season as peak flows.

The summer low base-flow relationship was less apparent in paired watersheds that had partial, shelterwood or patch cuts of 1.5 acres to 3.2 acres, and none of the studied watersheds had riparian buffers applied (Jones & Grant, 1996). Lower summer streamflows because of timber harvest are less likely in rain-dominated catchments (Moore & Wondzell, 2005). All the catchments in the project area are rain-dominated.

The canopy openings greater than 3.2 acres explain the changes in the magnitude and duration of initial summer streamflow surpluses and subsequent streamflow deficits. Alternative 2 would have areas of VRH, resulting in post-harvest relative density that would be less than 30 percent. The largest openings considered for this project are 4-acre group select areas, these would occur in both action alternatives in the Uneven-aged Timber Areas and the Late-Successional Reserve-Dry land use allocations, but not in the Riparian Reserves.

VRH and group select areas would produce stands of even age Douglas-fir trees as a result of proposed reforestation efforts. As discussed earlier, summer low flows have been found when Douglas-fir stands between 25-45 years make up a significant portion of a watershed. Therefore, higher evapotranspiration rates from plantings would decrease local groundwater contributions to streams 25 to 45 years out from plantings.

A long-term analysis from the Alsea Watershed Study (1950-2017) in the Coast Range of Oregon found that high evapotranspiration rates from Douglas-fir plantations appeared to explain summer low-flow deficits from 40- to 50-yr-old forest plantations. Contemporary forest practices including clearcuts with riparian buffers had only a minor effect on the streamflow deficits, and by a few years after logging, summer streamflow deficits had recovered. High evapotranspiration from rapidly regenerating vegetation, including planted Douglas-fir, and from the residual forest in the riparian buffer explains the persistence of streamflow deficits. Low streamflow deficits also were greater during warmer, drier years (Segura, et al., 2020).

Water Flow Magnitude, Duration and/or the Timing of Peak and/or Low Flows: The potential to enhance peak flows was analyzed in detail (Chapter 3.4 Hydrology & Sedimentation). The timing of the increase in streamflow that can be expected following forest harvest indicates the increased summer streamflow can occur for up to 5 years after harvest (Surfleet & Skaugset, 2013). Evapotranspiration rates should recover to pre-harvest rates and may even exceed pre-harvest rates in the long-term for the summer months. Any measurable enhancement of peak flows evaporates 2-4 years after the initial disturbance as vegetation reestablishes as effective canopy and transpiration increase (Best, et al., 2003).

Rationale: A plausible scenario for local streamflow downstream from units in the Last Chance project area is a short-term local increase in peak flows and annual water yield directly downstream of individual units. Due to the localization of these changes and small amount of change compared to analysis area size, these changes in duration, magnitude, and timing on the hillslope scale are not expected to add to any potential increases in annual water yields, low streamflow conditions, water flow intensity, duration and/or the timing of peak or low flows for any of the analysis areas that was evaluated. Flow conditions are likely to an equilibrium in 5 years after harvest (Brown, et al., 2005) and recovery to pre-harvest conditions for harvested units could occur within about 10 to 20 years (Moore & Wondzell, 2005). Due to the small portion of catchments would be logged and have areas with even age stands of Douglas-fir trees and because the openings would be outside of the Riparian Reserves with less impact to streamflow, no measurable decrease in summer low flows are expected.

The BLM expects upland thinning to produce relatively small and short-lived summer streamflow surpluses with no deficits. The BLM infers from the literature that tree retention, including the Riparian Reserves, the spatial arrangement of commercial harvest both within unit and on the landscape, and the intensity and timing of thinning would all serve to moderate summer streamflow surpluses and deficits. Any harvest related low flow changes would be immeasurable in absolute terms at the drainage scale, indistinguishable at the sub-watershed scale given patterns of land ownership/management and interannual streamflow variability.

Management actions that improve and sustain watershed resilience would moderate future impacts caused by climate change (Furniss, et al., 2010). This would maintain or slightly improve watershed resiliency for those areas, potentially reducing the magnitude of peak flows following stand-replacing fires. (Wampler, et al., 2023). In addition, road renovation and maintenance activities such as improving surfacing, installation of rolling dips, upsizing culverts to pass 100-year flow events, and other storm-proofing activities would increase the resilience of portions of the permanent roads that provide access for project activities, potentially reducing road failures and sediment delivery from peak flow events.

Issue B 16: How would forest hydrology (surface runoff and shallow groundwater) be impacted by timber harvest, fuels treatments, road construction, road renovation and timber hauling?

Background: Tree removal, temporary road construction and use, landing construction and use, changes in public access, vegetation removal, timber hauling, soil compaction, road and landing decommissioning and reclamation have the potential to affect forest hydrology.

Previously decommissioned roads are proposed to be re-opened for the project these are the reconstructed roads. Temporary routes on BLM-administered lands would be decommissioned after use. Decommissioning means that the road segments would be closed to vehicles on a long-term basis but may be used again in the future. Prior to closure the road would be left in an erosion-resistant condition by establishing cross drains, eliminating diversion potential at stream channels, and stabilizing or removing fills on unstable areas. Exposed soils would be treated to reduce sediment delivery to streams. The road would be closed with an earthen barrier or its equivalent. This category can include roads that have been or would be closed due to a natural process (abandonment) and may be opened and maintained for future use.

Timber harvest, including road building, has been shown to increase the fraction of precipitation that is available to become streamflow. However, separating road building from other forest harvest activities is difficult because, in most studies, these activities occur simultaneously. BLM-administered lands are only a portion of the watersheds (40% for Upper Cow, Middle Cow and Grave Creek); therefore, forest harvest techniques and land and water management practices on private and state lands can often mask project impacts.

Table B 16.1: Road Density and Estimated Road Disturbance (Roaded Area) of the Existing BLM Road System in the Project Area

Analysis Area Name^	Analysis Area (Acres)	Analysis Area (mi^2)*	Roads (mi)	Road Density (mi/mi^2)	Road Disturbance+ (Acres)	Percent Roaded Area
Last Chance Project Area	56,843	88.8	424	4.77	2,056	3.62%
BLM-Administered Lands in the Project Area	32,248	50.4	256	5.08	1,241	3.85%
Upper Cow Creek (5th level) & McGinnis Creek (6th level)	1,227	1.9	7	3.50	33	2.65%
Middle Cow Creek (5th level)	23,658	37.0	167	4.51	809	3.42%
Grave Creek (5th level)	31,959	49.9	250	5.00	1,211	3.79%
Whitehorse Creek (6th level)	7,951	12.4	57	4.60	277	3.48%
Quines Creek (6th level)	13,472	21.1	95	4.52	461	3.42%
Fortune Branch (6th level)	2,234	3.5	15	4.23	72	3.20%
Last Chance (6th level)	16,010	25.0	123	4.92	597	3.73%
Shanks Creek (6th level)	5,616	8.8	38	4.34	185	3.29%
Rat Creek (6th level)#	891	1.4	9	6.55	44	4.96%
Wolf Creek (6th level)	9,442	14.8	79	5.38	385	4.08%

^ These are the portions of the 5th level (HUC5) and 6th level (HUC6) areas within the Last Chance Project Area

* miles = mi

+ Roaded Area, calculated by assuming an average disturbance width of 40 feet

Rat Creek does not have any Commercial Timber Harvest Units

The percentage of roaded area for each analysis area is estimated at 5% or less (Table B16.1), well below 12 percent, which is the threshold that may result in increases of peak flow according to most studies (Ziemer, 1981).

Road density for BLM-administered lands is 5.08 $mi/mi^{2,}$ and for the project area, it is 4.77 mi/mi^2. The Proposed Action would add 241 miles of road renovation and 28 miles of road construction.

As part of maintaining roads for the project there would be culverts replaced as a requirement of the timber and/or stewardship contracts, as part of a reciprocal Right-of-Way agreements, through a watershed partnerships, and/or with BLM funding. No new culvert replacements are proposed on fish-bearing streams for this project, but if a culvert fails during the life of the project on a fish bearing stream, it would be replaced by the timber sale purchaser/operator or the BLM. Culvert replacements on fish-bearing streams would be done within the in-stream work window and use proper dewatering BMP methods R17 and R23 (USDI/BLM, 2016b, p. 169).

Eakin road accesses proposed timber extraction units 13-01, 13-03, 13-04, and 13-05 and currently has a temporary bridge installed to allow for crossing on Wildcat Creek a perennial fish bearing stream that is designated for Coho Critical habitat. It is unlikely this crossing could safely be used to haul timber. If this crossing is improved to allow for timber hauling it would need to be done to allow for Aquatic Organism Passage (AOP) and allow for a crossing design that simulates natural stream function, accommodates the one-percent annual chance of a flood event allowing for bedload and anticipated floatable debris (see Appendix C).

Replacement of this Eakin road culvert on Wildcat are in the design stage and would likely occur before these units in section 13 would be harvested, but if the purchaser considers the current temporary bridge adequate for hauling, they may use it before the replacement. In either case the road and the crossing would be used and would be replaced with an AOP crossing as funding and time allows.

Rationale: Permanent roads would be built according to BMPs as described in Appendix B, and all temporary routes would be decommissioned after use. Decommissioning is a type of road closure that would include barricading the entrance, leaving the road in an erosion-resistant condition. There would be a slight increase in road density over the long-term in one watershed (See Appendix D4: Watershed Analysis), but this would not result in any additional impacts to forest hydrology based on the analysis from the FEIS (USDI/BLM, 2016a). The relatively small amount of newly compacted ground and lack of connection to streams of the newly constructed permanent and temporary roads would not affect forest hydrology.

The hydrology issue analyzed in detail (Chapter 3.4 Hydrology and Sedimentation) would provide more information about keeping roads permanent under Alternative 2 and how impacts may change based on this decision by alternatives. These impacts include some proposed stream crossings that would either need to use old infrastructure or need new culverts or crossings as permanent roads.

Issue B 17: How would water quality be maintained within the range of natural variability and meet Oregon Department of Environmental Quality water quality standards with timber harvest activities, fuel treatments and roads?

Background: Poor water quality is typically the result of several combined factors. For example, nutrients can combine with high seasonal temperatures to reduce dissolved oxygen for aquatic life and impact drinking water quality. Another common example of combined factors is increased sediment loads can lead to wider and shallower streams that have higher summer temperatures.

The major water quality concerns from past, present, and future activities in southern Oregon and the project area are changes in nutrients, sediment, and water temperature. These can all be detrimental to the habitat of aquatic species such as salmon due to the production of algal blooms, loss of dissolved oxygen, high stream temperatures, and loss of physical habitat due to sedimentation. This also applies to the resident fish and other aquatic life, particularly resident cutthroat, which are present in Last Chance project area streams.

The BLM addresses Federal Clean Water Act Section 303(d)-listed waters through water quality assessments, providing data, validating listings and by working with DEQ and other state agencies as well as local tribes to implement watershed improvement work (ODEQ, 2022a). When impairment of water quality standards is identified by Oregon Department of Environmental Quality (DEQ), a Total Maximum

Daily Limit (TMDL) is developed for non-point source pollution; Oregon DEQ water quality standards are met by implementing Water Quality Restoration Plans (WQRPs).

There are three WQRPs that cover BLM-administered lands in the Last Chance project area; they are the Upper Cow Creek (USDI BLM, 2004a), Middle Cow Creek (USDI/BLM, 2004b) and Grave Creek (USDI BLM, 2001). Specific recommendations for forest management from these plans include implementing silvicultural treatments designed to promote hardwood and conifers health in the riparian areas and to minimize sedimentation with good road management. These concepts that are consistent with all the proposed alternatives.

The Oregon DEQ water quality assessment was evaluated for the Upper Cow, Middle Cow and Grave Creek (ODEQ, 2023a). Oregon surface waters are assessed to determine if they contain pollutants at levels that exceed protective water quality standards (ODEQ, 2022b). The result of these analyses and conclusions is called the “Integrated Report” because it combines the requirements of Clean Water Act section 305(b) to develop a status report and the section 303(d) requirement to develop a list of impaired waters.

Table B 17.1: Water Quality Status of Sub-watersheds in the Project Area in the Oregon 2022 Integrated Report

Stream Name - Watershed	Waterbody	Pollutant	Status
McGinnis Creek – Cow Creek	Snow Creek	Temperature	Impaired for Fish and Aquatic Life
Quines Creek – Cow Creek	Little Bull Run, Bull Run, and Quines Creek	Biocriteria, Temperature	Impaired for Fish and Aquatic Life
Fortune Branch – Cow Creek	Woodford Creek	Temperature	Impaired for Fish and Aquatic Life
Wolf Creek – Grave Creek	Coyote Creek and Wolf Creek	Biocriteria, Temperature	Impaired for Fish and Aquatic Life
Last Chance – Grave Creek	Big Boulder Creek, Boulder Creek, and Grave Creek	Temperature	Impaired for Fish and Aquatic Life

Pollutants identified in the Last Chance project area are temperature and biocriteria. The biocriteria standard states that water must be of sufficient quality to support aquatic species without detrimental changes in the resident biological communities. This protocol is based on biological community information for freshwater macroinvertebrates at reference sites. The most common water quality concern in the WQRPs is stream temperature which can also impact biocriteria (Stream Temperature is analyzed in the SWO RMP as Issue 1, starting on page 369), and this analysis is incorporated here by reference.

The Last Chance project area contains portions of Middle Cow Creek that is a source-water protection areas for the town of Glendale. There are no specific protection measures identified in the Source Water Assessments (SWAs) for these areas that are relevant to the proposed activities. There are some groundwater protection areas for the Heaven on Earth restaurant, the South Star gas station, and the Longfibre campground near Cow Creek, none of these groundwater protection areas extend to BLM-administered lands or lands considered for treatments under this project (ODEQ, 2022a).

Physical and chemical characteristics of the soil, combined with past and current land use management may alter water quality over the short-term. However, Best Management Practices (BMPs) and Project Design Features (PDFs) for this project would be implemented to reduce potential impacts to water quality (USDI/BLM, 2016b).

The Western Oregon FEIS looked at the effect of timber harvest and road construction in source water watersheds and the Proposed Actions are consistent with FEIS analysis for public water systems. Therefore, the Western Oregon FEIS analysis is incorporated here by reference (USDI/BLM, 2016a). The scientific literature indicates that forestry BMPs protect water quality when constructed correctly and in adequate numbers (Cristan, et al., 2016).

With BMPs and PDFs including buffers on water features and restricting motorized equipment no changes to surface or groundwater quality, streamflow or groundwater infiltration rates are expected below thinned units. Therefore, no changes to the water quality in dispersed water sources or public water sources are anticipated. Dispersed water sources include private domestic drinking water wells and surface intakes that serve rural homes downstream of proposed commercial thinning and fuel treatments, no changes to water quality or availability are expected for these sources (USDI/BLM, 2016b).

An example of implementing typical BMPs to reduce non-point source pollution to reduce impacts from project activities, would be requiring road maintenance to be done prior to the wet season (generally the wet season starts on October 15th), effective surface drainage on road surfaces and application of aggregate on roads used for timber haul would be achieved by pre-season maintenance (such as ditch proper cleaning), and when needed repairing drainage features or adding aggregate. Properly functioning roads also includes applying special measures to control sedimentation identified for hydrologically connected road crossings (Table C-20).

The Western Oregon FEIS analyzed how timber harvest might affect nutrient loading in streams, this analysis is incorporated here by reference. The FEIS analysis for nutrient loads found that the Inner Zone of the Riparian Reserve would be an effective nutrient filter on most or all streams and therefore timber harvest as proposed in the FEIS would have no substantive effect on nutrient loading in streams (USDI/BLM, 2016a, pp. 410-411).

It can be difficult to identify specific environmental impacts from nutrient increases and other changes in water quality from timber harvest. A recent study with the experimental manipulation of headwater riparian zones found that even when forested watersheds are disturbed and increases of nutrients and light to nearby streams is measured, this may not necessarily lead to increase algae that can be a food source for aquatic organisms but can also lead to the depletion of oxygen. The authors speculated that although dissolved inorganic nitrogen increase, other nutrients such as phosphorus were still limited and therefore did not result in algal blooms (Johnson, et al., 2023).

Macroinvertebrates are often used as indicator for watershed conditions to integrate multiple components of stream habitat (e.g. temperature, sediment, dissolved oxygen). In a 25-year assessment of forested watersheds in the Pacific Northwest AREMP found metrics for macroinvertebrates appear to be improving and specifically in BLM's Medford District (USDA-PNRS, 2023, p. 72 and 163).

It is expected that there would be local changes to nutrient and sediment loads from commercial harvest and fuels maintenance, but these impacts would be reduced by implementation of BMPs (USDI/BLM, 2016b, pp. 163-208) therefore, they would likely be unmeasurable, localized and short-term (less than 2 years). Based on water quality studies, both sediment and nutrients are generally elevated in the first 2 years after disturbances such as fire, timber harvest, and/or severe storm events, but loads tend to diminish as vegetation reestablishes or areas are stabilized and reclaimed.

An example of a reduction in potential impacts by implementing management direction from the SWO RMP is to restrict commercial harvest in the Inner Riparian Zone (Stream Buffers). This practice allows for an undisturbed vegetative buffer between commercial harvest areas and streams, which has been shown to be effective in reducing nutrient loads. A 2005 EPA study showed that, as a rule, in terrain with gentle side slopes, a 100-foot forest buffer retains about 80% of the nitrogen and phosphorus passing through in surface and subsurface flow from such activities (US EPA, 2005). The inner riparian zone is 120 feet for perennial streams and 50 feet for intermittent streams. Since most of the Last Chance project is not gentle this study shows the value of sediment buffers and is not advocating a specific distance in all cases.

Rationale: No streams in the Last Chance project area or downstream are currently listed on the 303(d) list for impaired waters due to exceeding water quality standards for nutrients (ODEQ, 2023a). There are units and proposed haul routes in the public source water protection areas for Glendale because their drinking water supply is from Cow Creek. The SWO RMP analyzed potential impacts to water quality and found no substantive effect to water quality from the type and magnitude of activities proposed for this project. Specific contaminants that might result from proposed activities are addressed in Table 3-69 of the FEIS (USDI/BLM, 2016b, p. 412) of the SWO RMP and are incorporated here by reference. Project activities are also analyzed in detail in Chapter 3 for potential downstream impacts from sediment and riparian shading important for maintaining stream temperature was analyzed and no measurable changes are expected.

In summary, impacts to water quality from commercial thinning and fuel treatments were considered but not analyzed in detail because the BLM's primary water quality protection strategy is expected to be protective of water quality. This strategy is composed of management direction for the Riparian Reserve land use allocation and application of BMPs. The scientific literature indicates that forestry BMPs protect water quality when implemented correctly (Cristan, et al., 2016) and play an important role in protecting watersheds and water quality (Edwards, et al., 2016). These preventative measures have complementary goals with Oregon's water quality and drinking water protection programs. With PDFs that implement site specific BMPs, no measurable effects to water quality for drinking water sources or impaired water bodies is expected due to project activities (USDI/BLM, 2016a).

Issue B 18: Would stream temperature and specifically maintaining effective shade be impacted by timber harvest activities, fuel treatments, road construction and road renovation result in a measurable increase in stream temperatures?

Background: Water temperature in streams and rivers is critical for aquatic life success, especially for salmon, and it is an important variable in determining the availability of dissolved oxygen and downstream impacts of nutrients. Stream shading reduces radiant energy from solar radiation responsible for increasing stream temperature. Solar radiation is the most important radiant energy source for the heating of streams during daytime conditions and therefore has a strong relationship to seasonal variability of daylight (Beschta & Taylor, 1988).

Effective shade is the percentage of sunlight blocked by topography, forest trees, and vegetation during a day. Effective shade reaches an upper limit in the 80-90% range from normally stocked young to mature stands (Leinenbach, et al., 2013). In addition to effective shade, micro-climate zones are important for maintaining stream temperatures, especially in headwater systems. These micro-climate zones are likely to coincide with to the Inner Riparian Zone and can have significantly lower air temperatures due to inversions and increased moisture compared to the surrounding forest. Buffers defined by the transition from riparian to upland vegetation or topographic slope breaks appear sufficient to mitigate the impacts of upslope thinning on the microclimate above headwater streams (Anderson, et al., 2007).

The analysis in the FEIS (USDI/BLM, 2016a, pp. 369-384) addresses stream shading along perennial and fish-bearing streams on BLM-administered land and is incorporated here by reference. Commercial thinning and fuel treatments are proposed in the Dry Forest west of Highway 97 and in Class I and Class III subwatersheds in keeping with the treatments proposed in this project.

The Proposed Action does not include commercial thinning in the Inner Riparian Zone. The 120-foot stream buffer for perennial streams would fully protect the primary shade zones and micro-climates on streams (Leinenbach, et al., 2013, p. 29). Thinning in the Outer Riparian Zone is expected to reduce some shading in the secondary shade zone during cooler parts of the day (2pm - 10am). The effects from thinning in the secondary shade zone have less impact to stream temperatures than does thinning in the primary shade zone (Leinenbach, et al., 2013, p. 31).

Based on a study conducted on the Rogue River Siskiyou National Forest in 2006 a no-cut buffer of 60 feet was found to be effective in maintaining the Angular Canopy Density and therefore the effective stream shade. The joint studies for implementing the Northwest Forest Plan found that density management or thinning beyond 15 meters (50 feet) from streams does not measurably affect microclimate (Leinenbach, et al., 2013). All proposed vegetation treatments, including activity fuels treatments, would be more than 50 feet from perennial and fish-bearing streams.

The spatial extent to which riparian management affects stream temperature downstream of harvest units depends on the spatial context of the stream reach in terms of hydrology and geomorphology and how these factors interact in the stream heat budget (Johnson & Jones, 2000). Thus, it is not possible to characterize the exact distance at which thinning activities would affect downstream temperature without accounting for all the factors that influence stream temperature. However, the rate of heat loss via convection and evaporation at the surface of small streams is very slow, as compared to the heat exchange rate associated with solar radiation loading. Therefore, the heat added to a stream by the sun would not be readily dissipated, and the distance over which elevated temperatures may extend downstream may be much longer than the length of the "treatment" (Leinenbach, et al., 2013).

For example, in stream reaches with cold tributary inflows and groundwater inputs that constitute a large percentage of the stream discharge (i.e., "gaining" reaches). Similarly, reaches with extensive hyporheic exchange (Moore & Wondzell, 2005) via the streambed and floodplain may show no effects of increased solar radiation on stream temperature (Janisch, et al., 2012). In contrast, bedrock-dominated stream channels like Grave Creek are likely to require very long recovery distances because they are not buffered by hyporheic exchange (Johnson & Jones, 2000).

Commercial thinning in the Outer Riparian Zone and fuel treatments are expected to reduce the potential for stand replacing crown fire, insects, disease, and promote healthier riparian stands (See the Proposed Action). Healthy riparian stands are more likely to withstand future disturbance, and therefore, more able to provide shade to stream systems in the long-term (greater than 50 years) (Ruzicka, et al., 2014).

The Western Oregon FEIS used two analytical methods to assess potential increases to stream temperatures and considered a shade loss exceeding 3% as representing a risk to stream temperatures. The first analytical method (Method A) used tree heights for mature to structurally complex stands. The second method used an EPA calibrated model (Method B) with tree heights for mature stands (50 to 70 years old). The FEIS identified that less than 0.5% of the total perennial and fish-bearing stream miles might have increases in stream temperature.

The only areas in the Last Chance Project area that have the potential for an increase beyond the 3% shade loss threshold identified in the FEIS are thinned stands in areas with existing low riparian canopy (i.e., streams with meadows where the secondary shade zone is important). However, there are no Outer Riparian Zones proposed for thinning in the Last Chance project area that could be considered to have existing low canopy cover in the Inner Riparian Zone.

Water temperature is monitored by BLM throughout the field office. There are 5 current monitoring sites in the project area (Whitehorse Creek, Russel Creek, Wolf Creek, and two sites in Grave Creek). Altogether there are 62 sites in the Last Chance project area that have had monitoring data for water resources collected.

Rationale: The effects of commercial thinning and non-commercial thinning in the outer and middle riparian zones under the action alternatives on effective shade and stream temperature is not analyzed in detail, because there would be no reasonably foreseeable effects beyond those disclosed in the FEIS. See the background section above for citations and details, but the middle and outer riparian zone protect the primary shade zone (trees that shade the stream from 10am to 2pm) and often provide some protection for the secondary shade zone (trees that shade the stream before after the primary shade zone).

Riparian thinning in the middle and outer zones is likely to reduce the risk for stand replacing crown fires. Fuel treatments, snag creation and tree tipping may occur in the Inner Riparian Zone but are unlikely to impact effective shading or microclimates. BLM would continue long-term monitoring of stream temperature in the project area, but the project is not expected to result in in any measurable change in stream temperatures, therefore this issue was not analyzed in further detail. Stream temperature monitoring and assessment would continue through the life of the project.

Issue B 19: How is the risk of landslides delivering sediment to stream channels impacted by timber harvest?

Background: Tree removal, temporary road construction and use, landing construction and use, changes in public access, vegetation removal, timber hauling, soil compaction, road and landing decommissioning and reclamation could potentially destabilize susceptible areas with landslide potential. Many of the BMPs limit disturbance and [what?] activities would reduce the risk of destabilizing slopes. For example, harvest activities are curtailed or restricted in the riparian reserve. BLM can extend designation of the inner riparian zone to unstable headwall areas common in this project area, with associated BMPs excluding project activities, thereby limiting or preventing disturbance. The treatments proposed for this project are consistent with the SWO RMP (USDI/BLM, 2016b).

Shallow landslides can provide episodic inputs of sediment to streams, especially in landscapes that have high road densities. A 25-year assessment of forested watersheds in the Pacific Northwest found a reduction in landslide risk for key watersheds with the greatest reduction in the Late Successional Reserves attributed to a reduction in road density overall (USDA-PNRS, 2023, p. 55).

Rationale: With BMPs and PDFs, unstable soils or areas prone to landslides are not likely to be impacted by Proposed Actions. The project area was assessed with GIS, field visits etc. to identify landslide prone/unstable areas and excluded them from project activities. If BLM finds more during project implementation, BLM would avoid them with roads and landing. Because there is no effect to landslide prone/unstable soils, BLM determined that this issue did not require detailed.

Issue B 20: How would ground water, aquifers, domestic wells and points of diversion be impacted by vegetation removal and ground disturbance associated with forest management activities?

Background: Domestic groundwater drinking wells or spring sources occur on private lands adjacent to BLM-administered land considered for timber harvest, or in some cases spring sources may be located on BLM-administered land. Typically, wells are shallow, and springs may come from a spring box located in a channel feature. In some cases, these water sources are in direct contact with surface runoff and could be impacted by vegetation management actions. Surface water points of diversion were evaluated using the Oregon Water Resources Department of Water Rights Mapping Tool. Some general locations identified during this effort or during public scoping are listed in Table 20.1.

Table B 20.1: Surface and Groundwater Points of Diversion in Proposed Treatment Areas

Location Description	Legal	Notes
BLM Greenback Helipond Reservoir	T34S R5W Sec. 04 NWNW	Fire protection, road construction and wildlife use

Location Description	Legal	Notes
BLM Eastman Gulch Pond	T33S R5W Sec. 35 SWSW	Fire protection, road construction and wildlife use
Cedar Mountain Tank Reservoir	T32S R4W Sec. 35 SWNE	Fire Protection
Small Unnamed Spring	T32S R5W Sec. 29 SENW	Spring used for domestic water
Tributary to Coyote Creek	T33S R5W Sec. 28 SWSW	Small amount of irrigation and domestic water
Springs above Placer Road	T24S R5W Sec. 04 NWSW	Springs for domestic water for downstream private lands
Scholey Gulch tributary to Coyote Creek	T33S R5W Sec. 28 SENW	Domestic water source and mining for two families
Two springs for domestic use	T33S R5W Sec. 35 SESE T34S R5W Sec. 02 NENE	Two springs in the headwaters of Grave Creek tributary Between Clark Creek and Eastman Gulch

Rationale: Local water quality impacts from timber harvest are analyzed in detail in Section 9.0 for sediment. With proper application of BMPs and PDFs, the proposed treatments might increase surface runoff locally in the first year or two after treatment, but would have no effect to the various types of ongoing water uses in the project area. No measurable impacts are expected to surface water diversions for irrigation or mining because…. Domestic water sources are typically developed near springs that would be buffered at least 25 feet., a buffer distance sufficient to physically protect the spring. Timber harvest would not cause changes locally or beyond to nutrient and sediment loads and therefore would not be measurable or long-term. Therefore, private domestic drinking water wells, spring improvements or surface intakes that serve rural homes downstream of proposed commercial thinning and fuel treatments are not likely to be impacted by Proposed Actions. Because the project would not affect domestic water sources, BLM determined that detailed analysis is not necessary.

Riparian Reserve Forest Health and Wood Recruitment for Streams

Issue B 22: How would the Riparian Reserve function be impacted by project activities (i.e. channel dynamics, processes, and the proper functioning condition of riparian areas, stream channels, and wetlands by providing forest shade, sediment filtering, wood recruitment, stream bank and channel stability, water storage and release, vegetation diversity, nutrient cycling, and cool and moist microclimates)?

Background: Riparian areas begin at the interface between hillside groundwater and surface water and are critical to support aquatic ecosystems. The boundary of this zone is typically defined by a change in vegetation, hydrology, and/or seasonally saturated soils. This boundary is typically defined by the Site Potential Tree Height (Baker, et al., 2013). The Riparian Reserve land use allocation includes the upland area that contributes directly to the function of riparian areas; there is 8,166 acres of BLM-administered Riparian Reserves within the project area. The area of Riparian Reserves varies by 5th-level watershed.

Table B 22.1: Riparian Reserve width by 5th-level watershed in the Last Chance project area with Totals for BLM-administered lands within the Last Chance project area.

5th-level Watershed (HUC 10)	Analysis Area (acres) *	Riparian Width (ft)+	Riparian Reserve (acres)	Percent of Total Riparian
Upper Cow Creek	1,227	160	124	1%
Middle Cow Creek	23,676	195	3,493	43%
Grave Creek	31,984	200	4,549	56%
Total:			8,166	100%
* Portion of the 5th-level watershed within the Last Chance project area + Riparian Reserves are only on BLM Administered lands acreage reflects Hydrology Field Data and is different than acreage totals shown in Table 1-3, due to some features having multiple LUAs.				

The condition of riparian areas, channel morphology, and hydrology can be affected by land use activities such as timber harvest or road use and maintenance that changes forest characteristics (Warren, et al., 2013). Declines in biodiversity in riparian forests is due to the loss of four major structural features: large live trees, large snags, large down wood on the forest floor, and large down wood in streams (Pollock & Beechie, 2014). Hydrology field work has been done to identify inception points for streams, identifying springs and seeps, and finding wetlands or areas with unstable soils. GIS, LiDAR, and current field surveys were conducted from 2018 to the present and were used to identify the location and extent of riparian reserves in the Last Chance project area. All surveys are checked during layout and calls can be adjusted based on more current surveys.

Management objectives and direction for Riparian Reserves are detailed in the Southwestern Oregon SWO RMP (USDI/BLM, 2016b, pp. 75-77 and 82-87). Management objectives and direction are incorporated here by reference and have already been built into the Proposed Action. Inner Riparian Zones are 120 feet for fish-bearing and perennial streams and 50 feet for non-fish bearing intermittent streams.

In general, the SWO RMP management direction for the Riparian Reserve is to limit disturbance from mechanical harvest and new construction of routes and landings in riparian areas near streams. For example, commercial harvest is restricted in the Inner Riparian Zone but allowed in the Middle and Outer Riparian Zone. Thinning with cut buffers have been shown to be effective at protecting in-stream wood recruitment. However, placement or tipping can increase the positive channel aspects more quickly than buffers alone (Benda, et al., 2016). Maintaining lower tree densities directly above riparian areas may be beneficial to increase tree growth and vigor in riparian areas (Ruzicka, et al., 2014).

Most of the project area is in Class I watershed classes for the Riparian Reserves, there is 1,229 acres of the project area that is in a Class III watershed, McGinnis Creek. The recommendations for timber harvest in riparian in this watershed is slightly different. Proposed unit 24-06 has an intermittent stream and is in this Class III watershed and therefor the Riparian Reserve is only 50 feet wide and does not have a middle or outer riparian zone. This unit is in the Harvest Land Base and would be dropped in Alternative 3. There is also RR Moist and RR Dry for areas west of highway 97, there is a slight difference in management actions, mostly for fuel treatments.

Within the Inner Riparian Zone logging activities may fell trees to build landings, yarding corridors or skid trails in the Riparian Reserves; these trees would be left in adjacent stands as woody debris or be removed to facilitate placement for fish restoration (USDI/BLM, 2016b, pp. 75-76). Within the Outer Riparian Zone logging activities may fell trees to build landings, yarding corridors or skid trails in the Riparian Reserves; these trees would be left in adjacent stands as woody debris, removed to facilitate placement for fish restoration, or sold (USDI/BLM, 2016b, p. 76). All activities would achieve post-harvest canopy cover, trees per acre, and snag requirements (USDI/BLM, 2016b, pp. 82-84). Skid trails in the Riparian Reserve would be scarified, seeded, water barred, mulched, and blocked after use.

There are 1,310 acres being analyzed for Outer or Middle Riparian Zone commercial thinning. Of this acreage 7 acres is in RR-moist. If unstable soils were identified during field surveys, non-commercial treatment buffers were extended, or units were dropped from consideration for treatment. Riparian thinning within Class I watersheds has the goal of promoting species diversity, forest health and improving resiliency to landscape disturbances. Commercial thinning and fuel management actions can achieve these goals by reducing competition for desirable species, increase tree size, reducing fuel loading, and putting forest stands on a trajectory to achieve complexity of age and structure.

No-commercial treatment buffers (120 feet for perennial, 50 feet for intermittent) have been applied to protect aquatic resources in Class I watersheds. Canopy cover in the Riparian Reserve would remain above 30% with 60 trees per acre on average. Therefore species diversity and forest health would be maintained. No-cut buffers have been shown to be effective at protecting in-stream wood recruitment. Buffers are also effective in protecting in-stream wood recruitment. However, placement or tipping can increase the positive channel aspects more quickly than buffers alone (Benda, et al., 2016).

Temporary and permanent road construction, timber hauling, ground-based harvest, yarding, landing construction and use, timber harvest and road maintenance would occur with BMPs as descried in the SWO RMP (USDI/BLM, 2016b). The SWO RMP identified BMPs as the most effective and practical method for the BLM to comply with the Clean Water Act. Project's design features (BMPs implemented site specifically) would eliminate or reduce pollution generated by non-point sources and by direct actions that would impact streams and riparian areas.

Rationale: Potential impacts for Riparian Reserve function was considered but not analyzed in detail, because commercial harvest treatments in the Inner Riparian Zone and mechanical disturbance in the Riparian Reserve limited to specific activities, fuel treatments would be conducted to reduce the risk of future stand-replacing crown fires and finally, maintaining canopy, density and snag requirements post-harvest (USDI/BLM, 2016b, pp. 82-84).

Commercial thinning would occur only in the Outer Riparian Zone and treatment areas would be a small percentage of the Riparian Reserve within the Last Chance project area At least 30 percent canopy cover and 60 trees per acre expressed as an average across the treated portion of the Riparian Reserve would be maintained. Thinning treatments in the Outer Riparian Zone would be done, "as needed to ensure that stands are able to provide trees that would function as stable wood in streams and fuel treatments would be done within 60 feet of fish-bearing or perennial streams as needed to reduce risk of stand-replacing crown fires. The Inner Riparian Zone buffers for commercial thinning would be protective of wood recruitment to perennial streams. Activities and surface disturbance in the riparian reserves would be evaluated during project implementation.

Issue B 23: Would wood recruitment to streams be impacted by thinning in the Outer and Middle Riparian Zones?

Background: Woody debris is important for maintaining the proper function of stream systems in southern Oregon. Coarse wood provides channel complexity, captures sediment, and creates pools and waterfalls. In addition to oxygenating water, increasing the storage of water, wood in streams also increases water movement in and out of the alluvial aquifer (hyporheic zone) which cools water and improves water quality. The physical and chemical benefits of coarse wood improve conditions for aquatic life including salmonids. Large woody debris is often more stable and less likely to migrate downstream with flood flows, but moderate and small diameter wood can often provide the same benefits to stream channels, both types of wood are called coarse wood.

Coarse wood in streams is primarily recruited through near-stream inputs (e.g., tree mortality and bank erosion) and landslides and debris flows. For near-stream riparian inputs, empirical and modeling studies suggest that stream wood input rates decline exponentially with distance from the stream and vary by stand type and age (Spies et al. 2013). The Interagency Coordinating Subcommittee (ICS) report compared studies and showed that 90 to 100% of the wood recruitment came from with 115 feet (35 meters) of the stream. The report found that a no treatment buffer of 120 feet (36.6 meters) would likely retain at least 95% of the wood available for recruitment to the stream from stands that have been harvested in the past (Spies, et al., 2013, p. 31).

Riparian buffers should consider the difference between short-term and long-term effects on wood recruitment. The use of no-harvest buffer zones may not properly account for the importance of wood sources further away from the stream. This is because small intermittent streams comprise most of the stream network length in the project area, and wood recruitment from these areas typically comes from episodic landslides and debris flows. Recruitment of wood near streamside (50 feet) areas appears responsible for most of the wood. However, low tree mortality and decomposition, fewer landslides and debris flows, breakage, and redistribution of existing instream wood, may result in future wood deficits in headwater streams in the absence of natural disturbances or human-mediated recruitment (Burton, et al., 2016).

Streams in the Last Chance project area have been impacted by historic land use practice that led to losses of instream wood and degraded fish habitats. In some locations streams are bordered be dense second-growth forests (30-80 years) with low potential for wood recruitment. A 25-year evaluation of streams in the Pacific Northwest found a general declined in large woody debris (> 24-inchs in diameter) and relatively steady amount of mid-sized to small-sized material in all areas measured including the Coast Range and Klamath/Siskiyou watersheds (USDA-PNRS, 2023, p. 40). Research using forest growth simulation models has found that wood recruitment and storage can be improved with riparian thinning and tree tipping and may be effective in restoring aquatic systems (Benda, et al., 2016).

There are Areas within the project area that have been identified as having the potential for stream restoration based on past activities, stream quality and gradient shown in Table B 23.1.

Table B 23.1: Potential Stream Restoration Reaches Within the Last Chance Project Area

Legal Location	**Stream Name**	**Stream Length (miles)**
34S-05W-01	Clark Creek	0.12
33S-04W-31	Boulder Creek	0.32
33S-05W-27	Coyote Creek	0.35
33S-05W-22	Tributary to Coyote Creek	0.3
33S-05W-10	Wolf Creek	1.8
33S-05W-02	Tennessee Gulch	0.9
32S-05W-35	Quines Creek	0.6
32S-05W-25	Bull Run	0.6
32S-05W-13	Wildcat Creek	0.3
32S-04W-29	Jones Creek	0.5
32S-04W-35	Grave Creek	0.8
33S-04W-03	Last Chance Creek	0.4
33S-04W-11	Grave Creek	0.2

Legal Location	Stream Name	Stream Length (miles)
33S-04W-15	Grave Creek	0.8

Streams in the project area are generally deficient in large woody debris and only Bull Run, Quines Creek, and Tennessee Gulch on BLM-administrative land have been treated in the past. Tree tipping activities are intended to aid in the restoration of degraded instream habitat conditions by in-stream wood placement. Instream log placements or tree tipping in various configurations are usually designed to increase sediment storage in a stream reach. Instream structures reduce flow velocity resulting in the sorting and deposition of sediment, and the creation of features, including gravel spawning beds and bars and floodplains storing shallow groundwater.

Rationale: The Inner Riparian Zone buffers for commercial thinning would ensure continued wood recruitment to perennial streams. Fuels treatments that would occur within 60 feet would leave tree boles greater than 6 inches on site for potential wood recruitment. Because this material would be left on site fuel treatments are not expected to impact wood recruitment to streams.

Woody material from the Outer Riparian Zone typically is transported to streams via landslides, debris flows, and wind events that are more common after wildfires. These disturbance events would still occur under the Proposed Action but may be less frequent because thinning is effective at reducing the potential for catastrophic wildfire. However, thinning in the Outer Riparian Zone is not likely to reduce material available for recruitment to the Inner Riparian Zone because a portion of the cut trees may be left on site or made available for fish habitat restoration and improve forest health and stand resilience (USDI/BLM, 2016b, pp. 76-77).

Individual tree cutting or tipping from Riparian Reserves in the Last Chance Project area would provide logs for stream restoration activities as funding and staffing allow. There are several reaches identified within the project area that would benefit from these stream restoration activities.

Silviculture

Issue B 24: Would the Proposed Action cause Port-Orford Cedar (POC) root disease *Phythophthora latereralis* to spread within the project area?

Background: Port-Orford Cedar (*Chamaecyparis lawsoniana*) is a species of conifer native to southwestern Oregon and northwestern California and grows from sea level up to approximately 4,900 feet in the Klamath Mountains, often along streams. POC root disease is primarily water-borne or is transported by humans and other vectors in mud from infested areas to un-infested areas. POC root disease infection begins when mycelium, from a germinated spore, invade the roots. The infection then spreads through the inner bark and cambium around the base of the tree. Spread up the trunk is generally limited. Infected tissue dies and effectively girdles the tree. The soil on vehicle tires, especially logging and transport trucks, is considered a potential mechanism of spread, due to the volume of soil that can be carried and the traffic frequency in and between susceptible areas.

Rationale: There are no known populations of POC in the Last Chance Project Area or on haul routes. No populations are within or immediately adjacent to any Proposed Actions (units or haul routes). The POC risk key does not require mitigation to be conducted. Therefore, BLM considered this issue, but determined detailed analysis was not necessary to determine there is no potential for significant effects to POC or the spread of POC root disease.

Issue B 25: How would the salvage of timber following incidental insect and disease outbreaks, and drought related mortality contribute to the Allowable Sale Quantity?

Within the Harvest Land Base BLM would recover volume from insect and disease outbreaks and drought related mortality during commercial operations. Commercial timber salvage on HLB allocations, including for safety and operation reasons is permitted (USDI/BLM 2016b, pp. 62-69).[Need a sentence that explains that ASQ only comes from the HLB and why, citing RMP]. Salvage would occur within the analyzed units only if the silvicultural prescription would continue to be within EA prescription analysis, RMP LUA management direction and the within the federal ESA consultation requirements. Project clearance surveys that are required for federal sensitive and T&E species would have already been completed for harvesting effects to habitat. Both Alternatives 2 and 3 are designed to offer flexibility such that if a leave tree succumbs to insect, disease, or drought related mortality, it may be swapped with a live tree and removed from the stand. Trees which have been weakened by drought are more susceptible to insects, by removing these trees from the landscape the overall health of stands would increase by potentially slowing or preventing the spread of insects to new host trees or swapping with green trees exhibiting and more vigorous character. Removing unhealthy trees allows for continued growth, or regeneration of healthy trees which would ensure sustained yield timber production from the Harvest Land Base.

Soil Productivity and Slope Stability

Issue B **26**: How would ground-based logging, cable yarding, ground disturbance associated with logging operations (yarding wedges, tractor swings, and landings), road building, roadside maintenance, and fuels treatments affect soil productivity, slope stability, mass movement, and surface erosion within and outside of harvesting units?

Background: The action of commercial logging operations, fuels treatments, road building, and roadside maintenance would impact soil productivity due to the removal of trees and vegetation, mixing of organic and mineral layers, compaction of soil, reduction of soil biological functioning (microbes, insects, roots), burning of organic matter and mineral soils, and the deposition of charcoal and ash from biomass burning. The impact of logging operations, road building, fuels treatments, and roadside maintenance would impact soil stability due to the removal of trees and vegetation, mixing of soil layers (organic and mineral layers), compaction of soil, reduction of soil biological functioning (microbes, insects, roots), burning of organic matter and mineral soils, and the deposition of charcoal and ash from biomass burning (Page-Dumroese, 2020; Pingree and DeLuca, 2017).

The impact from logging, road building, fuel treatments, and roadside maintenance would alter the productivity of soils by reducing water infiltration and storage capacity, reduce total soil nutrients, but also alter increase soil water and nutrients with the removal of vegetation and alter soil nutrient cycling with the deposition of ash and charcoal onto the forest floor. The impact of logging operations, road building, fuels treatments, and roadside maintenance would decrease slope stability and increase the likelihood of mass movement and surface erosion events. The removal of trees and vegetation not only removes the physical anchor that trees and vegetation provide with tap roots and fine roots, but also the deposited organic matter and physical benefits therein. This organic matter provides surface texture, facilitates decomposition processes, releases organic residues, and attract organisms that also act as conglomerating agents. Mixing soil layers, organic and mineral soils, also reduces the stability of soils on a slope by removing the protective organic layer on the soil surface and destroying the physical connections between roots, microbes, and soils.

Fuel treatments that result in the burning of the forest floor would also reduce the surface organic matter content, but deposit charcoal and ash, which can facilitate increase soil water storage and available nutrients that may help rebound the slope stabilizing components of the forest floor. Where impacts are detrimental, as described by the Forest Soil Disturbance Monitoring Protocol (Page-Dumroese et al., 2009), soil productivity is expected to be temporarily reduced where mitigation measures can be implemented (e.g., replace slash or add mulch, add native seed, rip/till temporary routes). Slope stability, mass movement, and soil erosion may occur where ground-disturbance activities are planned on commercial harvest units, access areas to units, fuels treatment units, and temporary and permanent roads.

Rationale: The potentially-ground impacting activities may affect up to 11,425 acres or 12% of the total project area (Appendix D4: Watershed Analysis: Table D.4.5 Soils Disturbance Summary). Ground-disturbing operations from commercial harvest, fuels reduction treatments, and road construction or reconstruction result in impacts that both positively and negatively affect soil productivity over different time scales. These impacts would not be permanent for the function of soil productivity across the 12% of the affected area. Furthermore, the expectation that 20% of the area ground disturbance is detrimental to soil productivity is likely an overestimation, as supported by projected logging systems, for example.

Soil disturbance assessments would be conducted after harvest activities based on the RMP Monitoring Plan (USDI/BLM, 2016b, p. 137) to help to plan future timber sales in a way to prevent detrimental soil disturbance creation, measure created disturbance during and after implementation, and identify the need and type of future best management practices that may be required. The timber sales would be monitored using the Forest Soil Disturbance Monitoring Protocol (FSDMP) (Page-Dumroese et al., 2009). During and after project implementation 10 percent of treatment units would be monitored according to the RMP Monitoring Plan (USDI/BLM, 2018b, p. 151). Changes in soil disturbance are visually quantified and the largest primary contributors to soil disturbance (for example, roads, skid trails, or dispersed disturbance) at the site are mapped. If the site follows management direction (<20% DSD), no further actions are necessary. But if the site exceeds 20% DSD, corrective actions would be implemented prior to timber sale contract closure. These actions are tailored, within the scope of the sale contract and established BMPs, to address the main disturbances at the site. Typical BMPs after harvest may include de-compacting existing or newly created landings or compacted areas, and utilizing slash, seed, or other materials as erosion control, among other actions. This process enables detrimental soil impacts to be predicted in advance, and harvest activities to avoid unacceptable disturbance. Further, on-the-ground evaluation and adaptive management ensures that project activities would comply with the RMP management direction. This issue was considered but not analyzed in further detail because the activities described in the proposed actions would not have negative impacts beyond that which was analyzed in the 2016 RMP, this is achieved through the implementation of Best Management Practices, Project Design Features, and site-specific prescriptions that ensure detrimental soil disturbance would remain below the RMP-required level of no more than 20% within a given harvest unit.

Issue B 27: How would forest management actions in DDR-TPCC LUAs promote desired soil conditions and minimize or eliminate degradation to the productive capacity of these soils?

Background: The impact of logging operations, road building, fuels treatments would impact soils due to the removal of trees and vegetation, mixing of soil layers (organic and mineral layers), compaction of soil, reduction of soil biological functioning (microbes, insects, roots), burning of organic matter and mineral soils, and the deposition of charcoal and ash from biomass burning. Similar to all soils within the project area, the physical impacts of timber harvest, silviculture treatments, and fuel treatments would decrease slope stability and soil productivity in the affected areas, but in some cases increase nutrient and water holding capacity with the addition of charcoal and ash on the forest floor. These processes are described in detail above (Issue 8: Soil Resources).

The DDR-TPCC LUA is reserved from sustained yield timber production. The DDR-TPCC soil limitations include slope gradients, nutrients, soil moisture (coarse texture), mass movement potential, surface erosion, and groundwater issues. Within the proposed actions that may impact soils (expected ground disturbing activities), DDR-TPCC (non-suitable forest land and non-forest land) accounts for 708 acres across the project area. The categories include fragile soils due to slope gradient, nutrient limitations, shallow groundwater, low site productivity, non-commercial species, and reforestation limitations due to surface fragments (erosion potential) (Appendix D: Watershed Analysis: Table D4.7 Soils TPCC Summary).

This project follows RMP management direction for DDR-TPCC (USDI-BLM, 2016b, pp. 55-56) land use allocation which directs the BLM to designate and undesignate these areas as DDR-TPCC and return or remove them to or from the HLB when field examination indicates that those lands either did or did not meet the criteria for reservation. The RMP also allows in the DDR-TPCC for the application of silvicultural or fuels treatments, including prescribed fire, that restore or maintain community-level structural characteristics, promote desired species composition, and emulate ecological conditions produced by historic fire regimens, in areas identified as unsuitable for sustained-yield timber production (USDI-BLM, 2016b, pp. 55-56).

This project also utilizes the Timber Production Capability Classification Handbook codes (1984) and the "Recommended Practices" within A Synopsis and Updated Guide of the Standard Operational Practices for Upland Soil Productivity in Western Oregon (SOP) (USDI-BLM, 2016a, pp. 27-35) to ensure that areas in both the DDR-TPCC land use allocation are correctly managed.

Table D.4.7 documents the fuels units, proposed road locations, and timber harvest units which have potential DDR-TPCC, TPCC-Withdrawn, or TPCC-Restricted soils derived from GIS that would be field verified prior to implementing actions. The outcome of field verification of these areas, which intersect with fuels, roads, and commercial units, would be disclosed in the subsequent Decision Records.

Initial identification of DDR-TPCC land use allocation and TPCC soils occurs in the office utilizing GIS data. As project activities are refined, the GIS classifications are reviewed for accuracy in the field. Following field review, the areas identified as TPCC-Withdrawn or TPCC-Restricted would follow one of the outcomes below based on the specific TPCC designation and land use allocation:

If field review confirms the DDR-TPCC land use allocation and TPCC designations are accurate, outcomes would be one of the following:

The areas would be deferred from treatment because design features are unable to avoid impacts. Where access (yarding/haul) is needed through these areas, apply Operational Guidelines for road construction, yarding, and hauling. No yarding or haul would occur in areas designated as withdrawn because of surface erosion concerns.

In the DDR-TPCC, apply the design features identified in the table above during silvicultural or fuels treatments. Treatments would restore or maintain community-level structural characteristics, promote desired species composition, and emulate ecological conditions produced by historic fire regimens. This is achieved by applying silvicultural prescriptions which focus on retaining minor species such as pine, oak, and cedar and removing small diameter encroaching Douglas-fir. Once slash has been disposed, the site would be assessed for the reintroduction of prescribed fire.

If field reviews determine the DDR-TPCC land use allocation and TPCC designations are NOT accurate, the TPCC designation for these lands would be changed to reflect on the ground conditions, and outcomes would be one of the following:

In the DDR-TPCC, if the changed TPCC classification no longer meets the reasons for allocating the lands as DDR-TPCC, these areas would be un-designated and returned to the harvest land base (USDI/BLM 2016a, p. 56). The un-designation process would be an interdisciplinary team exercise which may include a field visit with the project soils expert, the silviculturist, and the timber sale planner. If needed, other specialist such as a soil scientist or hydrologist would be consulted.

Forest prescriptions (silviculture and fuels) would be applied to achieve restoration and habitat goals with mitigating measures in place for soil and reforestation limitations described by the TPCC data. Proposed activities would be designed to protect the soil characteristics identified in the DDR-TPCC LUA after field surveys indicate that the description is accurate. Site specific mitigation of activities would be expected to protect these DDR-TPCC characteristics for specific sites, for example avoiding saturated soils with seasonal restrictions or limiting ground-based yarding on steep slopes.

Rationale: This issue was considered but not analyzed in further detail because the activities described in the proposed actions are not expected to have negative impacts beyond that which was analyzed in the 2016 RMP, this goal would be achieved through the implementation of Best Management Practices, Project Design Features, and site-specific prescriptions. These site-specific measures would be included in timber contracts and administered by BLM sales administrators on the ground and the Recommended Practices from the SOP would mitigate potential effects and minimize or eliminate degradation to the productive capacity of these soils.

Issue B 28: How would decommissioning of roads, temp routes, and any excessive ground-based disturbance affect soil productivity, mass movement, and surface erosion?

Background: After a temporary route or landing is created, to reduce the detrimental soil disturbance caused by the construction of the feature, specific mitigating activities are implemented to expedite recovery of the soil. These activities include decompaction, drainage, slash cover, and blocking routes for vehicle travel. Decompaction usually affects the upper mineral soil in order to reduce compaction caused by construction of the feature. Drainage includes forming ditches and water bars to move water off the compacted area quickly. Slash cover helps to disperse rain drops, increase infiltration rates, and reduce runoff rates. Tank traps and/or rocks are placed at the entrance of a decommissioned temporary route to limit motorized use and, thus, further compaction. Generally, these activities can reduce compaction from temporary routes and excessive ground-based disturbance, but actions should be considered in context of soil types, landscape forms, adjacent resources, and legacy disturbances.

Decompaction activities mix organic (if organic layers are present) and mineral soils, which can accelerate decomposition of organic matter and temporarily reduce organic matter, which usually reduces overall nutrient content and cycling. Soil mixing can also sever roots and provide habitat for invasive species if they are present on the route. Slash cover provides a physical input of organic matter and material that disperses water before it reaches the compacted soils, thus, reducing water-driven erosion and providing some input of nutrients. The placement of rocks at the entrance of a decommissioned temporary route compacts only the soil directly below the rocks and limits the possibility of motor vehicle travel, which contributes directly to compaction and, subsequently, erosion. While tank traps reduce travel, they also accelerate water-driven erosion and slope instability depending on the landscape topography.

Rationale: The impacts of activities involved in decommission of temporary routes provides an avenue to reclaim initial loss of soil productivity, soil instability, and soil erosion. All temporary routes proposed on the project area would have a combination of decommissioning activities, such as drainage, slash cover, blocking, that is deemed appropriate by a BLM engineer or soil scientist when considering the site-specific soils, landscape topography, road features, and adjacent vegetation cover. This issue was considered but not analyzed in further detail because the activities described in the proposed actions would not have negative impacts beyond that which was analyzed in the 2016 RMP, this is achieved through the implementation of Best Management Practices, Project Design Features, and site-specific prescriptions.

Terrestrial Wildlife and Special Status Species

Issue B 29: How would the project be monitored to assure that canopy cover requirements for the northern spotted owl are met?

Background: The Medford District has developed a Guide for Planning and Implementing Vegetation Management Projects (USDI/BLM 2015) which established six steps and five checkpoints to ensure that projects are consistent with National Environmental Policy Act (NEPA) documents and with Endangered Species Act (ESA) Section 7 consultation requirements. Included in these steps are habitat evaluations and northern spotted owl surveys. Silviculturists work with wildlife biologists to develop forest treatment prescriptions. The Biological Assessment and Biological Opinion are reviewed by the foresters and wildlife biologists. The marking crew lead and marking contract project inspector are informed of the consultation canopy cover, basal area, and specific habitat requirements to retain prior to the tree marking. The silviculturist coordinates with a wildlife biologist and other specialists for marking reviews and monitors the marking of trees as this task is completed to ensure it meets the consultation requirements and stand management objectives. Modifications to the marking of trees would be applied as needed. The Contract Administrator monitors harvesting activities and ensures contract stipulations and RMP management directions are met. Lastly, the wildlife biologist monitors a subset of units post-treatment to evaluate consistency between implementation, NEPA analysis, and ESA consultation requirements; this includes tree retention and spacing, tree selection, structure retention, and evaluating general canopy cover retention to verify that prescribed marking is appropriately applied according to the NEPA and Consultation effects.

Rationale: Monitoring of marked prescriptions pretreatment, contract administrator monitoring, and post-implementation monitoring of activities provides a reasonable assurance that canopy cover and other structural requirements for the northern spotted owl habitat would be consistent with the designed prescription, EA analysis, RMP management directions, and FWS consultation requirements. Therefore, this issue was considered but not analyzed in further detail.

Issue B 30: How would the potential risk of windthrow and effects to post-harvest canopy and relative density retention requirements be affected by applying LUA prescriptions?

Background: There is no known method to accurately predict harvest unit-level tree susceptibility to windthrow. While there is a level of risk for windthrow events, it depends on many biotic and abiotic influences. Predicting windthrow that would have substantial impact on proposed treatment units would be speculative. Analysis of potential windthrow would be speculative and not lead to a more reasoned decision. The PRMP/FEIS describes that windthrow mortality is often irregular or episodic in nature and is inherently difficult to predict the exact time in which it would occur (USDI/BLM 2016a p. 1203). The BLM is managing forest resources to reduce impacts from natural causes. Management direction on pages 68 and 72 of the RMP states the BLM is to “Conduct integrated vegetation management for any of the following reasons: Reduce stand susceptibility to disturbances such as a fire, windstorm, disease, or insect infestation” is just one of many potential treatment goals.

Silvicultural prescriptions proposed are designed to remove trees that are most susceptible to windthrow, such as those with low vigor, poor crown ratios and those with high height to diameter ratios (Worthington and Staebler, 1961, p. 21; Moore et al., 2003; Wonn & O’Hara, p. 92; Tappenier et al. 2007, pp. 129-130; O’Hara, 2014). Prescriptions would favor retaining species with deep tap roots such as sugar and ponderosa pine, largest and most well-developed trees, and healthy vigorous trees of other species would be preferentially retained (Smith et al. 1997) to lower the potential for blowdown. The lack of thinning can prevent stands from attaining vigorous conifer growth. Trees allocate resources to height growth before diameter growth and in the absence of disturbance (thinning) resources become limited and the risk of windthrow increases as tree stability decreases (EA, p. 27). The result of limited resources within a stand, means diameter growth lags behind height growth (O’Hara, 2014, pg. 100) which actually increases the risk of windthrow over time, as height to diameter ratios continue to increase and crown ratios decrease, and the topographic position, with ridge tops more susceptible (Mitchell 2000).

In some cases, the risk of windthrow could be increased in the short-term when opening up a stand. Thinning and group selection openings may indirectly increase surface wind gusts. Bigelow and North (2012) found evidence of this, observing moderate increases in average wind gusts in thinned stands (up to 1.5mph) and greater increases in openings (up to 5.6 mph in openings of 2 acres). Increasing spacing between the canopies of trees can contribute to increased wind speeds (Agee 1996). Increased surface wind speeds could contribute toward increased windthrow. Risk of windthrow could be increased in the short term (3-5 years) when opening up a stand (Cremer et al. 1982). However, windthrow occurs in both managed and unmanaged stands, and low levels of windthrow may be desirable for wildlife habitat and stand complexity as long as stand level RDI targets and required canopy cover for wildlife are attained overall post-harvest.

The BLM considered potential for short and long term windthrow canopy cover loss and considered this potential occurrence when developing the range of RD retention prescriptions and during the tree-mark review process. All commercial extraction units are subject to post-marking review and susceptible areas (such as laminated root disease infestations) would be ground verified to determine hazard potential. Those areas may be remedied by adding additional tree retention to avoid potential loss of canopy cover. These adjustments would be made during the monitoring implementation step of on-site post-mark field review. Provisions in the prescribed marking guidelines allow the silviculturist and other resource specialists to remedy detrimental canopy cover loss from windthrow, fragile soils, and marking discrepancies by allowing the additional retention of leave trees in susceptible areas. Site specific reviews in these areas would allow the silviculturist and wildlife biologist to determine the need for marked tree retention adjustments based on the site-specific condition and susceptibility to the hazard affecting overall stand canopy cover loss below prescribed thresholds.

Rationale: This issue was considered but not analyzed further in detail because as described in the PRMP/FEIS, and incorporated by reference into the EA, "this type of mortality is often irregular or episodic in nature, and is inherently difficult to predict the exact time in which it would occur" (USDI BLM 2016a FEIS, p. 1203). The BLM has analyzed and disclosed a reasonable discussion of effects of treatments on stand susceptibility to windthrow with reasonable measures to identify and adjust retention during field and post-marking review. Prescription retention design minimizes the potential effects from of windthrow from proposed treatments.

Issue B 31: How would timber harvest, activity fuels treatments, fuels maintenance treatments, and new road and landing construction affect spotted owl ***habitat***?

Background: The Last Chance FMP is located within the range of the NSO, which is listed as threatened under the Endangered Species Act. NSOs prefer coniferous forest with multiple layers of vegetation; a variety of tree species and age classes; and the presence of large down, woody material (to serve as habitat for prey species) and large diameter live and dead trees (snags) for nesting-roosting habitat. NSO nesting-roosting and foraging habitat in southwest Oregon is mixed-conifer habitats with recurrent fire history, patchy habitat components, and higher incidences of woodrats. NSOs also utilize younger stands with closed canopies for foraging and dispersing. Based on studies of owl habitat selection, including habitat structure and use, and prey preference throughout the range of the owl, NSO habitat consists of three components: nesting-roosting, foraging, and dispersal (Thomas et al., 1990). Table B-32.1 below provides habitat definitions specific to spotted owls.

To assess the baseline habitat values and project level impacts to northern spotted owls that would result from implementation of the Last Chance Project Action Alternatives, the Medford BLM used an Analysis Area specific to spotted owls to determine areas where spotted owls would be exposed to project effects. The spotted owl Analysis Area is based on the radius of a circle that would capture the average spotted owl provincial home range distance, which is 1.3 miles in the Klamath Mountains Province (Thomas et al. 1990 and Courtney et al. 2004). Therefore, for the Last Chance Project, the spotted owl Analysis Area represents all lands within 1.3 miles of proposed treatment units and all lands within any overlapping provincial home ranges of known spotted owl sites that could be directly, indirectly, or cumulatively impacted by the proposed action. The NSO Analysis Area is displayed below as figure B-1.

The following actions included in this EA have the potential to affect NSO habitat by modifying or removing habitat: timber harvest, small diameter understory thinning (hazardous fuels reduction treatments and underburning), road/route and landing construction, and quarry development. Treatment effects are described below and effects to NSO habitat by alternative are demonstrated in Table B 31.2.

Modified NR, F, or dispersal-only habitat occurs when an action or activity in nesting-roosting, foraging, or dispersal-only habitat removes some trees or reduces the availability of other habitat components but does not change the current function of the habitat because the conditions that would classify the stand as NR, F, or dispersal-only habitat would remain post-treatment. Habitat elements such as multiple canopy layers, snags, down woody material, and hardwoods, must be retained to maintain habitat function post treatment. The treated stand is expected to still function as NR or F habitat because it would continue to provide at least 60 percent canopy cover (treatment unit average), large trees, multistoried canopy, standing and down dead wood, diverse understory adequate to support prey, and may have some mistletoe or other decay (when present prior to harvest). For dispersal habitat, the treated stand would still maintain its habitat function by continuing to provide at least 40 percent canopy cover (treatment unit average), flying space, and an average of trees 11 inches DBH or greater. In the Last Chance FMP, NRF and dispersal-only habitat modification would occur from selection harvest, commercial thinning, small diameter thinning, roadside vegetation management, and harvest access (yarding corridors).

Downgraded NR or F alters the condition of spotted owl NR or F habitat, so the habitat no longer contains the variables associated with nesting, roosting, and foraging. Downgraded units would contain trees > 11 inches DBH and enough tree canopy cover to support spotted owl dispersal. Downgrade is defined when the canopy cover in a NR or F stand is reduced to 40-60 percent (treatment unit average) and other key habitat elements are removed, such as decadent down wood, snags, multistoried canopy layers, and hunting perches. Conditions are altered such that an owl would be unlikely to continue to use that unit for nesting or foraging. The removal of these key habitat features would reduce the roosting and foraging opportunities for owls and may lead to increased predation risk by exposing owls to other raptors. Downgraded NR or F continues to provide habitat for dispersal and potentially limited foraging opportunities. In the Last Chance FMP, NRF downgrade would occur from selection harvest and commercial thinning treatments.

Table B 31.1. Medford District NSO Habitat Types

Habitat Type	Habitat Sub-Type	Description
NRF - *Nesting, Roosting and Foraging Habitat*	Structurally Complex Habitat (RA32), A Subset of Nesting-Roosting Habitat	Older, multilayered, structurally complex forests characterized as having overstory trees greater than 17 to 21 inches in diameter (depending on annual precipitation), high canopy cover (greater than 60 percent), large trees present (at least 30" DBH), and quantifiable decadence components such as broken-topped live trees, mistletoe, cavities, large snags, and fallen trees (Figure 12). RA 32 habitat may vary due to climatic gradients across the range. Also functions as dispersal habitat.
NRF - *Nesting, Roosting and Foraging Habitat*	Nesting-Roosting	These forests have a high canopy cover (greater than 60 percent), a multilayered structure, and large overstory trees greater than 21 inches in diameter. Deformed, diseased, and broken-top trees, as well as large snags and down woody material, are also present. Nesting-roosting habitat meets all NSO life requirements. Also functions as dispersal habitat.
NRF - *Nesting, Roosting and Foraging Habitat*	Foraging	Canopy cover greater than 60 percent and canopy structure generally single layered. Overstory trees are generally greater than 16 inches in diameter. Snags and down wood not considered a requirement. Also functions as dispersal habitat.
Dispersal-only Habitat	Dispersal-only Habitat	This habitat is not for nesting, but provides requirements believed important for NSO dispersal. Canopy cover is generally between 40 and 60 percent. In stands with greater than 60 percent canopy cover, overstory tree diameters are generally between 11 and 16 inches DBH. The area has the capability of becoming nesting-roosting, or foraging habitat. Deformed trees, snags, and down wood are absent or less prevalent than in nesting-roosting habitat.
Unsuitable habitat	Capable	include forestland that is currently not functioning as spotted owl habitat but has the potential to develop into NR, F, or dispersal-only habitat in the future, as trees mature and the canopy closes.
Unsuitable habitat	Non-habitat	does not currently provide habitat for northern spotted owls and would not develop into NR, F, or dispersal-only habitat in the future (i.e. rock outcrops, meadows, barrens, etc.)

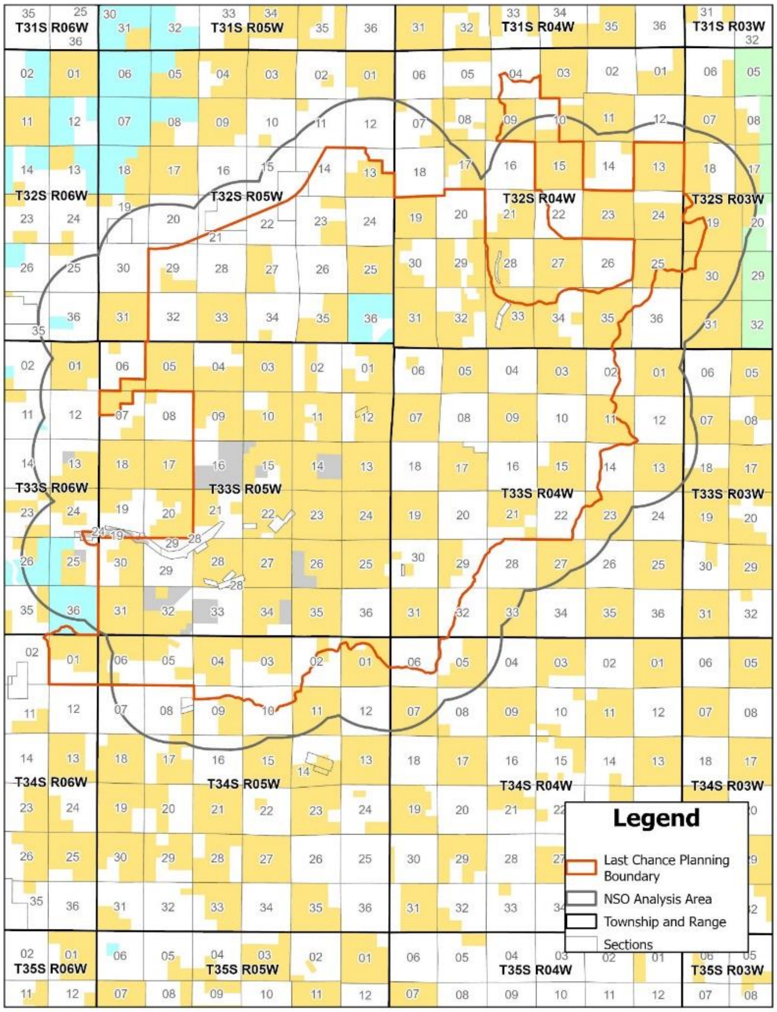

Figure B-1. Analysis Area for Evaluating Effects to Northern Spotted Owls

The proposed action is described as spotted owl habitat *removal* when the average stand level canopy cover would drop below 40 percent and canopy layering and other key habitat would be reduced so the unit would no longer function as spotted owl habitat post-harvest. Removal of dispersal-only habitat drops canopy cover to less than 40 percent (unit treatment average) and otherwise changes the stand, so it no longer provides dispersal habitat for NSO. The post-harvest stand would be too open to provide protection from predators. In the Last Chance FMP, NRF and dispersal-only habitat removal would occur from road and landing construction, commercial thinning, and selection harvest.

While the NSO home ranges in the spotted owl Analysis Area are comprised of Federal (BLM) and private lands, the following analysis only includes effects on Federal lands. Private lands within the NSO Analysis Area are made up of early-, mid-, and late-seral forests, agricultural, and shrub/oak lands. Most private forestlands are managed as tree farms for production of wood fiber on forest rotations. It is expected that any remaining late-seral forests on private timberlands would be converted to early-seral forest over the next one or two decades (USDI/BLM 2016b, p. 173).

The total treatment acres were calculated using the above-described treatment effect categories and assigning all treatments included as part of an action alternative into a treatment effect category as shown in table B 31.2. The effects of road and landing construction are based on reasoned assumptions that convert proposed new road/route miles and potential landing locations into acres of treatments by spotted owl habitat types. The total acreage value presented here are higher than the values presented in Table 2-1 of chapter two in the Proposed Action Summary Table because all project effects were converted into acreage impacts for the spotted owl analyses (e.g. converted road miles into acre footprint).

Table B 31.2: Effects of the Action Alternatives to Spotted Owl Habitat in the Analysis Area.

TREATMENT ACRES BY EFFECT TYPE	ALT 2	ALT 3
Commercial Treatments with Hazardous Fuels Reduction Treatments		
NRF Modified	967	779
NRF Downgraded	0	0
NRF Removed	3,420	0
Dispersal-only Modified	1,041	248
Dispersal-only Removal	2,332	0
Treatments in Unsuitable Habitat (No Effect)	480	32
SUBTOTAL	**8,240**	**1,059**
Hazardous Fuels Reduction Only Treatments		
NRF Modified	1,701	5,309
NRF Downgraded	0	0
NRF Removed	0	0
Dispersal-only Modified	760	3,885
Dispersal-only Removal	0	0
Treatments in Non-Habitat (No Effect)	985	1,433
SUBTOTAL	**3,446**	**10,627**
Effects from Road and Landing Construction		
NRF Modified	0	0
NRF Downgraded	0	0
NRF Removed	160	12
Dispersal-only Modified	0	0
Dispersal-only Removal	169	11
Treatments in Non-Habitat (No Effect)	44	1
SUBTOTAL	**373**	**24**
All Treatments Combined		
NRF Modified	2,668	6,088
NRF Downgraded	0	0
NRF Removed	3,580	12

Dispersal-only Modified	1,801	4,133
Dispersal-only Removal	2,501	11
Treatments in Non-Habitat (No Effect)	1,509	1,466
GRAND TOTAL	**12,059**	**11,710**

The amount of habitat modified or removed varies by alternative (Table B 31.2 above) and the overall change to the total spotted owl habitat on federal lands within the spotted owl Analysis Area as a result of full implementation of either action alternative is presented in Table B 31.3. There were no proposed habitat downgrades under any alternative. Under the Action Alternatives, the percent of federal lands containing nesting-roosting or foraging habitat in the NSO Analysis would be reduced by approximately eight percent under Alternative 2 (Alternative 2 and Sub-Alternative 2a would result in the same effect to spotted owl habitat) and two percent under Alternative 3 (Table B 31.2). Alternative 2 would result in the highest reduction in NSO NRF habitat of all action alternatives, with approximately 15.6 percent (3,580 acres) of the total NRF habitat on federal lands in the NSO Analysis Area removed. Comparatively, Alternative 3 would result in a reduction of a negligible 0.05% percent (12 acres) of NRF habitat on federal lands in the NSO Analysis Area.

Table B 31.3: Amount of NSO Habitat Pre- and Post-Treatment in NSO Analysis Area (Federal Land Ownerships Only).

Habitat Type	Current Condition / Alternative 1	Post Treatment (Acres and percent of Analysis Area)	
		Alternative 2	Alternative 3
Nesting-Roosting or Foraging	22,919 (49.6%)	19,339 (41.9%)	22,907 (49.6%)
Dispersal-only	12,360 (26.8%)	9,859 (21.3%)	12,349 (26.7%)
Unsuitable (Capable or Non-Habitat)	10,903 (23.6%)	16,984 (36.8%)	10,926 (23.7%)
TOTAL	46,182	46,182	46,182

Follow-up hazardous fuels reduction in the form of small diameter thinning would occur in treated units where canopy base height remains less than 5 feet after commercial thinning. Where nesting and roosting, foraging or dispersal habitat would be modified, canopy cover would be retained, and multiple canopy, uneven-aged structure where present, and tree species present prior to treatment would continue, but be thinned to a lesser density within the understory. Snags and coarse wood would be protected to the greatest extent practicable during slashing and piling. Retaining these primary features provides the vertical and horizontal structure for NSO roosting and foraging. This includes a multi-layered canopy, sufficient overhead canopy, species composition, and down wood features, while meeting hazardous fuels reduction goals.

RA-32

The BLM conducted field verification of suspected structurally complex forest (see RA-32 habitat definition, Table B-8) within the proposed treatment area to identify high-quality NSO habitat for Recovery Action 32 (USFWS 2011, pp.67-68). The proposed treatments under all alternatives would include up to 113 acres of RA-32 habitat.

All nesting-roosting habitat in the LSR LUA, including stands identified as RA-32, treatments would maintain habitat function regardless of NSO occupancy (USDI/BLM 2016b, p.71). In the HLB, Alternatives 2 and Sub-Alternative 2a would include removal of 142 acres of field identified RA-32 habitat, and Alternative 3 would remove eight acres of field identified RA-32 habitat. There are no proposed downgrades of RA-32 habitat under any of the alternatives. This is consistent with the direction in the 2016 ROD/RMP not to forego timber harvest of stands in the Harvest Land Base to contribute to Recovery Action 32 (USDI/BLM 2016b, p. 127).

Rationale: The BLM did not analyze this issue in further detail because there is no potential for significant effects beyond those already analyzed in the 2016 PRMP/FEIS (USDI/BLM 2016a pp. 346-347; 928-947), to which this EA is tiered. The BLM designed the Last Chance FMP to follow the management direction from the 2016 ROD/RMP for each LUA. The BLM, in the 2016 PRMP/FEIS, analyzed the effect of harvest of NSO habitat together with the effects of other Proposed RMP decisions and concluded that implementation of the Proposed RMP Alternative would contribute to a landscape that supports large blocks of NSO habitat that are capable of supporting clusters of reproducing owls, distributed across a variety of ecological conditions and spaced to facilitate owl movement between the blocks (USDI/BLM 2016a, pp. 932-941). The BLM is incorporating those analyses here by reference. The U.S. Fish and Wildlife Service (USFWS) confirmed in their BO on the RMP that these analyses are a reasonable approach to assessing NSO habitat change in the Planning Area resulting from timber harvest, ingrowth, and wildfire because it reflects the application of best available science and the acreages of land that would be subject to the range of management activities in the land use allocations in the RMP (USFWS 2016, p. 603).

In conclusion, there is no potential for significant impacts to NSO habitat beyond those already analyzed in the PRMP/FEIS because the project design and site-specific information is consistent with analysis in the PRMP/FEIS. This project would not result in substantially different effects than what was analyzed for in the PRMP/FEIS and there is no new information that would substantially change the conclusion reached in the PRMP/FEIS.

Issue B 32: How would timber harvest, activity fuels treatments, fuels maintenance treatments, and new road and landing construction affect ***spotted owls***?

Background: NSO site occupancy is defined as locations with evidence of continued use by spotted owls (including breeding), repeated location of a pair or single birds, presence of young before dispersal, or some other strong indication of continued occupancy. The Grants Pass Field Office conducted six years of consecutive NSO surveys following the USFWS 2012 revised protocol from 2018 to 2023 in order to determine occupancy and nesting status. Six of the known NSO sites (eight total territories) within the NSO Analysis Area are currently occupied (active in the last two years). Across both Action Alternatives, no treatments are proposed within the 70-acre (300-meter) nest patch buffer around occupied NSO site centers, and no commercial harvest would occur within 0.5 mile of the occupied site centers.

The amount of habitat that occurs within each historic owl site / territory across the Last Chance FMP can be used as a measure to compare the effects of the Action Alternatives by assessing the percentage of NRF habitat available within each spotted owl home range and half-mile core use area before and after project implementation. NRF habitat is a focus of the analysis because research has indicated that the quantity and configuration of "older forest" (analogous to NRF habitat) provides a valid inference into the likelihood of occupancy (Hunter, et al. 1995), survival, and reproduction (Franklin, et al. 2000; Zabel, et al. 2003; Olson, et al. 2004; Dugger, et al. 2005; Dugger, et al. 2011). For example, when less than 40 to 60 percent of the home range is in NRF habitat, the likelihood of spotted owl occupancy is lower, and survival and reproduction may be reduced (Thomas et al., 1990; Bart and Forsman 1992; Bart 1995; Dugger et al., 2005). Generally, survival and reproduction are supported when there is between 40 and 60 percent older forest within the core-use area (Dugger et al., 2005), but local conditions and possibly pair experience, contribute to large variance in actual amounts for individual owls. The amount of habitat within an approximate 0.5-mile radius provides reliable predictor of occupancy, and the quantity and configuration have been shown to provide reasonable inferences into survival and reproduction. Adjacent private lands have removed or could remove potential NRF habitat on their lands within spotted owl home ranges. Therefore, the BLM cannot assume private lands are contributing to the older forest conditions in these home range and core areas in the spotted owl sites for this analysis.

Table B.32.1. A comparison of the Effects of the Action Alternatives on the Number of Spotted Owl Sites Above or Below Habitat Thresholds within the Last Chance FMP.

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As shown in Table B.32.1, Alternative 2 (either sub-alternative would result in the same outcome for this analysis) would reduce the number of spotted owl sites found within the Last Chance FMP that were above 40% NRF at the home range scale at two sites (from six to four), and would reduce the number of spotted owl territories with 50 percent or greater NRF at the 0.5 mile core use scale across four sites (from 12 down to eight). Alternative 3 would not result in any changes to the number of owl sites that are above 40 percent NRF of the home range, and/or 50 percent NRF at the 0.5 mile core use area scale.

Although Alternative 2 would reduce the amount of spotted owl home ranges (by two) and 0.5-mile core use areas (by four) that are above the desired habitat thresholds of 40 and 50 percent NRF, respectively, none of the occupied spotted owl sites in the Last Chance FMP would lose more that 0.4 percent of the total NRF habitat within each home range or 0.5-mile core use area, and would not drop any home range or 0.5-mile core use area that is currently above the 40 or 50 percent threshold to drop below that threshold after treatment. Generally, when less than 40 percent of the home range, and/or 50 percent of the 0.5 mile core use area is NRF habitat, the likelihood of spotted owl presence is lower and survival and reproduction may be reduced (Thomas, et al. 1990; Bart and Forsman 1992; Bart 1995; Dugger, et al. 2005).

The question of whether the effects described above lead to incidental take via harm or harassment is a determination made by the US Fish & Wildlife Service. A more detailed analysis of the affects that this project is expected to have on individual spotted owls and spotted owl habitat across the Project Area is included in the Biological Assessment (BLM 2023) and the Biological Opinion (USFWS 2023) covering the terrestrial wildlife Threatened and Endangered species.

In general terms, small diameter thinning, in addition to all proposed treatments, could impact NSO foraging by changing habitat conditions for prey species. Effects to spotted owl prey species, such as woodrats, northern flying squirrels and other small mammals, which are the primary prey of spotted owls in the analysis area (Forsman et al. 2004), are expected to occur under the proposed treatments. Some changes to vegetation (habitat) can improve forage conditions, provided some ground cover is retained. Removal of older brush and dense understory in the treated areas may stimulate grass, forbs, younger shrub and associated seeds, providing food source for small mammals (Buermeyer and Harrington 2002, Wender et al. 2004). Woodrats are important components of the spotted owls' diet in in the Planning Area

(Forsman et al., 2004). Some beneficial effects to dusky-footed woodrats due to shrub development in thinned stands is possible (Sakai and Noon 1993; Suzuki and Hayes 2003). Gomez et al. (2005) noted that commercial thinning in young stands of coastal Oregon Douglas-fir (35-45 year) did not have a measurable short-term effect on density, survival or body mass of northern flying squirrels, an important prey species for spotted owls.

In addition to reducing the amount and intensity of treatments within the occupied spotted owl sites in the Last Chance FMP, seasonal restrictions listed as Project Design Features for this project (Appendix A) would also prevent disturbance to nesting spotted owls within the NSO Analysis Area. These PDFs would help reduce potential effects to the reproduction and survival of spotted owl territories. Project Design Features included for this project would be utilized to avoid adverse impacts to spotted owls with respect to prey availability, although localized, short-term changes in prey species distribution and abundance are likely to occur within a treated stand. Residual trees, snags, and down wood retained in the treated stands would provide some cover for prey species over time and would help reduce harvest impacts to some prey species, such as dusky-footed woodrats. Treatment implementation would be spread out temporally and spatially within the project area, which would leave untreated areas available for spotted owl foraging, reducing the impact of these effects at the project level.

Rationale: The effects of the proposed actions on spotted owl reproduction, survival, and the potential to cause incidental take, are not analyzed in detail, because there would be no potential for effects beyond those analyzed in the PRMP/FEIS, to which this EA is tiered. Even though spotted owl sites may be affected by the proposed action, survival and reproduction would not be affected at occupied owl sites because the BLM's commitment to conduct no harvest in the 70-acre site center and only conducting non-commercial work within 0.5 mile of the site center, and only treating NRF in any occupied owl sites with "light touch" treatments (i.e. treat and maintain or modify) would ensure that take would not occur, in compliance with the SWO ROD/RMP's management direction stating, "No Timber harvest that would cause the incidental take of northern spotted owl territorial pairs or resident singles" (USDI/BLM 2016b, p. 30; also wildlife PDF 45). The PRMP/FEIS acknowledged that the BLM would not "authorize timber sales that would cause the incidental take of northern spotted owl territorial pairs or resident singles from timber harvest until implementation of a barred owl management program consistent with the assumptions contained in the Biological Opinion on the RMP has begun" (USDI BLM 2016a, pp. 346-347). As of June 2024, no barred owl management program meeting that description has begun. One of the proposed actions that is common to all action alternatives is that there would be no incidental take to spotted owls.

The effects of the proposed actions are within the estimated effects to spotted owl populations analyzed in the PRMP/FEIS to which this EA is tiered (USDI BLM 2016a, pp. 947-973). The PRMP/FEIS analysis of the effects of management actions on spotted owl populations included population simulations. The PRMP/FEIS acknowledged that spotted owl populations in the Western Cascades and Klamath Provinces would continue to decline and the PRMP/FEIS did not show discernable differences among the alternatives when compared to the No Timber Harvest reference analysis (USDI BLM 2016a, pp. 961, 962, 969). There are two spotted owl demographic study areas associated with the Treatment Area: the KSA (within the Treatment Area), which represents the Klamath province and the SCS Demography Study Area (adjacent to the Treatment Area), which represents the West Cascades province. The last two years of annual reports for these study areas indicated a decline in the spotted owl population and an increase in barred owl detections (Dugger et al., 2019, Dugger et al., 2020, Lesmeister et al., 2019, Lesmeister et al., 2020). The findings in the most recent metadata analysis demonstrated continued declines of spotted owl populations across the range of the spotted owl. Franklin et al. (2021) found that the declines in both apparent survival and recruitment have accelerated since 2014, resulting in further losses to NSO populations beyond those reported by Dugger et al. (2016). Estimated population sizes have declined in all study areas in Oregon by over 60 percent since 1995, with Klamath Study Area declining by over 75 percent. These recent documented declines confirm the overall spotted owl population decline predicted in the PRMP/FEIS. Therefore, the results of the recent studies do not present new information that would create new effects to spotted owl populations since the PRMP/FEIS.

In conclusion, there is no potential for significant impacts to NSO habitat beyond those already analyzed in the PRMP/FEIS because the project design and site-specific information is consistent with analysis in the PRMP/FEIS. This project would not result in substantially different effects than what was analyzed for in the PRMP/FEIS and there is no new information that would substantially change the conclusion reached in the PRMP/FEIS.

Issue B 33: How would timber harvest, activity fuels treatments, fuels maintenance treatments, and new road and landing construction affect NSO Critical Habitat Unit function?

Background: In December 2021, the USFWS released the Designation of Revised Critical Habitat for the NSO, Final Rule, which designated NSO critical habitat on federal lands. A Critical Habitat Unit (CHU) identifies geographic areas that contain features essential for the conservation of the NSO and may require special management considerations. The Last Chance FMP NSO Analysis Area includes 19,343 acres of spotted owl CHU 10, including portions of sub-unit KLE-1, KLE-2 and KLE-3; however, treatments would only occur in KLE-2. The KLE-2 subunit, which extends well beyond the footprint of the Last Chance NSO Analysis area, contains a total of 70,376 acres of CHU. Only a portion (8,311 acres) of the treatments proposed as part of the action alternatives overlap with lands designated as KLE-2. The proposed treatments include up to 8,311 acres of NSO critical habitat (approximately 43 percent of the Critical Habitat in the spotted owl Analysis Area and 12 percent of the entire KLE-2 sub-unit). Both Action Alternatives would treat a total of 8,311 acres of critical habitat, but Alternative 3 would treat less acres with commercial harvest (these acres would be hazardous fuels reduction, which only modifies the understory) which would result in more acres of treatments that modify habitat, as opposed to downgrade or removal. Table B 33.1 below presents the potential effects that would result from implementation of either Action Alternative on the spotted owl habitat types within the critical habitat that overlaps the treatment areas.

Table B 33.1: Effects to NSO Habitat within Spotted Owl Critical Habitat in the NSO Analysis Area (Federal Land Ownerships Only).

TREATMENT ACRES BY EFFECT TYPE	ALT 2	ALT 3
Treatments within Spotted Owl Critical Habitat		
NRF Modified	2,399	4,461
NRF Downgraded	0	0
NRF Removed	2,137	8
Dispersal-only Modified	1,649	2,826
Dispersal-only Removal	1,115	5
Treatments in Unsuitable Habitat (No Effect)	1,011	1,011
SUBTOTAL	**8,311**	**8,311**

Rationale: The BLM did not analyze in detail the effects of the proposed alternatives on NSO critical habitat in the planning area because there is no potential for significant effects beyond those already analyzed in the 2016 PRMP/FEIS, to which this EA is tiered (USDI/BLM 2016b, pp. 990-993). The 2016 PRMP/FEIS analysis of the 2016 ROD/RMP on NSO critical habitat was based on the vegetation modeling (including timber harvest and growth) in the 2016 PRMP/FEIS. In the Biological Opinion for Western Oregon Resource Management Plan, the USFWS predicted that uneven-aged management would result in the loss of primary biological features, such as nesting-roosting and foraging habitat, in the HLB (USFWS 2016). The USFWS also concluded that the mitigation of these losses would occur because during the same time span, NSO critical habitat in reserved LUAs would develop through ingrowth and through management actions, such as thinning designed to speed the development of critical habitat primary biological features (USFWS 2016, pp 690 and 691). The proposed treatments would reduce the amount of nesting-roosting, foraging, and dispersal-only habitat within critical habitat under all action alternatives. However, the potential reduction of NSO habitat would not alter the intended sub-unit function of providing connectivity between subunits and critical habitat units because these changes are immeasurable at the sub-unit scale and therefore would not affect the dispersal of NSO between sub-units. Additionally, the proposed actions would not affect the ability for the critical habitat subunits to provide demographic support because incidental take of NSOs would not occur under all action alternatives, so the proposed actions would not affect NSO occupancy at active sites.

Issue B 34: How would the treatment of northern spotted owl structurally complex habitat (RA32) or nesting and roosting habitat in the Late-Successional Reserve (LSR) affect the project?

Background: Habitat surveys were conducted to locate structurally-complex habitat and nesting and roosting habitat in the LSR. All LSR units that were identified as either nesting and roosting habitat or structurally complex habitat were dropped from the proposed action and as a result, the Last Chance FMP does not propose commercially treating any LSR stands which are currently functioning as either nesting and roosting habitat or structurally complex habitat.

Rationale: The FEIS analysis forecasts long-term increases in mature and structurally complex habitat in the LSR (USDI/BLM 2016a, p. 850). Therefore, stand nesting function and structurally-complex habitat within LSR would be retained consistent with the RMP and is within and would not exceed the FEIS analysis and forecast and this issue was considered and not analyzed in further detail.

Issue B 35: How would noise associated with proposed timber harvest, fuels reduction activities, and roadwork affect northern spotted owls during their nesting season?

Background: The proposed project is located within the range of the northern spotted owl (NSO) and has the potential to cause noise disturbance near NSO nest sites. The BLM would follow guidance from the U.S. Fish and Wildlife Service (USFWS) and would conduct surveys in the project area to determine occupancy and nesting status. Sites are assumed occupied unless surveys or habitat conditions indicate otherwise. Activities (such as tree felling, yarding, road construction, hauling on roads not generally used by the public, prescribed fire, muffled blasting) that produce loud noises above ambient levels would not occur within specified distances of owl site between March 1 and July 15 unless protocol surveys have determined the activity center is non-nesting or failed in the nesting attempt. The distances may be shortened if significant topographical breaks or blast blankets (or other devices) muffle sound traveling between the work location and nest sites. The action agency has the option to extend the restricted season until September 30th during the year of harvest, based on site-specific knowledge if project would cause a nesting spotted owl to flush.

Based on protocol survey results, and protocol spot check surveys during year of implementation, no chainsaw or heavy equipment activity would occur 65 yards from the NSO nest tree if known or at least 65 yards from edge of the occupied or assumed occupied 328 yard (300 meter) nest patch area and un-surveyed NRF habitat. Seasonal restrictions would also apply to prescribed burning and use (Table B-12). Seasonal restrictions for different project activity types may be extended up to September 30th based on site-specific conditions (such as late nesting or re-nesting attempts).

Spot check protocol surveys during the years of harvest check harvest units with nesting roosting and foraging habitat, and within a quarter mile of nesting roosting and foraging habitat, to reduce the likelihood of disturbing nesting owls. Nesting owls are confined to an area close to the nest, but once the young fledge, they can move away from noise and activities that might cause them harm. Because all project activities would follow mandatory PDF distances and seasonal operation, as established by the FWS, no harm to nesting owls, or their young, is expected from project-related noise. Above-ambient noises further than these distances from spotted owls are expected to have either negligible effects or no effect to spotted owls.

Table B 35.1 – Spotted Owl Disruption and Disturbance Seasons and Distances (content adopted from USDI FWS 2016 USDI FWS 2016; Table 227, pp. 597-600 & Table 50, pp. 230-232).

Project Activity	Disruption Distance		Disturbance Distance
	March 1 – July 15	July 16 – Sept. 30	March 1 – Sept. 30
Light maintenance (*e.g.*, road brushing and grading) at campgrounds, administrative facilities, and heavily-used roads	No Disruption	No Disruption	≤ 0.25 mile
Log hauling on heavily-used roads	No Disruption	No Disruption	≤ 0.25 mile
Chainsaws (includes felling hazard/danger trees)	≤ 65 yards	No Disruption	66 yards to 0.25 mile
Heavy equipment for logging, road construction, road repairs, bridge construction, culvert replacements, etc.	≤ 65 yards	No Disruption	66 yards to 0.25 mile
Pile-driving (steel H piles, pipe piles); Rock Crushing and Screening Equipment	≤ 120 yards	No Disruption	121 yards to 0.25 mile
Burning (prescribed fires, pile burning)	≤ 0.25 mile	No Disruption	0.25 mile to 1 mile
Blasting	≤ 0.25 mile	No Disruption	0.25 mile to 1 mile
Helicopter: Chinook 47d	≤ 265 yards	≤ 100 yards (hovering only)	266 yards to 0.5 mile
Helicopter: Boeing Vertol 107, Sikorsky S-64 (SkyCrane)	≤ 150 yards	≤ 50 yards (hovering only)	151 yards to 0.25 mile
Helicopters: K-MAX, Bell 206 L4, Hughes 500	≤ 110 yards	≤ 50 yards (hovering only)	111 yards to 0.25 mile
Small fixed-wing aircraft (Cessna 185, etc.)	≤ 110 yards	No Disruption	111 yards to 0.25 mile

Rationale: This issue was considered but not analyzed in further detail because the potential for NSOs to be impacted by noise and cause Take associated with proposed project activities is reduced through the implementation of Project Design Features (PDF) (Appendix A in the Biological Assessment for Medford BLM FY23 Batch of Projects) consistent with FWS consultation.

Issue B 36: Does the U.S. Fish and Wildlife survey protocol adequately detect northern spotted owls?

Background: During external scoping for this project commenters questioned the effectiveness of the survey protocol to detect northern spotted owls. In recent years, research on spotted owls provided insights that raised concerns regarding the effectiveness of surveys, particularly those which do not result in spotted owl detections. Specifically, the invasion of the Pacific Northwest by the barred owl. The FWS developed the 2011 NSO Survey Protocol to promote consistent and scientifically rigorous procedures to survey for northern spotted owls. To address this concern, the Service and cooperators conducted analyses of historical survey data, leading to estimates of detection rates for spotted owls that account for the effects of barred owl presence. The professional opinion of researchers, survey practitioners, and regulators were integrated into this product, and the development of the protocol benefitted from data analysis, input, and reviews by the interagency Barred Owl Work Group. Use of the 2011 Protocol provides a methodology that results in adequate coverage and assessment of an area for the presence of spotted owls and ensures a high probability of locating resident spotted owls and identifying owl territories thereby minimizing the potential unauthorized incidental take. Spotted owl surveys that are conducted as part of demographic long-term monitoring programs is considered a reasonable alternative to the 2011 protocol (USFWS 2011, pp.4-5).

The BLM has conducted long term NSO surveys in the project area since 1991 following the 2009 USDA PNW-GTR-440 publication protocol for known NSO sites within the Klamath Province demographic study. The BLM has also conducted NSO surveys following the 2011 Protocol for Surveying Proposed Management Activities that May Impact Northern Spotted Owls (USDI/USFWS 2012) to survey spotted owl habitat for areas not covered by long term demographic surveys. Detections for NSOs and barred owls have been recorded each year, providing knowledge and experience of NSO habitat use and NSO occurrence, which has been combined with the survey protocol to produce survey results with a high level of confidence. Barred owls have been documented since 1997 in owl sites within the project area and responses are throughout the project area and within all known occupied and historical owl sites. Because the BLM is required to follow the USFWS survey protocols, it is beyond the scope of the EA to change how surveys are conducted.

Rationale: This issue was considered but not analyzed further in detail because the BLM followed NSO survey protocols approved by the USFWS. The BLM does not establish the survey protocol for NSO surveys. The project area has a long continuous history of surveying known NSO sites in the Klamath Mountains Demographic Study Area, and project area surveys continue through project implementation.

Issue B 37: How would proposed timber harvest and associated landings, road construction, and fuels reduction, affect northern spotted owl landscape dispersal?

Background: Watersheds can provide a landscape-level qualitative evaluation for dispersal function using the concepts of Thomas, et al (1990), along with more recent analyses of dispersal function per Lint, et al. (2005), Davis, et al. (2011). Davis, et al. (2016) suggested that landscapes having at least 40 percent of dispersal habitat conditions (including both older and younger forests) would be sufficient to support spotted owl dispersal for adults and juveniles across the landscape. The USFWS has generally recommended using a watershed, or larger landscapes, for assessing dispersal habitat conditions because watersheds or provinces offer a more biologically meaningful way to evaluate dispersal function. Table B-13 below provides estimates of the current spotted owl habitat conditions at the landscape 5^{th} field watershed level associated with the Last Chance project area.

Post-harvest, approximately 64 percent of federal lands in the project area (average across all watersheds) would still support and facilitate spotted owls dispersing through the landscape under the highest impact alternative (Table B-13). Each individual 5th field watershed would also have at least 60% dispersal-capable habitat or greater after project implementation under the most impactful action alterative (alternative 2a). NSOs can disperse across a fragmented mosaic of non-forested areas and a variety of forest age classes (Forsman et al. 2002). This information represents the best available habitat data and analysis approach to evaluate landscape dispersal-habitat function for spotted owls.

Table B 37.1: 5th Field Watershed Current Habitat Conditions Supporting NSO Dispersal

	Total **Watershed Acres**	**Total NRF Habitat Acres**	**Total Dispersal Acres (NRF+ Dispersal Only)**	**Percent Watershed Dispersal Habitat (NRF +Dispersal-only)**	**Proposed NRF/ Dispersal removal acres**	**Percent new watershed amounts**
Grave Creek 5th Field Watershed	104,517	36,502	67,244	64%	3,323	61%
Middle Cow Creek 5th Field Watershed	113,081	39,259	69,681	62%	2,142	60%
Upper Cow Creek	47,480	25,152	37,856	80%	299	79%

Rationale: The 5th field watersheds would retain approximately 60 percent nesting and roosting, foraging, and dispersal habitat, and substantially exceed minimum 40 percent conditions consistent with recent literature sufficient to support spotted owl dispersal across the landscape. Landscape NSO habitat conditions are expected to support the foraging and roosting, and provide opportunities for nesting, for dispersing juvenile, subadult, and adult spotted owls within occupied owl sites. Therefore, this issue would not be analyzed further.

Issue B 38: Would timber harvest, fuels reduction, and new road/landing construction affect barred owl and spotted owl encounters and interactions which could cause an increase in northern spotted owl and barred competition?

Background: In 2006, the U.S. Fish and Wildlife Service convened seven experts to identify threats to the northern spotted owl (USDI/USFWS 2011b). The experts identified past habitat loss, current habitat loss, and competition from barred owls as the most pressing threats, even though implementation of the Northwest Forest Plan reduced the rate of timber harvest on Federal lands. They noted evidence of these threats in the scientific literature. The range of threat scores by the individual experts was narrowest for barred owl competition, indicating more agreement about the threat from barred owls.

In 2014, Northern spotted owl populations were estimated to be declining across their range at an annual rate of 3.8 percent (Dugger et al., 2016; p. 70). Franklin et al. (2021) found that the declines in both apparent survival and recruitment have accelerated since 2014, resulting in further losses to NSO populations beyond those reported by Dugger et al. (2016). Most research and modeling show a general expectation of wide scale and continuing declines in spotted owl populations regardless of retention of habitat (FEIS Figure 3-188, p. 959; Wiens et al. 2014; Yackulic et al. 2019; Franklin et al. 2021). Davis et al. (2022) estimated that the range wide carrying capacity for northern spotted owls (maximum number of owl sites that could be contained in a given landscape based on biological and physical features) on federal lands has increased by 3.5 percent from 1993 to 2017, but territory occupancy had declined by approximately 62 percent.

A principal cause of the decline is competition from barred owls, which have colonized portions of Washington, Oregon, and California during the past forty years. Barred owls now occupy the entire range of the northern spotted owl, utilize all northern spotted owl habitats and prey species, displace northern spotted owls from their breeding territories, inhibit northern spotted owls from establishing new territories, and outbreed northern spotted owls (Forsman *et al.*, 2011; Van Lanen *et al*., 2011; Dugger *et al.,* 2011; Wiens *et al.,* 2014). The recent NSO metadata analysis found that barred owl occupancy had a negative effect on NSO colonization and a positive effect on extinction of spotted owl territories (Franklin et al. 2021, p. 28). Current research provides no evidence that the BLM can manage individual forest stands to provide northern spotted owls with a competitive advantage over barred owls (Dugger *et al.,* 2011; Wiens *et al.,* 2014). Instead, research reaffirms the importance of older forest conditions and managing for large blocks of unfragmented older forest (Dugger *et al.* 2011, p. 2463; FEIS p. 948, Wiens *et al,* 2014, pp. 36–38) and the implementation of a barred owl management program to support the recovery of the spotted owl (USDI/BLM 2016a, pp. 961-962).

During the development of the current RMP, the Final Environmental Impact Statement (FEIS) considered and evaluated the relationship between spotted owls, barred owls and late-successional habitat (USDI/BLM 2016a pp. 947-973). In general, the FEIS concluded there would be no discernable difference in the northern spotted owl population response under any of the alternatives or sub-alternative, the RMP, or a management scenario reflected by the No Timber Harvest reference analysis, indicating that northern spotted owl populations would not respond substantively to the different amounts and distributions of habitat provided by each alternative and the RMP (i.e., the habitat provided by each alternative and the RMP would not limit the population response). However, in each modeling region and physiographic province, the northern spotted owl population response would be substantively higher with implementation of the RMP and a barred owl control program. This indicates that, within the scope of the alternatives and the RMP, the northern spotted owl population response is determined by the effect of barred owl encounter rates on northern spotted owl survival (USDI/BLM 2016a, p. 961). Simulations for the Klamath-Siskiyou-West and Klamath-Siskiyou-East modeling regions and the Oregon Klamath Physiographic Province, show no discernable differences in northern spotted owl population responses among the alternatives and the RMP. The NSO population would continue to decline at a similar rate for the alternatives and the RMP, unless a barred owl management program was implemented (USDI/BLM 2016a, p. 961).

In summary, the northern spotted owl population is under severe biological stress in much of western Oregon, and this population risk is predominately due to competitive interactions between northern spotted owls and barred owls. Habitat management by the BLM alone would not be sufficient to produce stable populations of northern spotted owls in the Oregon Coast Range Physiographic Province, the Oregon Western Cascades Physiographic Province, and the Klamath Basin Physiographic Province within the RMP planning area (USDI/BLM 2016a , pp. 961-962). However, habitat on BLM-administered lands plays an indispensable role in northern spotted owl conservation in the Oregon Eastern Cascades Physiographic Province (USDI/BLM 2016a, p. 962). Therefore, the greatest contribution to conservation and recovery of the northern spotted owl would come from a combination of habitat management and barred owl management (USDI/BLM 2016a, Vol 4; p. 973).

Rationale: The stand treatments and associated activities would alter habitat by maintaining, or removing habitat function, but implements a fraction of the projected annual and decadal timber harvest treatment acres within structurally-complex (RA32) stands, nesting-roosting habitat, and dispersal habitat (USDI/BLM 2016a, p. 984 and p. 1774). The project presents no potential of exceeding the effects of implementing the Sustained Yield Unit's (SYU) timber harvest program of work, which was already disclosed in the RMP FEIS.

BLM avoids treatment of Recovery Action (RA32) habitat within the LSR, the Proposed Action avoids treatment of RA32 (USDI/BLM 2016b, p. 71) and nesting-roosting habitat, applying the RA32 action. The Proposed Action potentially modifies but maintains foraging habitat to increase habitat resiliency and reduce risk of loss to catastrophic wildlife (USDI/BLM 2016a, p. 930) and promote development of better foraging and nesting-roosting habitat (USDI/BLM 2016b, pp. 71-72) The LSR-Dry land use allocation creates large blocks of habitat, for developing, and maintaining, large blocks of older forests. The Proposed Action contributes to the development and maintenance of large blocks of habitat (USDI/BLM 2016b, pp. 1, 20, 22-23, and 70; USDI/BLM 2016a, pp. 929, 932-933, and 935) consistent with the PRMP FEIS analysis. The 290.5 acres of LSR commercial treatments do not exceed decadal average of 17,000 acres at the SYU. The Proposed Action avoids designing landscape-level stand prescriptions that would remove NSO habitat in the LSR that is capable of developing into nesting habitat.

With Project Design Features to align the project with RMP required management direction, the project presents no new or unique facts or circumstances that deviate from the modeling assumptions used in the RMP FEIS or would cause the SYU to harvest in excess of the projections, or commercially treat LSR inconsistent with management direction, or exceed owl effects analysis of the RMP FEIS. Therefore, it was considered but not analyzed in further detail because the effects of barred owls on spotted owls are within and would not exceed what was already analyzed in the RMP FEIS.

Issue B 39: Would the Proposed Action cause the incidental take of northern spotted owls?

Background: There are several management directions incorporated into this project from the Southwestern Oregon RMP. The BLM would not authorize timber sales that would cause the incidental take of northern spotted owl territorial pairs or resident singles from timber harvest until implementation of a barred owl management program consistent with the assumptions contained in the Biological Opinion for the RMP (USDI/BLM 2016b, p. 30). The BLM would be authorizing timber harvest that does not result in incidental take of northern spotted owls (e.g., harvest in unoccupied home ranges or harvest within occupied home ranges that does not constitute incidental take), provided that such harvest otherwise meets BLM's obligations under the ESA Section 7 (USDI/BLM 2016b, p. 30) to, "design timber harvest treatments in a manner sufficient to avoid incidental take" (USDI/BLM 2016b, p. 121).

Rationale: Effects to spotted owls were considered while planning this project. All project components were planned to avoid timber sales that would result in an "incidental take" determination by the USFWS. Therefore, the proposed treatments are designed where incidental take would be avoided, while contributing to the District's Allowable Sale Quantity and improving forest resiliency by reducing competition for resources in stands with high relative densities, which is consistent with the RMP and exemption language (RMP). The wildlife biologists, and foresters for this project worked together to design treatments in occupied spotted owl sites that would not result in an "incidental take" determination by the USFWS, and BLM conducted consultation streamlining with USFWS during project development to ensure incidental take would be avoided. Project units continue to be surveyed according to protocol through harvest implementation, and if resident owls are located, the BLM would consult with the USFWS. Units would be dropped or modified to reduce potential adverse effects and avoid incidental take to owls located at new owl sites or previously unoccupied owl sites, consistent with RMP USFWS Biological Opinion, therefore, it was considered but not analyzed in further detail.

Issue B 40: How would proposed activities affect the threatened coastal marten and its designated critical habitat?

Background: The USFWS listed the coastal distinct population segment (DPS) of the coastal marten as a threatened species under the ESA and published the rule on October 8, 2020 (Federal Register 2020b). The coastal marten selects closed-canopy, late-successional, mesic coniferous forests with complex physical structure near the ground such as dense, extensive shrub cover. Occupied serpentine habitats have open tree canopies, dense shrub cover, and an abundance of boulder piles, while non-serpentine sites have closed, multi-layered tree canopies, dense shrub cover, and older age-class stands.

Rationale: The proposed Project Area does not occur within the expected range of current southern coastal Oregon population area (USDI FWS 2018, p. 85) or designated critical habitat (USDI FWS 2024), and there are no known den sites or detections within the Proposed Action area. Adverse effects to the marten coastal distinct population segment would not occur, and there would be no impacts to coastal marten or coastal marten critical habitat, therefore it is not analyzed in further detail.

Issue B 41: How would timber harvest, activity fuels treatments, fuels maintenance treatments, and new road and landing construction affect Franklin's bumble bee (*Bombus franklini*)?

Background: The USFWS (Service) proposed to list Franklin's bumble bee as endangered on August 13, 2019 (USDI FWS 2019), and final listing decision was published on August 24th, 2021. Critical habitat has not been proposed for Franklin's bumble bee; however, High Priority Zones (HPZs) were identified. These zones contain all known historic observation locations of Franklin's bumble bee, supplemented by additional modeling of Substantial Floral Resources (SFR) and other habitat characteristics most likely to support the species within the historic range. Annual locally concentrated surveys take place in the best Franklin's bumble bee habitat in SW Oregon known to have been historically occupied (including the last known location of a Franklin's bumble bee) and these surveys have not yielded any Franklin's bumble bee detections with the last detection in 2006 on Mt Ashland, Oregon.

Franklin's bumble bees require a constant and diverse supply of flowers that bloom from spring to fall (USDI FWS 2018, p. 18), typically found in open meadows in proximity to seeps and other wet meadow environments. Information about these habitat types is not available at the level of minute scale/detail on the corporate habitat layers the District has on hand. However, for the purposes of this analysis, the BLM employed a multipronged approach to identify potential Franklin's bumble bee habitat that may occur within the planning area. First, the BLM used a broadscale vegetation type layer (Oregon Vegetation Type Cover - GAP) as a surrogate approach to estimate potential habitat. The wet meadow and sub-alpine meadow vegetation types were used as a reasonable surrogate for Franklin's bumble bee habitat. However, none of these vegetation types occur within the analysis area. Second, the BLM also reviewed GIS layers considering wetland presence, low canopy cover, past surveys, presence of other threatened pollinators, and past observations of Franklin's bumble bee when identifying potential habitat. Based on this GIS review, BLM determined approximately 737 acres of potential meadow habitat occur in the planning area. All 737 acres of potential meadow habitat fall outside of HPZs. Of these 737 acres, approximately 27 acres overlap with proposed treatment areas. These 27 acres would occur in high canopy forested or young stand environments where flowering habitat is minimal, due to limited canopy openings that would allow for the growth of SFR. While some minimal floral resources may be present, these flowering plants are unlikely to sustain a colony of bees throughout its life cycle because flowering plant numbers and diversity are low. The best available evidence indicates it is unlikely that Franklin's bumble bee would be present in the planning area. If the BLM identifies any areas with SFR within proposed treatment units, the BLM would consult with the Service and apply the PDFs (see Appendix C) as appropriate to avoid any adverse impacts.

Rationale: There are no known populations of Franklin's bumble bee and no historical records of observations in the planning area. Habitat impacts are expected to be short-term in nature, with some regrowth of shrub sprouting, germination, and flowering forb growth potentially occurring in one to two years. Selected stands for hazardous fuels reduction have already been previously treated for hazardous fuels reduction and are proposed for a maintenance re-treatment, and do not include early successional habitat or open (non-forested) meadows in proximity to seeps and other wet meadow environments and would be staggered over multiple years. Proposed harvest units are not expected to be suitable habitat capable of supporting populations, and the likelihood of adverse significant impacts to Franklin's bumble bee is extremely low, therefore, it is not analyzed in further detail.

Issue B 42: How would ground disturbance from proposed project activities and timber harvest affect Bureau Special Status wildlife species?

Background Information: Based on BLM Manual 6840 – Special Status Species Management (USDI/BLM 2008), the BLM would address Bureau Sensitive species and their habitats in land use plans and would implement measures to conserve these species and their habitats, to promote their conservation, and reduce the likelihood and need for these species to be listed under the Endangered Species Act (USDI/BLM 2016a, p. 830). The BLM conducts evaluations of the distribution, abundance, population trends, current threats, or habitat for Bureau Sensitive species using available information in regard to actions the BLM proposes to undertake, consistent with the BLM Special Status Species Management manual. The BLM may or may not conduct field surveys as part of these evaluations for Bureau Sensitive wildlife species (USDI/BLM 2016a, p. 831). BLM Manual 6840, and the RMP do not require project clearance surveys, habitat buffers, or seasonal restrictions for these species.

The PRMP modeled habitat availability for 66 Bureau Special Status Species. Thirty species (45 percent) would have no change in habitat availability because they are associated with special habitats (e.g., coastal dunes and oak woodlands) that would be protected under all alternatives. Habitat availability was modeled for 36 species occurring within forested habitat associations. The PRMP showed increase in habitat over current conditions for 34 species utilizing forest habitat structural stage associations of Early (Early Successional and Stand Establishment), Mid (Young), and Late (Mature and Structurally-complex). Two species (white-tailed deer and Siskiyou short-horned grasshopper) which would have a decrease in young stage habitat development do not occur in the project area.

For Riparian (Reserve) associated species, 100 percent of the species would have in increase in riparian habitat by 2063 and no change to wetland acres (USDI/BLM 2016a, p. 843; Appendix S, pp. 1667-1675). The BLM would manage naturally occurring special habitats, such as wetlands and natural ponds, to maintain their ecological function. Additionally, stream restoration would benefit pond turtle habitat. Stream restoration actions, such as log and boulder placement and fish passage improvements that are beneficial to fish habitat, would also result in short-term increases in sediment delivery to stream channels. Removal of culverts and other instream structures like blockages would cause stream channel disturbance during summer instream operating periods. The addition of structure to stream channels would create additional pools and slow-flowing, shallow areas. (USDI/BLM 2016a, p. 1971).

The Medford District manages T&E and Sensitive species following the BLM Manual 6840 guidance, including the information and status of the species in the Oregon/Washington State Director's Special Status Species List (USDI/BLM 2021a). For this project, various wildlife survey databases were reviewed for known locations of Bureau Special Status Species. For species not directly observed within the project area, the project wildlife biologist determined whether or not a species' known range extended into the project area, whether or not surveys located a species, and then whether or not a species' habitat was present within the project area, followed by whether or not treatment units contained habitat for a species and whether the treatment would have any substantial negative effects to the habitat and need to list the species under the ESA. Only those species that are known or suspected to occur on the Medford BLM District were assessed and the summarized results from this exercise are presented below in Table B 42.1. The full Oregon/Washington State list of current Bureau Special Status Species is located on the Interagency Special Status Species Program website, hosted by the Forest Service – https://www.fs.fed.us/r6/sfpnw/issssp/agency-policy/.

TABLE B 42.1. List of the current Bureau Sensitive Species (including Federally Threatened and Endangered) and a summary of our current knowledge regarding each species within the Last Chance FMP. See Status and Occurrence definitions below this table.

COMMON NAME	SCIENTIFIC NAME	STATUS	PROJECT OCCURENCE	NOTES
MAMMALS				
Gray wolf	*Canis lupus*	FE	Absent	All current gray wolf sightings in SW OR have generally been north or east of I-5, in the Cascade mountain foothills. No known occurrences in planning area.
Coastal Marten	*Martes caurina humboldtensis*	FT	Absent	Planning area is outside of designated coastal marten Extant Population Areas or known detections for coastal marten. No detections in project units or planning area. PDF's reduce impact to habitat (PDFs 32-38; where applicable).
Fisher	*Pekania pennanti*	SEN (FC)	Suspected	Planning area is outside of known distribution regionally. No verified detections in project units or planning area. PDF's reduce impact to habitat (PDFs 32-38;47 where applicable)
Fringed myotis	*Myotis thysanodes*	SEN	Suspected	Species known to occur across general region, no known occurrences in proposed treatment areas. PDFs for snag retention (PDFs 33-38) should minimize effects to potential roost sites.
Townsend's big-eared bat	*Corynorhinus townsendii*	SEN	Suspected	Species known to occur across general region, no known occurrences in proposed treatment areas. Records outside of project units in 33S-05W-22. Project would not affect primary habitat (caves and historic buildings).
Pallid bat	*Antrozous pallidus*	SEN	Suspected	Species known to occur across general region, no known occurrences in proposed treatment areas. PDFs for snag retention (PDFs 33-38) should minimize effects to potential roost sites.
BIRDS				
Marbled murrelet	*Brachyramphus marmoratus*	FT	Absent	Planning area outside of known range.

Northern Spotted Owl	*Strix occidentalis caurina*	FT	Known	Many historic sites across planning area, more details provided in NSO section issue NAID 31-32, p. XX. PDFs 41-45 minimize project level impacts.
Bald eagle	*Haliaeetus leucocephalus*	EPA, SEN	Known	One historic territory (two nest trees) within planning area. Project Design Features (PDFs 46-47) for this species would reduce direct effects.
Lewis's woodpecker	*Melanerpes lewis*	SEN	Suspected	Mostly associated with oak woodland & pine habitats. Treatments would have little to no effect to primary habitat.
White-headed woodpecker	*Picoides albolarvatus*	SEN	Absent	Post-fire ecosystem associated / east side of cascades. Not present in project units.
Oregon vesper sparrow	*Pooecetes gramineus affinis*	OR-SEN	Absent	Associated with grasslands with high structural diversity for foraging and nesting. These typically include grassy areas interspersed with trees and shrubs and some bare ground. No known occurrences in planning area. Closest known site is within the Cascade Siskiyou National Monument. See Wildlife NAID #6 (EA p. 275).
Tricolored blackbird	*Agelaius tricolor*	OR-SEN	Unknown	Not upland forest associate and should be absent from project units. No known occurrences in planning area. See Wildlife NAID #6 (EA p. 275).
Purple martin	*Progne subis*	OR-SEN	Unknown	Not upland forest associate and should be absent from project units No known occurrences in planning area. See Wildlife NAID #6 (EA p. 275).
Grasshopper sparrow	*Ammodramus savannarum*	OR-SEN	Unknown	Not upland forest associate and should be absent from project units. No known occurrences in planning area. See Wildlife NAID #6 (EA p. 275).

American white pelican	*Pelecanus erythrorhynchos*	SEN	Absent	Nest on Islands in remote brackish and freshwater lakes of inland North America. Not upland forest associate and absent from project units.
REPTILES & AMPHIBIANS				
Northwestern pond turtle	*Actinemys marmorata*	SEN (FP)	Present	Associated with ponds, rivers, and/or large waterbodies. No direct impacts to aquatic habitat from project activities. See Wildlife NAID #X (EA p. XXX).
Siskiyou mountains salamander	*Plethodon stormi*	SEN	Absent	Planning area outside of known range.
Black salamander	*Aneides flavipunctatus*	SEN	Absent	Planning area outside of known range.
Foothill yellow-legged frog	*Rana boylii*	SEN	Suspected	Could be present in larger riparian zones, but no direct impacts from project; PDFs for aquatics (PDFs XX) mitigate direct effects to this species.
Oregon spotted frog	*Rana pretiosa*	FT	Absent	Planning area outside of known range. East side species, closest known site is within the Cascade Siskiyou National Monument.
INVERTEBRATES				
Vernal pool fairy shrimp	*Branchinecta lynchi*	FT	Absent	Small freshwater crustacean found in vernal pool habitat. Planning area outside of known range.
Franklin's Bumble bee	*Bombus franklini*	FE	Absent	Associated with grassy coastal prairies and coast range mountain meadows, near seeps and other wet meadow environments with floral resources for nectaring flowering throughout the spring and summer. Last known sighting 2006. No known occurrences in planning area. SEE NAID #

Western bumble bee	*Bombus occidentalis*	SEN	Suspected	Western bumble bees use a wide variety of natural, agricultural, urban, and rural habitat types. They are now largely confined to high-elevation sites and areas east of the Cascade Crest. No known occurrences in planning area. PDFs 291, E3
Monarch butterfly	*Danaus plexippus*	SEN	Known	Summer migrant; larval foodplant is milkweed (*Asclepias* sp.), adults nectar on a variety of flowering plants. Project units should not contain primary habitat, therefore no direct impacts to this species.
Gray-blue butterfly	*Plebejus podarce klamathensis*	SEN	Absent	High elevation sub-alpine associate. No habitat in planning area.
Mardon skipper	*Polites mardon*	SEN	Absent	Small skipper found on prairies populated by native grasses such as Roemer's fescue (*Festuca roemeri*) and red fescue (*Festuca rubra*). Planning area outside of known range.
Coronis fritillary	*Speyeria coronis coronis*	SEN	Absent	Large butterfly associated with serpentine influenced, rocky hill-slopes dominated by Jeffery pine (*Pinus jeffreyi*) and other serpentine associated forbes and grasses. Project units do not contain primary habitat. No known occurrences in planning area.
Oregon branded skipper	*Hesperia colorado oregonia*	SEN	Absent	Small skipper associated with sparsely vegetated Garry Oak (*Quercus garryana*) and coastal sand spit ecosystems. Planning area outside of known range.
Johnson's hairstreak	*Callophrys johnsoni*	SEN	Suspected	Old-growth conifer mistletoe associate. No known occurrences in planning area.
Siskiyou short-horned grasshopper	*Chloealtis aspasma*	SEN	Suspected	Associated with forest meadows and openings, often along edges of forests and upland of wetlands. No known occurrences in planning area.

Oregon shoulderband	*Helminthoglypta hertleini*	SEN	Unknown	Terrestrial snail generally associated with open, grassy meadows with talus. Project should not affect primary habitat. No known occurrences in planning area.
Highcap lanx	*Lanx alta*	SEN	Unknown	Small freshwater clam. Inhabits spring-influenced areas of larger rivers and tributaries. No known occurrences in planning area. PDFs for aquatics (PDFs XX) should mitigate direct effects to this species if present.
Scalloped Juga	*Juga acutifilosa*	SEN	Unknown	Medium-sized freshwater gilled snail. Closest known site is within the Cascade Siskiyou National Monument. No known occurrences in planning area. PDFs for aquatics (PDFs XX) should mitigate direct effects to this species if present.
Crater Lake tightcoil	*Pristiloma crateris*	SEN	Unknown	Terrestrial snail generally found in riparian areas, wet meadows, and moist forests, often among shrubs and at the bases of plants. No known occurrences in planning area.
Dalles hesperian	*Vespericola depressus*	SEN	Unknown	Terrestrial snail associated with moist forests. Only 16 confirmed records in Oregon. No known occurrences in planning area.
Siskiyou hesperian	*Vespericola sierranus*	SEN	Unknown	Terrestrial snail associated with riparian zones, found in perennially moist habitat, including spring seeps and deep leaf litter along streambanks and under debris and rocks. Moist valley, ravine, gorge, or talus sites are preferred, near the lower portions of slopes in areas that are not subject to regular flooding. No known occurrences in planning area.

Table B.42.1. Definitions:

Status:

FT – Federally Threatened under ESA.

FE – Federally Endangered under ESA.

SEN – Bureau Sensitive Species

OR-SEN - *Sensitive only in Oregon*

EPA – Bald and Golden Eagle Protection Act

FC – Candidate for listing (nominated)

FP – Proposed for listing (under 12 mo. review)

Occurrence:

Absent – does not occur within the Project Area (PA).

Known – Species is known to occur in the PA

Suspected – Species has not been formally documented to occur within the PA, but reasonable potential to exist based on habitat.

Unknown – Insufficient information available to make precise determination.

Under Alternative 2, for species dependent upon forested late-successional characteristics and large conifer/hardwood structure, unique stand features such as snags, large down woody material, large hardwoods, and legacy trees would be retained to maintain desired structural components and provide habitat for wildlife in treated stands (Section 3.2 and Section 3.3 of land use allocation management direction/objectives).

Up to 3,580 acres of late-successional habitat which is approximately 80 years old or older, also habitat that may function as NSO NRF which has been calculated for the project area (approximately 15.6 percent of the NSO NRF in the project area), would be removed or substantially changed by treatments that would result in downgrading/removal of habitat under the highest impact possible (alternative 2). However, occurrence of these species within the Last Chance project area would continue because there would still be up to approximately 19,339 acres retained in the project area exhibiting these late-successional characteristics, and long-term development of Riparian Reserve, and Late-Successional Reserve habitat would increase for these species as forecasted in the FEIS. Project design features and RMP management directions, such as the retention of key structural elements of legacy pine/fir trees, snags, large down woody material, large hardwoods, and untreated skip areas, or modified prescriptions would retain important features within in Late-Successional, Riparian Reserve, and Harvest Land Base treatment areas for known populations of these species, and still provide habitat in addition to untreated areas.

Under Alternative 2, no stand level structural change would occur to Riparian Reserves within the Inner Zones. For Riparian Reserve associated species, 100 percent of the species would have an increase in riparian habitat by 2063 and no change to wetland acres (USDI/BLM, p. 843; Appendix S, pp.1667-1675).

Rationale: For Bureau Sensitive species with strong wetland or riparian association (foothill yellow-legged frog, western pond turtles, Siskiyou hesperian), the Riparian Reserves/wetland throughout the project area would continue to function as habitat for these species. Long-term resilience and development of Riparian Reserve and Late-Successional Reserve habitat would increase as forecasted in the FEIS. RMP management direction, such as the retention of key structural elements would retain important features within in Late-Successional Reserve, Riparian Reserve, and Harvest Land Base treatment areas for these species, and still provide habitat in addition to untreated areas.

The Proposed Action utilizes the prescriptions parameters from the RMP land use allocation management direction and does not exceed decadal Harvest Land Base SYU harvest levels and Late-Successional Reserve decadal commercial treatment acres. Therefore, the conclusions in this EA are consistent with FEIS modeling analysis and forecasting and would not contribute to the need to list these species under the ESA as threatened or endangered. Therefore, this issue was considered but not analyzed in further detail.

Issue B 43: How would timber harvest, fuels reduction, and new road and landing construction affect migratory bird/landbird focal species/BLM/USFWS bird species of concern?

Background: The RMP (USDI/BLM 2016b, p. 114) stated Wildlife management objectives:

Implement conservation measures that reduce or eliminate threats to Bureau Sensitive species to minimize the likelihood of and need for the ESA listing of these species.

Conserve or create habitat for species addressed by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act and the ecosystems on which they depend.

Direction in the Memorandum of Understanding between the BLM and USFWS to promote the conservation of migratory birds (BLM MOU WO-230-2010-04) states that the BLM shall address the conservation of migratory bird habitat and populations when developing, amending, or revising management plans for BLM-administered lands (USDI/BLM 2016a, p. 832). All alternatives and the RMP would lead to an increase in habitat for a majority of Bureau Sensitive and landbird focal species in 50 years. Under all alternatives and the RMP, the distribution of structural stages in the decision area in 50 years would be within the range of the average historic conditions, increasing the habitat availability for many Bureau Sensitive, Bureau Strategic, and Survey and Manage species. The BLM revised the Bureau Sensitive and Bureau Strategic wildlife species considered in this analysis based on the updated State Director's Special Status Species List (July 13, 2015) (USDI/BLM 2016a, p. 830). A New State Director's Special Status Species List was published March 2019 (IM No. OR-2019-003).

Oregon-Washington Partners in Flight, the American Bird Conservancy, and the Klamath Bird Observatory have prepared a series of conservation plans for landbirds intended to inform planning efforts and habitat management actions (Altman and Alexander, 2012). The strategy for achieving functioning ecosystems for landbirds is described through the habitat requirements of 'focal species. By managing for a suite of species representative of important habitat attributes in functioning ecosystems, many other species and elements of biodiversity could also be conserved. Inclusion of these focal species in the analysis could help inform what the differences in effects amongst the alternatives and the RMP are for landbirds, as well as the habitat attributes and forest stages and ecosystems they represent (USDI/BLM 2016a, p. 832).

In the FEIS analysis, the BLM assumed that the structural stages used in the vegetation modeling represent habitat conditions for Bureau Sensitive and landbird focal species; this modeling is based on structural stage output from the vegetation model and using the analytical assumptions of habitat relationships described in Appendix S of the FEIS. The BLM combined the issues of habitat availability for Bureau Sensitive and landbird focal species into one issue, because the analytical procedures used were similar and the discussion of results would be similar for species with similar habitat associations. The BLM tabulated the amount of Early Successional, Stand Establishment, Young, Mature, and Structurally-complex structural stages that would be available in 50 years under the alternatives and the RMP. The BLM also generalized habitat associations for the species considered into one of seven broad categories: Early Successional or Stand Establishment habitat associate (early), Young habitat associate (mid), Mature or Structurally-complex habitat associate (late), non-forest associate (NF), oak woodland associate (oak), wetland associate (wet), and stream or near-stream associate with riparian (RR).

The RMP would lead to an increase in the development of Mature and Structurally-complex habitat through 2063, decrease of Stand Establishment (early and mid-seral) habitat from 18 percent to 1–8 percent of habitat-capable acres in 50 years, 69–73 percent of species associated with Early Successional habitats would have an increase in habitat availability, RMP would result in a decrease of Young forest habitat from 29 percent to 17 percent of habitat-capable acres in 50 years (USDI/BLM 2016a, pp. 839-840).

Under the RMP, the proportion of wildlife species that the BLM modeled as using Mature and Structurally-complex habitat would have increased availability, for at least 97 percent of the species compared to the No Action Alternative, and 100 percent increased habitat for riparian associated Bureau Sensitive species. The RMP would lead to an increase in habitat in 50 years for 34 of the 66 Bureau Sensitive species for whom habitat was modeled, compared to 35 for the No Action Alternative (USDI/BLM 2016a, p. 845). An additional 45 percent (30) of Bureau Sensitive species would have no change in habitat availability, because they are associated with special habitats (e.g., coastal dunes and oak woodlands) that would be protected under all alternatives and the RMP.

The RMP would lead to an increase in habitat in 50 years for a majority (26) of the 34 landbird focal species for whom habitat was modeled, equal to the number of species in the No Action Alternative (USDI/BLM 2016a, p. 850), and twice as many as the No Timber Harvest Alternative. Of 8 species with declining or slightly declining habitat, all areas are early successional habitat groups. The purple finch, also a USFWS Birds of Conservation Concern (BCC) species would have slightly declining habitat (young high-density, mature multilayered, structurally complex) at 97 percent (USDI/BLM 2016a, Appendix S Table S-33 p.1667 and S-37 p.1691).

The BLM would manage landbird species under the Migratory Bird Treaty Act and following guidance provided by WO IB 2010-110, the Memorandum of Understanding between the BLM and USFWS to promote the conservation of migratory birds (August 31, 2010). At the project level, the BLM would implement measures to lessen take of migratory birds under the Migratory Bird Treaty Act focusing on species of concern as identified by the BLM and USFWS (USDI BLM 2016a, p. 851). USFWS BCC potentially breeding in the project area and effected by the Proposed Action include: Peregrine Falcon, Rufous Hummingbird, Allen's Hummingbird, Olive-sided Flycatcher, Willow Flycatcher (c), Horned Lark, Oregon Vesper Sparrow, and Purple Finch. None of these BCC species are closely associated with dense or closed canopy coniferous forests in the project area. One peregrine falcon site within the project area is managed with a seasonal disturbance restriction (EA, Appendix B). Commercial harvest and hazardous fuels reduction treatments would be staggered over a period of several years in multiple projects, and seasonal restrictions that were developed to minimize effects to northern spotted owls and peregrine falcon would also benefit migratory birds and minimize the amount of disturbance during their nesting season.

Snags: In the FEIS wildlife analysis, the effects and development of complex early successional stand development are discussed under Snags and Down Woody Material (e.g., effect to species associated with snags and down woody material in younger stands). See Appendix C of the RMP for additional details on the Forest Structural Stage Classification. Habitat for species associated with snags and down woody material in younger stands, would increase under the RMP (USDI/BLM 2016a, p. 843). Habitat for species associated with legacy structures in older stands would have an increase in habitat under the RMP (USDI/BLM 2016a, p. 844).

The RMP included snag retention and creation targets based on the desired conditions for wildlife species as interpreted from the Decayed Wood Advisor (DecAID) (Mellen-McLean *et al*., 2012) in conjunction with estimates of the current abundance of snags and down wood from the Current Vegetation Survey inventory plots (see the Snags and Down Woody Material section of Appendix S (USDI/BLM 2016a, pp. 1663-1666 and 1972).

The BLM developed snag and down woody material creation targets by comparing the number of existing snags and down wood against desired amounts and any deficits from the desired condition was used as a creation target for silvicultural treatments (USDI/BLM 2016a, p.1663). The Last Chance project applies the RMP management direction for the retention of snags and for snag creation level (USDI/BLM 2016b, p. 63 and 73-74).

Rationale: The Proposed Action follows RMP prescriptions and snag retention management direction, therefore, long-term habitat structure supporting cavity nesting birds is expected to continue to increase for species using mature and structurally-complex habitat, and decrease for stand establishment (early and mid-seral) habitat. This is consistent with the FEIS snag analysis, and effects to bird species using snags are not expected to exceed what was already analyzed in the FEIS. The breeding range of Bureau Sensitive cavity nesters is not expected to occur within the project area, therefore the project is not expected to contribute to listing cavity nesting birds under the ESA. Bureau Sensitive species, USFWS BCC, and bird Focal Species associated with mature and complex habitat are expected to increase, with long-term development of these habitats, while species associated with young seral forest habitat would decrease, as analyzed in the FEIS but still provide early seral habitat. Therefore, this issue was considered but not analyzed in further detail.

Issue B 44: How would the proposed activities affect the Pacific fisher?

Background: The fisher was proposed for federal-listing in 2019 (USDI FWS 2019b). After completing a full review of the species, including an assessment of the current population and distribution as well as a threat and long-term population viability assessment, the USFWS determined that the Northern California/Southern Oregon (NCSO) distinct population segment (DPS) of the fisher did not warrant listing under the ESA on May 15, 2020 (Federal Register 2020a). The Proposed RMP would result in an increase in total fisher habitat from 571,355 acres to 612,265 acres and denning, resting, foraging habitat from 319,503 acres to 366,541 acres on BLM-administered lands in 50 years, and exceeds the No Action reference analysis (USDI/BLM 2016a, pp. 874-875). The FEIS analysis concluded that the RMP would not reduce the fisher population below any known, critical population thresholds, the RMP would result in a slight increase in fisher populations in 50 years, and that the RMP would contribute to fisher population increases over time and would contribute to larger population increases (USDI/BLM 2016a, p. 879).

Fisher (*Pekania pennanti*) use forests with dense canopy closure and multiple canopy layers, large diameter conifers and hardwoods and snags with cavities and other deformities, and large diameter down wood with cavities. Surveys conducted by BLM and by an OSU survey team across many years have not detected fishers within the project area. There are no known or suspected natal or maternal denning sites in the project area for management (USDI/BLM 2016a, p. 117).

Rationale: The proposed project treatments would not occur near any credible observations of fisher, and there are no known den sites within the Proposed Action area. If a fisher den site is located within the Proposed Action area project specific BMPs would be implemented to mitigate any direct effects to fisher den sites and therefore it is not analyzed in further detail.

Issue B 45: Is the BLM required to analyze for species which are not federally listed or Bureau Sensitive species?

Background: During external scoping for this project commenters requested that the BLM not limit the project's impact analysis to federal listed or Bureau Sensitive species.

Rationale: The BLM's Special Status Species Policy in the BLM Handbook (6840) does not require pre-project surveys or analysis for species which are not threatened and endangered, candidate, or bureau sensitive species. Other Agencies produce species lists for guidance that are not Bureau Policy, but aide in meeting other regulations such as the Migratory Bird Treaty Act. For wildlife species in addition to Bureau Sensitive Species, see the Wildlife Bureau Sensitive Species/Bird Focal Species/USFWS Birds of Conservation Concern Issue addressed in that issue. Therefore, the issue is not analyzed in further detail.

Issue B 46: How would proposed changes in forest canopy and structure from timber harvest, fuels reduction, and roadwork activities affect woodpeckers, cavity nesters, and snags?

Background: The FEIS analysis, assumed that the structural stages used in the vegetation modeling represent habitat conditions for Bureau Sensitive species, and migratory birds, USFWS bird species of concern and landbird focal species; this modeling is based on structural stage output from the vegetation model and using the analytical assumptions of habitat relationships described in Appendix S of FEIS. The BLM combined species of concern as identified by the BLM and USFWS, and the issues of habitat availability into one issue, because the analytical procedures used were similar and the discussion of results would be similar for species with similar habitat associations. See Issue B 47 below.

Issue B 47: How would fragmentation from timber harvest affect wildlife species and their habitat?

Background: Fragmentation for late-successional forest is a term that is used to describe the creation of smaller patches or blocks of late-successional habitat from what was previously larger contiguous landscape of late-successional habitat. Disjunct small openings within a large block of late-successional habitat create diversity of habitats but not fragmentation. Fragmentation occurs where a patch of late-successional habitat is surrounded by younger successional stage habitat and when the habitat removal and edge effects reduce interior late-successional habitat, resulting in a stand net loss of habitat.

Timber harvest, past wildfires and fire suppression, and road, landing, and gravel pit constructions throughout the planning area have fragmented forest stands. This is largely due to the mixed checkerboard ownership and intensive forest management on non-BLM land. Timber harvest on BLM-administered lands for decades, has also fragmented stands and changed the distribution and abundance of wildlife species within the analysis area. The habitat loss has negatively affected late-successional forest habitat-dependent species by reducing the size and amount of late seral stage stands. Harvest prescriptions in some stands have reduced stand complexity through intensive harvesting or reduced or modified stand components such as dying trees, large snags or coarse wood, through thinning to remove suppressed or less vigorous individuals, simplifying the stand structure. Bureau and USFWS special status species that are associated with or rely on open, early seral and younger forested conditions and edge habitat, however, have benefited from these changes due to the increased acres of young seral stands and benefit Bureau and USFWS special status species that rely on early seral and open conditions. Changes to habitat from past actions are accounted for in the NSO habitat baseline update, which was used to calculate the general current habitat conditions and late-successional habitat within the analysis area.

Private lands within the analysis area are dominated by early and mid-seral forests, agricultural, and shrub/oak lands. Most private commercial forestlands are managed as tree plantations for production of wood fiber on forest rotations, with approximately 40 to 60-year rotations. It is expected that any remaining late-seral forests on private timberlands would be converted to early-seral forest over the next one or two decades. Federal ownership within the NSO analysis area is limited at approximately 38 percent, therefore, intensive forest management practices on non-federal land is expected to have the majority of the contribution to landscape habitat loss and fragmentation from forest thinning and removal, using standard intensive forest management practices rather than ecological forestry principles. For those species dependent on early-seral habitat, private forestlands do not always provide quality habitat as competing vegetation that includes flowering plants, shrubs and hardwood trees are regularly treated to reduce competition with future harvestable trees.

Rationale: Forest fragmentation refers to a loss of forest habitat and the division of the remaining forest into smaller blocks, and the effects are species dependent. The effects of habitat loss to special status species is considered under those species which adverse effects may occur and contribute to the need to list species as threatened or endangered, or may result in incidental take of federal listed species. The proposed actions follow prescriptions and management directions as outlined in the RMP for HLB and Reserves LUA and are within the FEIS analysis and forecast for Bureau sensitive species, migratory bird, landbird focal species, and BLM/USFWS bird species of concern, and are consulted on with FWS to avoid incidental take of listed species, therefore, the issue of fragmentation to forest habitat is not considered further.

Visual Resources, Recreation, and Protected Areas

Issue B 48: How would the proposed forest management and associate roadwork operations affect dispersed recreational activity throughout the project area, as well as unauthorized off-highway vehicle use post treatment?

Background: As part of the RMP, the BLM has designated portions of BLM-administered lands for recreation opportunities. Within each of these designated areas, the BLM has established recreation and visitor service objectives and identified supporting management actions and allowable uses. BLM-administered land designated for recreation opportunities are categorized into two recreation management areas: Extensive Recreation Management Areas (ERMAs) and Special Recreation Management Areas (SRMAs) (USDI/BLM 2016b, p. 259).

ERMAs are an administrative unit that requires specific management consideration to address recreation use, demand, and recreation and visitor services program investments. Management of ERMAs is commensurate with the management of other resources and resource uses. SRMAs are an administrative unit where the existing recreation opportunities and recreation setting characteristics are recognized for their unique value, importance, and distinctiveness as compared to other areas used for recreation. Within SRMAs, where specific recreation opportunities and recreation setting characteristics are managed and protected on a long-term basis, recreation is the predominant land-use focus. There are no ERMAs in the Last Chance project area, and two designated SRMAs, the Burma Pond SRMA and King Mountain Trail SRMA.

The above mentioned SRMAs were analyzed in detail in the Environmental Assessment and won't be discussed further in this section. Recreational use in the remainder of the project area is generally low and dispersed in nature, consisting primarily of hunting, dispersed camping, driving for pleasure, and exploration. It is not expected that there would be any appreciable effects to recreational opportunities on the remainder of BLM-administered lands in the project area.

Forest management and associated roadwork operations have the potential to disrupt dispersed recreational activities in the following ways:

1) during harvest, noise from trucks and equipment could discourage recreational use of some areas;
2) truck and equipment noise from timber harvest and fuels treatment activity during the fall hunting seasons could scare game and cause them to leave the area proximate to treatment activity, which may negatively affect hunters' experiences by making game more difficult to locate and harvest;
3) treatments occurring adjacent to roads or trails may negatively affect the experience of those exploring the area or temporarily limit camping experiences; and
4) treatments have the potential, albeit low, to 'open up' land to off-highway vehicle intrusions.

Rationale: This issue was considered but eliminated from further detailed analysis because of the dispersed nature of the proposed treatments, and incorporation of Project Design Features and Best Management Practices that would limit unauthorized OHV use post treatment. PDFs that would address potential OHV use post treatment include decommissioning of temporary roads, blocking skid trails at end of use, covering with slash, and closing, blocking, and rehabilitating any unauthorized vehicular intrusions.

Effects to dispersed recreational activities would be low due to the dispersed nature of the proposed treatments spread widely across the project area. Only a portion of the BLM-administered lands in the project area are proposed for forest management treatments which would leave the remainder of the BLM-administered lands available for dispersed recreation. Additionally, treatments would occur in different locations over a period of 3 to 5 years, the average length of a timber sale contract. While there is the potential that some recreationists may be discouraged from recreating near treatment areas during timber harvest, there are numerous other areas that recreationists could hike, hunt, bird watch, etc. in the project area and beyond.

Issue B 49: How would the proposed forest management and associated roadwork operations affect Visual Resources within the project area?

Background: The RMP states that scenic values on public lands are to be protected (RMP, p. 113). Visual Resource Management (VRM) is how BLM implements the management of scenic values. There are four

(I-IV) VRM classes where Class I should have minimal modification to the landscape scenery while Class IV could have major modifications to the landscape scenery. The BLM lands in the Last Chance project area are predominantly Class IV, with a few small blocks of Class III. The descriptions below explain the allowable levels of modification within these classes (USDI/BLM 2016b, p. 114):

- VRM Class III – manage areas for moderate levels of change to the characteristic landscape. Management activities will attract attention but will not dominate the view of the casual observer.
- VRM Class IV – management activities may dominate the view and will be the major focus of viewer attention.

There are no proposed timber harvest, fuels reduction, or associated roadwork operations on BLM-administered lands classified as VRM Class I or II. In the early planning stages, the project units were modified to exclude certain BLM-administered lands, such as SRMAs, to protect the sensitive recreation and scenic values on those lands.

A Visual Contrast Rating (VCR), a scenic value assessment, was conducted during project planning to evaluate the potential effects of the Proposed Action on BLM-administered lands. In the greater project area, there are approximately 886 acres of VRM class III and 31,385 acres of VRM class IV BLM managed lands. Of these lands, approximately 11,686 acres are proposed for forest management treatments, and are predominantly VRM Class IV. Of proposed treatment acres, 162 acres of VRM Class III are proposed for commercial harvest, and 276 acres of Class III are proposed for fuels maintenance treatments. The remainder of proposed treatments are on VRM Class IV lands. Key Observation Points including highly travelled routes such as I-5, designated trailheads, and access routes leading to SRMAs were chosen for the assessment. Lands within the SRMAs are not proposed for timber sales under this project.

Rationale: This issue was considered but eliminated from further detailed analysis because the Proposed Action would not significantly impact the scenic values of the VRM class III or IV lands within the project area. The Proposed Action would not draw attention from the casual observer due to the existing contrast of treated lands and because the project cannot be viewed from major travel corridors or communities. The project may be observed for short periods of time while travelling through the project area on logging roads. Project activities would occur on BLM lands, with many parcels adjacent to private or public lands where timber harvest has occurred in the past. Many access routes pass through previously treated lands, which is a typical and characteristic landscape in the project area. Project design features such as reclamation of skid trails and landings, skips, varied prescriptions for percentage canopy cover retention, retention of larger trees, hydrology buffers, and soil buffers would minimize any visual impacts both short term, and long term. The project as proposed would not exceed allowable change in visual contrast and would meet all VRM objectives for both Class III and Class IV.

Issue B 50: How would the Proposed Action affect the preservation of Lands with Wilderness Characteristics (LWC) or Wild and Scenic Rivers (WSR)?

Background: The BLM signed the Southwestern Oregon ROD/RMP on August 5, 2016. The approved RMP provides overall direction for the management of all resources on BLM-administered lands and established land use allocations which direct future uses for the purposes of achieving the various RMP objectives. For the purpose of preserving wilderness characteristics for the long term, the Southwestern Oregon RMP designated District Designated Reserve-Lands Managed for their Wilderness Characteristics (DDR-LMWC). These areas were deemed to have roadlessness, naturalness, opportunities for solitude, and primitive unconfined recreation, and identified supplemental values. There are no DDR-LMWC designated areas within the Project Area.

Similarly, in the RMP, the land use allocation for designated and suitable Wild and Scenic Rivers (WSR) are considered in the Congressionally Reserved Lands and National Conservation Lands. WSRs are a system of nationally designated rivers and their immediate environments that have outstanding scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values and are preserved in a free-flowing condition. There are no designated or suitable WSRs in the project area.

Rationale: This issue was considered but eliminated from further detailed analysis because there is no District Designated Reserve Lands Managed for their Wilderness Characteristics (DDR-LMWC) within the project area. Also, there are no designated or suitable Wild and Scenic Rivers in the project area.

APPENDIX C: BEST MANAGEMENT PRACTICES AND PROJECT DESIGN FEATURES

Best Management Practices BMPs are designed to prevent and reduce nonpoint source pollution and maintain water quality at the highest practicable level to meet water quality standards and not to exceed Total Maximum Daily Level (TMDL) loads as set by Oregon Department of Environmental Quality (USDI/BLM 2016b, pp. 163-164). The BMPs would be monitored and, where necessary, modified to ensure compliance with Oregon Water Quality Standards (USDI/BLM 2016b, p. 165). A recent comprehensive evaluation of scientific literature found that BMPs based on physical principles continue to be effective in reducing non-point source pollution with the passage of time (Cristan et al., 2016).

The BMP listed below are organized by core activities (USDI/BLM 2016b, pp. 165-166). This EA uses the same list of core activities as the RMP, excluding those which are irrelevant to the analysis. The pertinent core activities are road and landing maintenance and construction, timber harvest activities, silvicultural activities, fire and fuels management, surface water sources for drinking water, recreation management, spill prevention and abatement, restoration activities, and dry forest specific BMPs. The applicable BMPs are identified by the “BMP Number” and these citations correspond to the BMP numbers listed in the tables in Appendix C of the RMP.

Project Design Features (PDFs) are an integral part of the alternatives and are considered in the analysis of project impacts. They are developed to avoid or reduce the potential for adverse impacts to resources. PDFs include seasonal restrictions on many activities that help minimize erosion and reduce disturbance to wildlife. PDFs also outline protective buffers for sensitive species, mandate the retention of snags, and delineate many measures for protecting streams and wetland features. PDFs are often site-specific applications of principles described in the BMP list. They are standard operating procedures that reflect the Management Objectives and Directions in the RMP. The PDFs listed below would be carried forward and become required specifications in timber harvest contracts. The BLM contract administrators and inspectors monitor operations to ensure that contract specifications are implemented as designed.

Best Management Practices

Table C-1: Roads and Landings

BMP Number	Best Management Practice	Applicable to this Project?
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).	X
R 02	Locate temporary and permanent road construction or improvement to minimize the number of stream crossings.	X
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.	X
R 04	Locate roads and landings to reduce total transportation system mileage. Renovate or improve existing roads or landings when it would cause less adverse environmental impact than new construction. Where roads traverse land in another ownership, investigate options for using those roads before constructing new roads.	X
R 05	Design roads to the minimum width needed for the intended use.	X

BMP Number	Best Management Practice	Applicable to this Project?
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.	X
R 07	Design road cut and fill slopes with stable angles, to reduce erosion and prevent slope failure.	X
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.	X
R 09	Construct road fills to prevent fill failure using inorganic material, compaction, buttressing, sub-surface drainage, rock facing, or other effective means.	X
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.	X
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.	X
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.	X
Permanent Stream Crossings		
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.	X
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.	X

BMP Number	Best Management Practice	Applicable to this Project?
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 (USDI/USFWS 2013) fish passage criteria and state fish passage criteria.	X
R 18	Design stream crossings to minimize diversion potential if 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.	X
R 19	Design stream crossings to prevent diversion of water from streams into downgrade road ditches or down road surfaces.	X
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.	X
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.	X
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.	X
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.	X
R 25	Install stream crossing structures before heavy equipment moves beyond the crossing area.	X
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.	X
Temporary Stream Crossings for Roads and Skid Trails		

BMP Number	Best Management Practice	Applicable to this Project?
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.	X
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.	X
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.	X
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.	X
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.	X
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.	X
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.	X
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.	X
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.	X
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.	X
R 37	Divert road and landing runoff water away from headwalls, slide areas, high landslide hazard locations, or steep erodible fill slopes.	X
R 38	Design landings to disperse surface water to vegetated stable areas.	X
Cross Drains		

BMP Number	Best Management Practice	Applicable to this Project?
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.	X
R 40	Space cross drain culverts at intervals enough 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.	X
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”.	X
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.	X
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.	X
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.	X
R 45	Cut protruding shotgun culverts at the fill surface or existing ground. Install downspout or energy dissipaters to prevent erosion.	X
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.	X
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.	X
Timing of In-water Work		
R 48	Conduct all nonemergency in-water work during the ODFW instream work window unless a waiver is obtained from permitting agencies.	X

BMP Number	Best Management Practice	Applicable to this Project?
	Avoid winter sediment and turbidity entering streams during in-water work to the extent practicable.	
R 49	Remove stream crossing culverts and entire in-channel fill material during ODFW instream work period.	X
Low-water Ford Stream Crossings		
R 50	Harden low-water ford approaches with durable materials. Provide cross drainage on approaches. Limit ford crossings to the ODFW instream work period.	X
Maintaining Water Quality -Non-native Invasive Plants, including 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.	X
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.	X
R 55	Direct pass-through flow or overflow from in-channel and any connected off-channel water developments back into the stream.	X
R 56	Direct overflow from water harvesting ponds to a safe non-eroding dissipation area, and not into a stream channel.	X
R 57	Limit the construction of temporary in-channel water drafting sites. Develop permanent water sources outside of stream channels and wetlands.	X
R 58	Do not place pump intakes on the substrate or edges of the stream channel. When placing intakes instream, 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.	X
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.	X
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.	X
Erosion Control Measures		

BMP Number	Best Management Practice	Applicable to this Project?
R 61	During roadside brushing, remove vegetation by cutting rather than uprooting.	X
R 63	Apply native seed and certified weed-free mulch to cut and fill slopes, ditch lines, 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.	X
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.	X
R 65	Use biotechnical stabilization and soil bioengineering techniques to control bank erosion (e.g., commercially produced matting and blankets, dead plant material, rock, and other inert structures).	X
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.	X
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/yd2 of road surface, assuming a 50:50 (lignin sulfonate to water) solution.	X
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 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	X

BMP Number	Best Management Practice	Applicable to this Project?
	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).	
R 70	Retain ground cover in ditch lines, except where sediment deposition or obstructions require maintenance.	X
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.	X
R 72	Avoid undercutting of cut-slopes when cleaning ditch lines.	X
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.	X
R 74	Do not sidecast loose ditch or surface material where it can enter wetlands, Riparian Reserve, floodplains, and waters of the State.	X
R 75	Retain low-growing vegetation on cut-and fill slopes.	X
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.	X
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.	X
R 78	Repair damaged culvert inlets and downspouts to maintain drainage design capacity.	X
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.	X
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.	X
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.	X
Road Closure and Decommissioning		
R 83	Decommission temporary roads upon completion of use.	X

BMP Number	Best Management Practice	Applicable to this Project?
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.	X
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.	X
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.	X
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.	X
R 88	Reestablish stream crossings to the natural stream gradient. Excavate sideslopes back to the natural bank profile. Reestablish natural channel width and floodplain.	X
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.	X
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.	X
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.	X
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.	X
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.	X
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 snowbank at periodic intervals to allow snowmelt to drain off the road surface.	X

BMP Number	Best Management Practice	Applicable to this Project?
R 96	Avoid removing snow from unsurfaced roads where runoff drains to waters of the State.	X
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.	X
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.	X

Table C-2: Timber Harvest Activities

BMP Number	Best Management Practice	Applicable to this Project
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 number 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.	X
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.	X
TH 03	Require full suspension overflowing streams, non-flowing streams with highly erodible bed and banks, and jurisdictional wetlands.	X
TH 04	When logging downhill into Riparian Reserve, design the logging system to prevent converging yarding trails from intersecting the stream network.	X
TH 05	Prevent stream banks 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.	X
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.	X

BMP Number	Best Management Practice	Applicable to this Project
Ground-based Harvesting		
TH 07	Exclude ground-based equipment on hydric soils, defined by the Natural Resources Conservation Service.	X
TH 08	Limit designated skid trails for thinning or VRH to ≤ 15 percent of the harvest unit area to reduce displacement or compaction to acceptable limits.	X
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.	X
TH 10	Ensure leading end of logs is suspended when skidding.	X
TH 11	Restrict non-road, in unit, ground-based equipment used for harvesting operations to periods of low soil moisture (dry conditions); generally, from May 15th to October 15th. 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.	X
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.	X
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.	X
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.	X
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.	X
TH 17	Construct waterbars on skid trails using guidelines in Table C-6 where potential for soil erosion or delivery to waterbodies, floodplains, or wetlands exists.	X
TH 18	Subsoil skid trails, landings, or temporary routes 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.	X
TH 19	Block skid trails to prevent public motorized vehicle and other unauthorized use at the end of seasonal use.	X

BMP Number	Best Management Practice	Applicable to this Project
TH 20	Allow harvesting operations (cutting and transporting logs) when ground is frozen or adequate snow cover exists to prevent soil compaction and displacement.	X
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.	X
TH 22	Maintain at least the minimum percent of effective ground cover needed to control surface erosion, as shown in Table B-3, following forest management operations. Ground cover may be provided by vegetation, slash, duff, medium to large gravels, cobbles, or biological crusts.	X
Helicopter		
TH 23	Consider the use of helicopter or aerial logging systems to prevent water quality impacts from road construction or ground-based timber yarding, where other BMPs would be more costly or have limited effectiveness.	X
Horse		
TH 24	Within Riparian Reserve, limit horse logging to slopes less than 20 percent.	X
TH 25	Construct waterbars on horse skid trails when there is potential for soil erosion and delivery to waterbodies, floodplains, and wetlands.	X

Table C-3: Soil cover based on erosion hazard ratings (Table C-3 from RMP)

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

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

Table C-4: Silvicultural Activities

BMP Number	Best Management Practice	Applicable to this Project
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	X

BMP Number	Best Management Practice	Applicable to this Project
	temporary ford crossings to the ODFW instream work period, unless a waiver is obtained from permitting agencies.	
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.	X

Table C-5: Fire and Fuels Management

BMP Number	Best Management Practices	Applicable to this Project
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.	X
F 02	Reduce fuel loads by whole tree yarding, and piling material, as necessary, prior to under burning in dry forest types where fuel loads are elevated.	X
F 03	Avoid burning of large woody material that is touching the high-water mark of a waterbody or that may be affected by high flows.	X
F 04	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.	X
F 05	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.	X
F 06	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.	X
Pile and Burn		
F 07	Avoid burning piles within 35 feet of a stream channel.	X
F 08	Avoid creating piles greater than 16 feet in height or diameter. Pile smaller diameter materials and leave pieces >12" diameter within the	X

BMP Number	Best Management Practices	Applicable to this Project
	unit. Reduce burn time and smoldering of piles by extinguishment with water and tool use.	
F 09	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.	X
F 10	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)).	X
F 11	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.	X
F 12	Place residual slash on severely burned areas, where there is potential for sediment delivery into waterbodies, floodplains, and wetlands.	X

Table C-6: Water bar spacing by gradient and erosion class (Table C-6 from RMP)

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

See page 191 of the RMP for further detail.

Table C-7: Spill Prevention and Abatement

BMP Number	Best Management Practices	Applicable to this Project
Operations Near Waterbodies		
SP 01	Take precautions to prevent leaks or spills of petroleum products (e.g., fuel, motor oil, and hydraulic fluid) entering the waters of the State.	X
SP 02	Take immediate action to stop and contain leaks or spills of chemicals 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.	X
SP 03	Inspect and clean heavy equipment as necessary prior to moving on to the project site, 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 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 materials. 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.	X

BMP Number	Best Management Practices	Applicable to this Project
	Store equipment containing reportable quantities of toxic fluids outside of Riparian Reserve.	
Spill Abatement		
SP 05	Spill Prevention, Control, and Countermeasure Plan (SPCC): All operators shall develop a modified SPCC plan prior to initiating project work if there is a potential risk of chemical or petroleum spills near waterbodies. The SPCC plan will include the appropriate containers and design of the material transfer locations. No interim fuel depot or storage location other than a manned transport vehicle would be used.	X
SP 06	Spill Containment Kit (SCK): All operators shall have a SCK as described in the SPCC plan on-site during any operation with potential for run-off to adjacent waterbodies. The SCK will be appropriate in size and type for the oil or hazardous material carried by the operator.	X
SP 07	Operators shall be responsible for the clean-up, removal, and proper disposal of contaminated materials from the site.	X

Table C-8: Instream Restoration Activities

BMP Numbers	Best Management Practices	Applicable to this Project
RST 01	Confine work in the stream channel to the ODFW instream work period unless a waiver is obtained from permitting agencies.	X
RST 02	Do not drive heavy equipment in flowing channels and floodplains instream channels that are sensitive to disturbance (e.g., meadow streams).	X
RST 03	In well-armored channels that are resistant to damage (e.g., bedrock, small boulder, and cobble-dominated), consider conducting most of the heavy-equipment work from within the channel, during low streamflow, to minimize damage to sensitive riparian areas.	X
RST 04	Design access routes for individual work sites to reduce exposure of bare soil and extensive stream bank shaping.	X
RST 05	Limit the number and length of equipment access points through Riparian Reserve.	X
RST 06	Limit the amount of stream bank excavation to the minimum necessary to ensure stability of enhancement structures. Provide isolation from flowing water during excavation. Place excavated material above the flood-prone area and cover or place a berm to avoid its reentry into the stream during high-flow events.	X

BMP Numbers	Best Management Practices	Applicable to this Project
RST 07	Inspect all mechanized equipment daily for leaks and clean as necessary to ensure that toxic materials, such as fuel and hydraulic fluid, so not enter the stream.	X
RST 08	Locate equipment storage areas at least 100 feet from any water feature, including machinery used in stream channels for more than one day.	X
RST 09	When using heavy equipment in or adjacent to stream channels during restoration activities, develop and implement an approved spill containment plan that includes having a spill containment kit on-site and at previously identified containment locations.	X
RST 10	Refuel equipment, including chainsaws and other hand power tools, 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.	X
RST 11	Use waterbars, barricades, seeding, and mulching to stabilize bare soil areas along project access routes prior to the wet season.	X
RST 12	Prior to the wet season, stabilize disturbed areas where soil will support seed growth, with the potential for sediment delivery to wetlands, and waters of the State. Apply native seed and certified weed-free mulch or erosion control matting in steep or highly erosive areas.	X
RST 13	When replacing culverts, design placement location, crossing type, and installation depth to avoid excessive scour through the site, consider using larger culverts and embedding the culvert to 30 percent bedload. Use bridges on high-gradient stream channels.	X
RST 14	Rehabilitate headcuts and gullies. Use large wood in preference to rock weirs.	X
RST 15	Implement measures to control turbidity. Measures may include installation of turbidity control structures (e.g., isolation, diversion, and silt curtains) immediately downstream of in-stream restoration work areas. Remove these structures following completion of turbidity-generating activities.	X

Dry Forest Specific Best Management Practices

Table C-9: Timber Production Capability Classification Soil Categories of Concern

BMP Numbers	Best Management Practices	Applicable to this Project
Category	Description of Soil Categories	
Surface Erosion FM	These sites have soil surface horizons that are highly erodible, easily detached and subject to bouncing or sliding downhill (dry ravel), even if partially vegetated. The soils overlay intrusive volcanic bedrock (e.g.,	1 acre in unit 31-08

BMP Numbers	Best Management Practices	Applicable to this Project
	granite, diorite, and schist). The Natural Resources Conservation Service (NRCS) provides a Revised Universal Soil Loss Equation soil loss tolerance factor, known as T factor, which ranges from a low of 1 (on shallow soils, 1-10” depth), to 5 (on soils deeper than 60”). This factor describes the maximum rate of annual soil loss in tons/acre that can be lost and still permit crop productivity to sustain economically and indefinitely. Disturbances from harvesting or burning create increased dry raveling of soil, losses of soil nutrients, and burying of newly planted seedlings. Classification coding may be FMR for suitable lands or FMNW for non-suitable lands.	
Timber Harvest: Cable Yarding		
DF 01	Use full log suspension whenever practicable on TPCC soils identified as prone to surface erosion, category FM in Table C-13. Use one-end suspension on these soils if full suspension is not practicable. Restrict yarding to the dry season, generally from June to end of September.	1 acre in unit 31-08
Fire and Fuels Management		
DF 03	Avoid mechanical piling to limit severe surface disturbance and displacement on TPCC soils identified as category FM or FP in Table C-13.	1 acre in unit 31-08
DF 04	Implement prescribed burning on FP and FM soils when fuel moisture contents would result in ‘cool burned’. Post-burn surface soil characteristics may include litter that is consumed and duff that is deeply charred or consumed or organic matter that is partially charred to a depth >1.0 cm, but mineral soil is not visibly altered.	1 acre in unit 31-08

Project Design Features

Table C-10: Harvest Operation Project Design Features

PDF Number	Project Design Features	Applicable to this Project
PDF 1	To caution forest road users of potential hauling and operational activities, warning signs would be placed where appropriate to satisfy Oregon Safety and Health Administration (OSHA) standards. The proper use and maintenance of the signs will be monitored using Oregon OSHA regulations.	X

Table C-11: Botanical Project Design Features

PDF Number	Project Design Features	Applicable to this Project
Preventing the Introduction and Spread of Non-native Invasive Plants		
PDF 2	Equipment and vehicles that leave established road surfaces will be cleaned of soil, seeds, vegetative matter, and other debris that could contain noxious weed seeds prior to entering BLM administered lands. If work occurs in an area known to contain priority non-native invasive plants, equipment shall be cleaned before moving to another project area. Areas appropriate for cleaning equipment prior to leaving the project area will be designated as appropriate. Cleaning may be accomplished by using a pressure hose.	X
PDF 3	Ensure that there will be no parking of vehicles or mechanical equipment where high priority non-native invasive plant infestations are known to occur that have not been effectively treated prior to disturbance. Equipment, vehicles, and personnel will avoid working within flagged non-native invasive plant sites. Orange flagging labeled in black with "NOXIOUS WEEDS" will be used to delineate avoidance boundaries.	X
PDF 4	Native seed and certified weed-free straw, prescribed by the project botanist, would be used for post-treatment restoration where project activities such as decommissioning and other such activities result in bare soil. Ensure hay, straw, and mulch are certified as free of prohibited noxious vegetative parts or seeds, per 75 FR 159:51102. Straw or hay must be obtained from the BLM or purchased from growers certified by the Oregon Department of Agriculture's Weed Free Forage and Mulch Program. Seeding would occur from September 1 to March 31.	X
PDF 5	All material, including rock and gravel, utilized in the building, reconstruction, or maintenance of roads (temp, permanent, etc.) should be sourced from Oregon Department of Agriculture approved rock sources or from a BLM approved site that has been inspected and approved by a BLM botanist.	X
PDF 6	Identification and/or treatment and/or mitigation of A, B and C list noxious weeds is required prior to implementation. Project areas are subject to monitoring for a minimum of 3 years post implementation and new occurrences or spread of weed populations identified during or post implementation will require treatment.	
PDF 7	Quarries must be inspected for noxious weeds and approved prior to approval for use. If a quarry has noxious weed issues the project botanist will determine mitigation options. Noxious weeds may be mitigated by either 1) pre-disturbance treatment, 2) removal of overburden and infested gravel and use of only clean weed-free rock (removal depth typically 6"), 3) partial use of a quarry to include only clean weed, free rock, 4) use of infested gravel where an equal or greater infestation is already present, or 5) If no other options are viable, infested rock may be used but should be recorded for follow-up monitoring and treatment.	X

PDF Number	Project Design Features	Applicable to this Project
PDF 8	Sites treated with herbicides will be signed and flagged to increase public awareness and safety. At the discretion of Field Managers, flagging may be restricted in remote locations where public access is unlikely, within special management areas, or where there are resource concerns. These exceptions would be noted in Annual Treatment Plans.	
Threatened, Endangered & Bureau Sensitive species		
PDF 9	Surveys for bureau sensitive species must be completed prior to implementation of any ground disturbing activity. Any populations located during survey will be flagged for avoidance and buffered according to proposed activity. Yellow and black striped flagging will delineate no activity zones.	
PDF 10	For timber harvest activities, no project activities will occur within populations of bureau sensitive botanical species. Yellow and black stripe flagging will delineate no activity avoidance zones. Populations of sensitive botanical species will be buffered by 100 feet and with orange and black “Plant Buffer” flagging. Tree falling and shrub removal may occur within the buffer at the discretion of the project botanist but must be directionally felled away from the activity exclusion area and ground disturbance within buffers is prohibited, except where waived by the project botanist.	X
PDF 11	Fuels treatments (hand thinning, pile, and slash scatter only) may occur within the 100-foot buffer for bureau sensitive species populations at the discretion of the project botanist, within a seasonal restriction that project activities must occur during the dormant season (November 1 – March 1) and trees must be directionally felled away from the plant population marked by yellow and black striped flagging	X
PDF 12	Do not locate anchor trees within plant sites. Plant Sites will be marked with yellow and black striped flagging.	X
PDF 13	Do not burn landing slash within 100 feet of plant sites. Plant Sites will be marked with yellow and black striped flagging.	X
PDF 14	Construct new landings at least 100 feet from plant sites or at a distance approved by the project botanist. Plant sites will be marked with yellow and black striped flagging. Permit use of previously existing landings.	X
PDF 15	No new road construction, corridors, truck turnarounds, or staging areas may occur within 100-foot plant site buffers unless approved on a case-by-case basis by the project botanist. Permit use of existing roads, or temporary or permanent route renovation on existing road beds only within existing plant sites and buffers unless otherwise examined on a site specific basis and approved by the project botanist.	X
PDF 16	Broadcast burning or under burning may occur within plant populations and buffer zones as approved by the project botanist and is restricted to the dormant season (November 1 – March 1).	X

PDF Number	Project Design Features	Applicable to this Project
PDF 17	Trees would be directionally felled away from all no disturbance buffers marked with yellow and black striped flagging.	X
PDF 18	The use of heavy equipment is not permitted within plant site buffers without prior review and approval by the project botanist. Heavy equipment includes tractors, dozers, loaders, graders, excavators, cranes, skid steers, and similar equipment. Pick-up trucks, ATVs, UTVs, and similar soft-wheeled vehicles may be permitted within a plant site buffer on a limited basis in dry conditions in the dormant season, if authorized by the project botanist. Waivers for heavy equipment operation within plant site buffers will not exceed a total of 5% of the buffer acreage within the entire project area over the lifetime of the project and waivers must be justified to ensure no impact to existing bureau sensitive species populations.	X

Table C-12: Cultural Resources

PDF Number	Project Design Features	Applicable to this Project
Newly Identified Sites		
PDF 17	If cultural resources are discovered during project implementation, the project would be redesigned to protect the cultural resource values present, or evaluation or mitigation procedures would be implemented based on recommendations from the Resource Area Archaeologist with input from federally recognized Tribes, approval from the Field Manager, and concurrence from theSHPO.	X
Inadvertent Discoveries		
PDF 18	If previously unidentified cultural resources are discovered during project implementation, work will be halted in the immediately vicinity of the find, and the resource area archaeologist will determine the appropriate course of action which may include: evaluation of the resource for NRHP eligibility (if not eligible, work may proceed); project redesign to avoid impacts; and/or development of mitigation measures in consultation with the SHPO and Native American tribes.	X
Mining Ditch Crossings		
PDF 19	Direct ground disturbance of linear features/mining ditches should be avoided if possible though use of logging systems which utilize overhead suspension cable systems and directional felling of trees away from features.	X
PDF 20	If full suspension cannot be achieved, the timber sale administrator and/or operator should work with archaeologist to identify appropriate	X

PDF Number	Project Design Features	Applicable to this Project
	location for crossing based on limiting damage to resource. If ditch must be crossed, the operator must fill the mining ditch with logs at the location of yarding corridors. The logs must fill the ditch to ensure that yarding only disturbs the top of the ditch, and all logs must be removed upon completion of yarding, as well as any soil that has been displaced. The ditch should be re-contoured.	
PDF 21	If ground-based machinery must cross a mining ditch, the skid trail should be constructed perpendicular to the ditch. The mining ditch should be filled with logs enough to support the entire length of the machinery. All logs shall be removed following completion of yarding, as well as any soil that was disturbed, and the ditch should be re-contoured.	X
Archaeological Avoidance Areas		
PDF 22	No equipment shall operate the areas flagged for avoidance with orange and black striped flagging within the proposed units. Trees shall be felled away from the flagged avoidance areas. No trees shall be yarded across the flagged avoidance areas. No ground disturbing activities shall take place within the flagged avoidance areas.	X
Helicopter Logging Within Mining Sites		
PDF 23	No heavy equipment shall operate within designated historic mines. All trees shall be cut manually and yarded via full-suspension with a helicopter.	X

Table C-13: Terrestrial Wildlife Species

PDF Number	Project Design Features	Applicable to this Project
PDF 32	Implement conservation measures to mitigate specific threats to Bureau Sensitive and T&E species during the planning of activities and projects. Conservation measures include altering the type, timing, location, and intensity of management actions. Conservation measures would be determined based on species, proposed treatment, site-specific environmental conditions, and available management recommendations.	Apply to any wildlife species as needed
PDF 34	Maintain existing snags (all snags >20 inches DBH; and snags 6-20 inches DBH in decay classes III, IV, V) except those that need to be felled for safety reasons or fuels reduction reasons or for logging systems (e.g., skyline corridors). Snags felled for safety reasons would be left on site unless they would also pose a safety hazard as down woody material.	All Operations
PDF 35	Retain existing large down woody material in the stands. (>20 inches diameter at the large end and >20 ft length, and 6-20 inches diameter at the large end and >20 ft length in decay classes III, IV, V).	All Operations

PDF Number	Project Design Features	Applicable to this Project
PDF 36	Create two snags per acre (1 snag >20 inches DBH and 1 snag >10 inches DBH) in LSR and Riparian Reserve treatment areas.	LSR / RR treatments
PDF 38	Locate skid trails to minimize disturbance to down woody material. Where skid trails encounter large down woody material, a section would be bucked out for equipment access. The remainder would be left in place and would not be disturbed. Snags and down wood in landings would be moved adjacent to the landing.	All Operations
PDF 39	Protect any bureau sensitive species raptor nests or centers of activity as necessary to maintain the integrity of the site. Activities that produce noise above ambient levels that may disturb or interfere with nesting would be prohibited within one-quarter mile of active nesting areas between approximately March 1 and July 15.	As needed
PDF 40	Protect the core area within one-half mile of active peregrine nest sites. No scheduled timber harvest or new road construction would occur within one-half mile of active peregrine nest sites between approximately January 1 and July 15 unless the activity would not adversely affect the integrity of the site.	No Known Peregrine Sites in Planning Area
PDF 41	Any of the following measures may be waived in a particular year if nesting or reproductive success surveys conducted according to the USFWS survey guidelines reveal that NSOs are non-nesting or that no young are present that year. Waivers are valid only until March 1 of the following year. Previously known well-established sites/activity centers are assumed occupied unless protocol surveys indicate otherwise.	All Operations
PDF 42	Activities (such as tree felling, yarding, temporary route construction and re-construction, hauling on roads not generally used by the public, prescribed fire, and muffled blasting) that produce loud noises above ambient levels would not occur within specified distances (Table B-15) of any documented owl site between March 1 and July 15 (or until two weeks after the fledging period, typically up to August 31) – unless protocol surveys have determined the activity center to be not occupied, non-nesting, or failed in their nesting attempt. The distances may be shortened if significant topographical breaks or blast blankets (or other devices) muffle sound traveling between the work location and nest sites. Portions of the following timber sale units would be seasonally restricted: 01-03, 01-04, 02-02, 03-05, 03-10, 04-01, 05-01, 09-01, 10-01, 11-02, 11-03, 11-04, 13-01, 13-04, 14-01, 14-02, 15-05, 15-06, 15-07, 15-08, 15-09, 15-10, 15-11, 17-01, 17-02, 19-05, 21-01, 21-02, 23-04, 23-05, 25-01, 25-02, 25-12, 27-01, 29-03, 29-05, 30-05, 31-01, 31-02, 33-03, 33-04, 34-01, 35-01, 35-02, 35-03, and 35-05 .	All Operations
PDF 43	The action agency has the option to extend the restricted season until September 30 during the year of harvest, based on site-specific	All Operations

PDF Number	Project Design Features	Applicable to this Project
	knowledge (such as a late or recycle nesting attempt) if the project would cause a nesting NSO to flush (See Table B-15) for disturbance distance.	
PDF 44	The buffer distance (Table B-15) to the prescribed area may be modified by the action agency biologist using topographic features or other site-specific information. Buffer distance for prescribed fire may be reduced if substantial smoke from prescribed fire would not enter the nest stand March 1 – July 15. The restricted area is calculated as a radius from the assumed nest site (tree).	All Operations
PDF 45	Do not authorize timber sales that would cause the incidental take of NSO territorial pairs or resident singles from timber harvest until implementation of a barred owl management program consistent with the assumptions contained in the Biological Opinion on the RMP has begun.	All Operations
PDF 46	Seasonal restrictions would be implemented for any HFR treatments proposed to occur in NRF habitat, where habitat evaluations and spotted owl surveys are not current at the time of implementation. These seasonal restrictions would be waived if field habitat evaluations determine the units are dispersal-only habitat or if protocol surveys (project clearance or demography protocol) determine resident single or territorial pairs are not present.	Fuels Treatments
PDF 47	Do not remove overstory trees within 330 feet of bald eagle or golden eagle nests, except for removal of hazard trees. This is applicable to the Resting Cow site in T32S-R05W-S29 and any new sites that are established within the planning area.	All Operations
PDF 48	Work activities that cause disturbance above ambient noise levels (hauling, chainsaws, and helicopters) would not take place within 660 feet from an active bald eagle nest or 330 feet from an alternate bald eagle nest between January 1 and August 31. The above restrictions could be waived in a particular year if surveys indicate the site is unoccupied or nesting attempts failed or until 2 weeks after the young have fledged. Waivers would only be valid until January 1 of the following year.	All Operations
PDF 49	Maintain ≥ 80 percent canopy cover within at least 50 feet of documented fisher natal and maternal dens. No activities may occur within stands containing known fisher den sites from March 1 to July 30. Maintain sufficient (at least 60 percent) canopy clover on a within-stand average basis. Protect fisher denning structures by retaining ≥ 24” diameter snags, down woody material, and live trees with cavities in the stand and if, for safety concerns, it is necessary to fall such snags or live trees with cavities, retain those cut trees or snags in the stand as additional down woody material. Do not apply vegetation treatments to all portions of the stand.	No Fisher Detections Known in Planning Area
PDF 50	In NWPT aquatic habitat: Culvert replacements would be interchanged with culverts that allow for turtle passage. In areas with known turtle	X

PDF Number	Project Design Features	Applicable to this Project
	populations or a high likelihood of use by turtles, berms or fencing would be installed to direct turtles to the culvert. In NWPT nesting habitat: No soil compacting activities would occur and non-compacting activities (hand treatments and minimal ground disturbance) would be seasonally restricted during nesting season, May 15 through July 31. In NWPT overwintering habitat: Seasonal restrictions would be implemented in overwintering habitat within 656 ft (200 m) of aquatic habitat between October 1 and March 31 for cutting and piling of fuels treatments and for timber treatments. For broadcast burning in overwintering habitat within 656 ft of aquatic habitat, only one third of an area would be treated annually. When feasible, such as burning in a small area, exclosures would be utilized to prevent turtles from entering the treatment area. Group selections and landings would avoid NWPT habitat within 656 ft of aquatic habitat. Portions of the following timber sale units would be restricted October 1-March 31: 01-03, 01-04, 02-02, 03-05, 03-10, 04-01, 05-01, 09-01, 10-01, 11-02, 11-03, 11-04, 13-01, 13-04, 14-01, 14-02, 15-05, 15-06, 15-07, 15-08, 15-09, 15-10, 15-11, 17-01, 17-02, 19-05, 21-01, 21-02, 23-04, 23-05, 25-01, 25-02, 25-12, 27-01, 29-03, 29-05, 30-05, 31-01, 31-02, 33-03, 33-04, 34-01, 35-01, 35-02, 35-03, and 35-05. For broadcast burning, portions of the following fuels units would be implemented incrementally (only 1/3 an area of overwintering habitat annually) Barrens Mine Recl. 25, Bull Trip 1, Coyote Junction 2, Coyote Junction 4, Coyote Pete 27-8A, Coyote Pete 28-11, Dutch Herman 9, Eastman's Grave 2, Eastside 13-1, Eastside 23-2, Eastside 25-1A, Eastside 25-1B, Eastside 3-3A, Eastside 35-1, Grave Creek 14-1, Grave Creek UW10-1, Grave Ford 8A, Gravey 3807, Gravey 7T, King Wolf 10R-2, King Wolf 14-5, King Wolf 14-9B, King Wolf 14R-3, King Wolf 14R-3a, King Wolf 14R-4, King Wolf 15-4, King Wolf 15R-4, King Wolf 3-1B, King Wolf 7-1, King Wolf 9-4, King Wolf 9-6, King Wolf 9R-1, McCollum 2-A, McCollum Creek 2, PP&J 11, and Wildcat B/O 2. NWPT PDFs could be waived by the project wildlife biologist if field evaluations reveal habitat is not suitable for NWPTs or if the NWPT is not listed as a threatened or endangered species.	
PDF 51	For any action, no more than one third of an overall site capable of sustaining Franklin's bumble bee would be treated in a single year.	X

PDF Number	Project Design Features	Applicable to this Project
	Treatments, including prescribed fire, would be seasonally restricted between May 15 and September 30 and skips would be left to provide refugia.	

Table C-15: Spotted Owl Disruption and Disturbance Seasons and Distances (content adopted from USDI FWS 2016 USDI FWS 2016; Table 227, pp. 597-600 & Table 50, pp. 230-232).

Project Activity	Disruption Distance		Disturbance Distance
	March 1 – July 15	July 16 – Sept. 30	March 1 – Sept. 30
Light maintenance (*e.g.*, road brushing and grading) at campgrounds, administrative facilities, and heavily-used roads	No Disruption	No Disruption	≤ 0.25 mile
Log hauling on heavily-used roads	No Disruption	No Disruption	≤ 0.25 mile
Chainsaws (includes felling hazard/danger trees)	≤ 65 yards	No Disruption	66 yards to 0.25 mile
Heavy equipment for logging, road construction, road repairs, bridge construction, culvert replacements, etc.	≤ 65 yards	No Disruption	66 yards to 0.25 mile
Pile-driving (steel H piles, pipe piles); Rock Crushing and Screening Equipment	≤ 120 yards	No Disruption	121 yards to 0.25 mile
Burning (prescribed fires, pile burning)	≤ 0.25 mile	No Disruption	0.25 mile to 1 mile
Blasting	≤ 0.25 mile	No Disruption	0.25 mile to 1 mile
Helicopter: Chinook 47d	≤ 265 yards	≤ 100 yards (hovering only)	266 yards to 0.5 mile
Helicopter: Boeing Vertol 107, Sikorsky S-64 (SkyCrane)	≤ 150 yards	≤ 50 yards (hovering only)	151 yards to 0.25 mile
Helicopters: K-MAX, Bell 206 L4, Hughes 500	≤ 110 yards	≤ 50 yards (hovering only)	111 yards to 0.25 mile

Small fixed-wing aircraft (Cessna 185, etc.)	≤ 110 yards	No Disruption	111 yards to 0.25 mile

Table C-16: Water Quality, Soil Productivity, and Off-site Erosion

PDF Number	Project Design Features	Applicable to this Project
Harvest & Yarding Operations		
PDF 47	When using conventional ground-based yarding systems, whole tree yarding with tops attached is the preferred harvest method as long as the contractor can operate without causing bark slippage, girdling, broken tops, or damage to live crowns. If it is determined by the Authorized Officer that an unacceptable amount of damage is occurring, tree bucking and limbing would be required as directed by the Authorized Officer. Delivered log length would not exceed 41 feet.	X
PDF 48	When ground-based yarding equipment is used off of designated skid trails, it shall walk on a mat of existing or created slash when practical.	X
PDF 49	Do not operate ground-based machinery for timber harvest 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.	X
PDF X	Limit the use of specialized ground-based mechanized equipment (those machines specifically designed to operate on slopes greater than 35 percent) to a slope determined to be safe and operationally feasible given the environmental conditions.	X
Prevention and Containment of Hazardous Material Spills		
PDF 50	The Purchaser would be required to be in compliance with OAR 629-605-0130 of the Forest Practice Administrative Rules. Notification, removal, transport, and disposal of oil, hazardous substances, and hazardous wastes would be accomplished in accordance with OAR 340-142 (OARD, 2018), and the operator will have a Spill Prevention, Control and Countermeasure Plan (SPCC) in place.	X
PDF 51	The Purchaser shall not refuel equipment, store, or cause to have stored, any fuel or other petroleum products within 150 feet of streams, springs or wetlands. All petroleum products shall be stored in durable containers and located so that any accidental releases will be contained and not drain into any stream system. Hydraulic fluid and fuel lines on heavy mechanized equipment would be in the proper working condition in order to minimize the potential for leakage into streams. Absorbent materials shall be onsite to allow for immediate containment of any accidental spills. Spilled fuel or oil and any contaminated soil shall be cleaned up and disposed of at an approved disposal site, according to the SPCC.	X
Road Renovation, Timber Hauling and Road Use		

PDF Number	Project Design Features	Applicable to this Project
PDF XX	Road renovation/maintenance shall generally take place in the dry season (between May 15th and October 15th of the same year). Waivers may be granted for road renovation/maintenance during dry conditions in the wet season. Erosion control measures shall be in place concurrent with ground disturbance to allow for immediate storm proofing	X
PDF XX	Hauling may occur during the wet season, with the Authorized Officer's approval, on roads with durable paved and/or 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. Haul may occur during the wet season, with the Authorized Officer's approval, on hydrologically connected rocked and natural surface roads during dry conditions. Haul would not occur on hydrologically connected aggregate or natural surface roads when water is flowing in the ditchlines due to precipitation or during any conditions that would result in any of the following: surface displacement such as rutting or ribbons, continuous mud splash or tire slide, fines being pumped through road surfacing from the subgrade, resulting in a layer of surface sludge, or where turbid runoff is likely to reach stream channels. Refer to Table XX for the list of hydrologically connected haul roads in the project area. Hauling on hydrologically connected natural surface or rocked roads with insufficient rock depth, that received a ½ inch or more precipitation within a 24-hour period, would not resume for a minimum of 48 hours following any storm event, or until road surface is sufficiently dry, and as approved by the Authorized Officer. If hauling activities during the wet season causes or begins to cause road damage or the transport of sediment into streams, the Authorized Officer may suspend wet season haul or require additional erosion control devices to prevent damage or off-site transportation of sediment. Additional rock may be required at the Purchaser's expense to repair any damage that occurs to the road during wet season haul.	X
Culvert Installation and Road, and Landing Construction		
PDF 57	Design culverts, bridges, and other stream crossings for a 100-year flood event, including allowance for bed load and anticipated floatable	X

PDF Number	Project Design Features	Applicable to this Project
	debris. Culverts will be of adequate width to preclude ponding of water higher than the top of the culvert. For streams with ESA-listed fish, design stream crossings to meet design standards consistent with existing ESA consultation documents that address stream crossings in the decision area. (RMP, p. 92)	
PDF 59	Limit within unit landing, temporary road, and road construction, reconstruction, and decommissioning activities to dry conditions. Activities occurring outside of the dry season (generally May 15 – Oct. 15 of the same year) may occur with an approved waiver from the Authorized Officer. Keep erosion control measures concurrent with ground disturbance to allow immediate stormproofing. (BMP R 62)	X
PDF XX	All temporary roads shall be winterized if access is needed over two dry seasons by October 15th. Winterization includes water barring, seeding, mulching, and barricading. All temporary roads shall be ripped, water barred, barricaded, seeded, and mulched after use unless otherwise specified.	X
PDF 60	Sediment reduction techniques would be implemented to reduce sedimentation into streams containing Bureau Sensitive Species. Sediment reduction techniques include settling basins, brush filters, sediment fences, straw bales and/or check dams to prevent or minimize sediment conveyance to streams. Specifically, these sediment barriers would be installed at stream crossings with a hydrologic connection to perennial surface waters. This would include streams with Coho salmon habitat. Refer to Table C-20.	X
PDFXX	Quarry blasting operations will use Tables D-1 and D-2 to determine appropriate charge weights and setback distances based on distance to Coho habitat. Each charge weight listed will utilize a micro delay of 8 milliseconds or longer to stagger detonation of the charges in time.	X
Fuels Treatments and Underburning		
PDF 61	On all units with fuel maintenance and where underburning may occur, do not have ignition points within a minimum 25 feet from bank full width of intermittent streams and 60 feet for perennial streams to protect streambank stability and riparian vegetation (RMP, pp. 82-83)	X
Soils Resources		
PDF 62	Limit detrimental soil disturbance from forest management operations to a total of < 20 percent of the harvest unit area. Where the combined detrimental soil disturbance from implementation of current forest management operations and detrimental soil disturbance from past management operations exceeds 20 percent of the unit area, apply mitigation or amelioration to reduce the total detrimental soil disturbance to < 20 percent of the harvest unit area. Detrimental soil disturbance can occur from erosion, loss of organic matter, severe	X

PDF Number	Project Design Features	Applicable to this Project
	heating to seeds or microbes, soil displacement, or compaction. (RMP p. 109)	
PDF 63	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. (RMP pl. 109-110)	X
PDF XX	In TPCC FMR areas, decrease treatment intensity, avoid group selects which require replanting, and lop and scatter slash to increase soil moisture holding capacity.	X
PDF XX	In TPCC FN-G areas, avoid and buffer sites which are generally greater than 65 percent in concave positions and 80 percent in convex positions – common locations are in inner gorges, above streams, and headwall drainages.	X
PDF XX	In TPCC FN-N areas, thin stands light to moderately, avoid group selects which require replanting, lop and scatter slash to increase nutrients. Consider the application of fertilizer.	X
PDF XX	In TPCC FN-W areas, buffer sites with poorly drained soils found to be saturated.	X
PDF XX	In TPCC NCFL-LPS areas, retain and culture minor species such as pine and oak over small Douglas-fir; lop and scatter slash; apply low intensity prescribed fire.	X
PDF XX	In TPCC NCFL-NCSP areas, consider treating these areas to promote desired minor species such as pine and oak. Reintroduce fire to favor fire tolerant understory species.	X
PDF XX	In TPCC RN-K areas, thin stands light to moderately, avoid group selects which require replanting, lop and scatter slash, apply low intensity prescribed fire.	X
PDF XX	In TPCC RR-KM areas, thin stands light to moderately, avoid group selects which require replanting, lop and scatter slash, apply low intensity prescribed fire.	X
PDF XX	In TPCC RR-T areas, avoid group selects and lop and scatter slash.	X

Table C-17: Tree Retention Preference

PDF Number	Project Design Features	Applicable to this Project
PDF 65	Reserve Pacific yew and preferred hardwoods, where operationally feasible, to contribute to monitoring desired stand conditions. Conifer	X

	species retention preference, in general: Pacific yew, Western red cedar, ponderosa pine, sugar pine, incense cedar, Douglas-fir, Western hemlock, and true fir.	

Table C-18: Riparian Reserves

PDF Number	Project Design Features	Applicable to this Project
PDF 66	Riparian Reserves distances are one site-potential tree (200 feet in Grave Creek, 195 feet in Middle Cow Creek, and 200 feet for Upper Cow Creek) of fish-bearing streams, perennial, and intermittent streams. Extend the Riparian Reserves to include stable areas between such an unstable area where there is potential for the failure to reach the stream (RMP, pp. 75-77). The project area is in the dry and moist RR west of highway 97, and therefore, stands thinned in the Outer and Middle Riparian Zones may be made available for sale (RMP, pp. 82-84).	X
PDF 67	On all units, commercial extraction would not occur within the Inner Riparian Zone buffer which is a minimum of 50 feet from bankfull width on all intermittent streams and 120 feet from bankfull width on all fish-bearing and perennial streams (RMP, pp. 82-83).	X
PDF 68	In the Inner Riparian Zone, where trees are cut for yarding corridors, skid trails, road construction, maintenance, and improvement, retain cut trees in adjacent stands as down woody material or move cut trees for placement in streams for fish habitat restoration, at the discretion of the BLM (RMP, pp. 75-76).	X
PDF 69	Slumps, intermittent seeps, irrigation ditches, wetlands, ponds and other features would be buffered (no treatment) by leaving one row of overstory trees or a 25-foot diameter buffer (whichever is greatest), from the outer edge of instability, around these areas for soil stabilization (RMP, p. 77).	X
PDF 70	Create two snags per acre, via girdling with a chainsaw or other practice, (1 >20 inches DBH and 1 >10 inches DBH) in Riparian Reserve treatment areas (RMP, p. 73).	X
PDF 73	Maintain access to roads and facilities by removing hazard trees and blowdown from roads and facilities. Retain such logs as down woody material within adjacent stands or move for placement in streams for fish habitat restoration, unless removal of logs, including through commercial harvest, is necessary to maintain access to roads and facilities (RMP, p. 75).	X
PDF 74	In the Riparian LUA, allow yarding corridors, skid trails, road construction, stream crossings, and road maintenance and improvement where there is no operationally feasible and economically viable alternative to accomplish other resource management objectives (RMP, p. 75).	X

PDF Number	Project Design Features	Applicable to this Project
PDF 75	In the Riparian LUA, where trees are cut for yarding corridors, skid trails, road construction, maintenance, and improvement in the Inner Zone or Middle Zone, retain cut trees in adjacent stands as down woody material or move cut trees for placement in streams for fish habitat restoration, at the discretion of the BLM. Where trees are cut for yarding corridors, skid trails, road construction, maintenance, and improvement in the Outer Zone or in Riparian Reserves associated with features other than streams, retain cut trees in adjacent stands as down woody material, move cut trees for placement in streams for fish habitat restoration, or sell trees, at the discretion of the BLM. RMP, p. 75-76	X
PDF 76	When conducting commercial thinning in any portion of the Outer Zone in a stand in all watershed classes, cut or tip from 0 to 15 square feet of basal area per acre of live trees, averaged across the Riparian Reserve portion of the treated stand. Leave cut or tipped trees on site or yard, deck, and make cut or tipped trees available for fish habitat restoration. The cut or tipped trees can be of any size and come from any zone (RMP, p. 76-77).	X
Minimizing Impacts to Riparian Reserves from Activity Slash Treatments And Prescribed Fire		
PDF 77	Apply low or moderate-severity prescribed burns where needed to invigorate native deciduous tree species. Moderate severity prescribed burns will be limited to no more than 20 percent of the area of Riparian Reserve sub-watershed (HUC 12) each year (RMP, p. 82).	X
PDF 78	Do not conduct fuels treatments within 60 feet of fish-bearing or perennial streams (RMP, p. 82).	X
PDF 79	When conducting fuels or prescribed fire treatments, retain at least 50 percent canopy cover per acre in the inner zone, do not cut trees > 12" DBH in the inner riparian zone, retain down woody material at greater than 2 percent of pieces > 4 inches in the treatment area, and maintain 30 percent canopy and 60 trees per acre in the middle and outer riparian zones (RMP, p. 82).	X
PDF 80	When conducting fuels or prescribed fire treatments, retain down woody material at 2% cover of down wood greater than 4-inch diameter. Down woody material retention standards would be met as an average at the scale of the treatment area and is not intended to be attained on every acre (RMP, p.82).	X

Table C-19: Activity Slash and Prescribed Fire

PDF Number	Project Design Features	Applicable to this Project
Reduce Impacts to Resources		

PDF Number	Project Design Features	Applicable to this Project
PDF 81	Merchantable sawlogs (including pole decks) would be removed from yarded material and may be hauled off site for processing. Debris at the landing sites would be burned, chipped, or otherwise removed from these sites within 24 months of unit harvest completion.	X
PDF 82	Hand piles would not be allowed on roadways, turnouts, shoulders, or on the cut bank .	X
PDF 83	The Authorized Officer will determine the location of pole/hardwood decks.	X
PDF 84	Activity slash remaining in units could be lopped-and-scattered, chipped, underburned, machine piled, or hand piled and burned to prevent an increase in fire hazard.	X
PDF 85	For prescribed burning operations, firelines would be constructed by hand.	X
PDF 86	In units that aren't broadcast burned, activity slash within twenty (20) feet of each finished landing pile will be added to the pile. Construct a fireline approximately eighteen (18) inches wide and down to mineral soil within twenty (20) feet of each finished landing pile to prevent escaped fire. Each landing pile would be covered with a large enough piece of four-millimeter-thick black plastic to ensure a dry ignition spot (generally 10 feet x 10 feet or large enough to cover 80 percent of the pile).	X
PDF 87	Landing piles would not be placed adjacent to or within 15 feet of leave trees to minimize scorch and mortality. Landing piles would be as free of dirt as reasonably possible to facilitate desired consumption.	X
PDF 88	Landing and hand piles would be burned in the fall to spring season after 1 or more inches of precipitation has occurred. Patrol and mop-up of burning piles would occur when needed to prevent treated areas from re-burning or becoming an escaped fire.	X
PDF 89	Prescribed fire burn plans would be completed before ignition, as would smoke clearance to minimize impacts on air quality.	X
PDF 90	Each hand pile would be covered with a large enough piece of 4-mil polyethylene black plastic to ensure a dry ignition spot (generally 5 feet x 5 feet or large enough to cover 80 percent of the pile). Hand piles would not be placed adjacent to or within 10 feet of leave trees or large woody debris to minimize scorch and mortality. Residents would be advised of prescribed burning through news releases.	X
PDF 91	Prescribed burning would occur under atmospheric conditions that allow for the mixing of air to lessen the impact on air quality. All prescribed burning would be administered in a manner consistent with the requirements of the Oregon Smoke Management Plan administered by the Oregon Department of Forestry and the regulations established by	X

PDF Number	Project Design Features	Applicable to this Project
REC 33	During active timber harvest and hauling, ensure that roads are open for public access to designated recreation sites on weekends, holidays, and at least intermittently during the week.	X
REC 34	Establish a no commercial harvest buffer of 50 feet from centerline for all linear trails. Allow harvest and fuels reduction within the buffer if needed for public safety, to protect/maintain setting characteristics, and/or to achieve recreation objectives. Fell trees away from trails and recreation routes, and avoid skidding logs across trails to prevent damage.	X
REC 35	Camouflage and block skid trails leading off system roads or radiating from landings by placing woody debris or other appropriate barriers (e.g. rocks, logs, slash) on the first 100 feet of the skid trail. Close, block, and rehabilitate unauthorized OHV intrusions to protect sensitive areas and water quality. The intent is to minimize erosion and to prevent unauthorized use by OHVs.	X

PDF Number	Project Design Features	Applicable to this Project
	the Air Quality Division of the Oregon Department of Environmental Quality.	
PDF 892	Burning of slash piles would occur after a sufficient period of curing (generally over a year) and adequate seasonal moisture to ensure desired consumption of material and to minimize the risk of fire escape. Smoke clearance(s) would be obtained prior to ignition to minimize impacts on air quality.	X

Table C-20: Hydrologically Connected Perennial Stream Crossings on Proposed Haul Routes

BLM Road Number and Road Name	**Proposed Action**	**Alt 3**	**Surface**	**Description of Hydrologically Connected Activities to Perennial Surface Waters**[+]	**Stream System**
Non-BLM Road off 31-5-10.0	Maintenance	N	Unknown	Unknown structure	Last Chance
Non-BLM Road off 32-5-35.0	Permanent Reconstruction	N	Unknown	Unknown structure, looks like inside ditches on both sides	Quines

BLM Road Number and Road Name	Proposed Action	Alt 3	Surface	Description of Hydrologically Connected Activities to Perennial Surface Waters[+]	Stream System
Non-BLM Road off 32-5-35.0	Maintenance	Y	Unknown	Unknown structure, looks like inside ditches on both sides	Quines
Non-BLM Road off 33-4-31.0	Maintenance	N	Unknown	Unknown structure, looks like inside ditches on both sides	Last Chance
Non-BLM Road off 33-4-31.0	Permanent Reconstruction	N	Unknown	Unknown structure, looks like inside ditches on both sides	Starveout
32-4-20.0 Starveout Crk	Maintenance	Y	Aggregate	There are two culverts on perennial streams with connected inside ditches.	Starveout
32-4-20.3 Goodwin Crk	Maintenance	Y	Aggregate	There are four culverts on perennial streams with connected inside ditches. Upper Crossing is not in Alt 3	Jones
32-4-22.0 Whitehorse	Maintenance	N	Aggregate	There are three culverts on perennial streams with connected inside ditches.	Whitehor se
32-4-23.2 Whitehorse Saddle	Maintenance	N	Aggregate	There are two culverts on perennial streams with connected inside ditches.	Whitehor se
32-4-30.0 Starveout Jones	Maintenance	Y	Aggregate	There are two culverts on perennial streams with connected inside ditches just before the confluence	Jones
32-4-32.4 Starveout MI	Maintenance	N	Aggregate	There are three culverts on perennial streams with connected inside ditches.	Starveout
32-4-33.1 Cedar Spg Mtn	Maintenance	N	Aggregate	One culvert on perennial stream with connected inside ditches and old road.	Last Chance
32-4-35.0 Cedar Spg	Maintenance	N	3 Aggregate 1 Natural	There are four culverts on perennial streams with connected inside ditches.	Grave
32-4-35.2 Headwaters Grave Crk	Maintenance	N	Aggregate	One crossing on perennial stream with connected inside ditches.	Grave
32-5-22.0 Murphy	Maintenance	Y	Aggregate	One crossing on perennial stream with connected inside ditches.	Woodfor d
32-5-23.0 Eakin	Maintenance	Y	Aggregate	One crossing on perennial stream with connected inside ditches on the north side	Wildcat
32-5-25.0 Bull Run	Maintenance	Y	Aggregate	There are three crossings on perennial streams with connected inside ditches.	Bull Run
32-5-25.6 Bull Run Spur	Permanent Reconstruction	N	Aggregate	Culvert removed in the past. Temporary crossing proposed	Bull Run

BLM Road Number and Road Name	Proposed Action	Alt 3	Surface	Description of Hydrologically Connected Activities to Perennial Surface Waters+	Stream System
32-5-35.1 lower Quines	Maintenance	Y	Aggregate	One crossing on perennial stream with connected inside ditches.	Quines
32-5-35.1 upper Quines	Maintenance	N	Aggregate	One crossing on perennial stream with connected inside ditches.	Quines
33-4-10.1 Grave Chance Spur	Permanent Reconstruction	N	Unknown	Need to Check in the field, Crossing on perennial, may not be there	Last Chance
33-3-18.0 Evans Grave Connect	Maintenance	N	Aggregate	One crossing on perennial stream with connected inside ditches.	Grave
33-4-11.1 Grave Swamp	Maintenance	N	Aggregate	Two crossings, one is totally inadequate and is frequently plugged by beavers, the second one is a perennial with connected inside ditches.	Grave
33-4-11.2 Section 11 Spur	Maintenance	N	Aggregate	There are two culverts on perennial streams with connected inside ditches.	Quines
33-4-15.0 Last Chance	Maintenance	Y	Aggregate	These 8 crossings are mostly culverts that cross Last Chance Creek. All 8 are hydrologically connected to surface waters.	Last Chance
33-4-15.1 Boulder Creek	Maintenance	N	Aggregate	There are four crossings on perennial streams with connected inside ditches.	Big Boulder
33-4-15.6 Grave Creek 15	Maintenance	N	Aggregate	One crossing on perennial stream with connected inside ditches.	Grave
33-4-15.8 Grave Creek 15	Perm Reconstruction	N	Aggregate	There are two crossings on perennial streams with connected inside ditches.	Grave
33-4-17.2 Little Boulder	Maintenance	N	Aggregate	One crossing on perennial stream with connected inside ditches.	Little Boulder
33-4-17.3 Seventeen W	1-Maintenance 2-Perm Construct	N	2-Aggregate 1-unknown	Three crossing all in a row, two will be new culverts.	Little Boulder
33-94-19.0 Channel 5 Spur	Maintenance	N	Aggregate	One crossing on perennial stream with connected inside ditches.	Slate
33-4-21.0 Old Grave Creek	Maintenance	N	Aggregate	One crossing on perennial stream with connected inside ditches.	Lick
33-4-21.1 Upper Green Grave	Maintenance	N	Aggregate	One crossing on perennial stream with connected inside ditches and wetland above the road.	Grave

BLM Road Number and Road Name	Proposed Action	Alt 3	Surface	Description of Hydrologically Connected Activities to Perennial Surface Waters+	Stream System
33-4-21.2 Upper Green Grave	Maintenance	N	Aggregate	One crossing on perennial stream with connected inside ditches.	Grave
33-4-21.3 Morning Star	Maintenance	N	Aggregate	Bridge across Grave Creek, no inside ditches, check 33-4-21.0	Grave
33-4-22.0 Morning Star	Maintenance	N	Aggregate	Two crossings on perennial streams and one crossing over a failed culvert on Lick Creek, 3ft stream running under	Lick
33-4-29.1 Lucky Buck Spur	Perm Reconstruction	N	Aggregate	One new constructed permanent crossing on Roth Creek	Grave
33-4-3.7 Last Cance Crk S	Maintenance	N	Aggregate	One crossing on perennial stream with connected inside ditches	Last Chance
33-4-30.0 Lower King Mt	Maintenance	N	Aggregate	One crossing on perennial stream with connected inside ditches	Last Chance
33-4-31.0 Lower Baker Crk	Maintenance	N	Aggregate	One crossing on perennial stream with connected inside ditches	Last Chance
33-4-4.0 Big Boulder Crk	Maintenance	N	Aggregate	There are three crossings on perennial streams with connected inside ditches.	Big Boulder
33-4-9.0 Boulder Crk N	Maintenance	N	Aggregate	There are two crossings on perennial streams with connected inside ditches.	Big Boulder
33-4-9.1 Boulder Ck Spur	Maintenance	N	Aggregate	One crossing on perennial stream with connected inside ditches.	Big Boulder
33-5-1.1 Quines Crk N	Maintenance	N	Aggregate	One crossing on perennial stream with connected inside ditches.	Big Boulder
33-5-1.1 Quines Crk N	Maintenance	N	Aggregate	One crossing on perennial stream with connected inside ditches.	Quines
33-5-10.0 Wolf Creek Rd	Maintenance	N	Aggregate	There are four crossings on perennial streams with connected inside ditches.	Wolf
33-5-10.2 Bummer Gulch	Maintenance	N	Aggregate	There are three crossings on perennial streams with connected inside ditches.	Wolf
33-5-10.5 Wolf Ck	Perm Reconstruction	N	Aggregate	One new permanent constructed crossing on perennial stream.	Wolf
33-5-10.6 Wolf Pup Rd	Maintenance	N	Aggregate	One crossing on perennial stream with connected inside ditches.	Wolf

BLM Road Number and Road Name	Proposed Action	Alt 3	Surface	Description of Hydrologically Connected Activities to Perennial Surface Waters+	Stream System
33-5-10.8	Perm Reconstruction	N	Aggregate	One new permanent constructed crossing on perennial stream.	Wolf
33-5-10.11 Wolf Head Rd.	Perm Reconstruction	N	Aggregate	One new permanent constructed crossing on perennial stream.	Wolf
33-5-14.4 Dutch Herman Sp	Perm Reconstruction	N	Aggregate	One new permanent constructed crossing on perennial stream.	Wolf
33-5-21.0 Coyote Crk	Maintenance	N	Aggregate	There are four crossings on perennial streams with connected inside ditches.	Coyote
33-5-21.1 Scholey Gulch	Maintenance	N	Aggregate	There are three crossings on perennial streams with connected inside ditches.	Coyote
33-5-22.1 Coyote Crk	Maintenance	N	Aggregate	There are two crossings on perennial streams with connected inside ditches.	Coyote
33-5-25.0 Upper Baker Crk	Maintenance and Perm Reconstruction	N	Aggregate	There are two crossings on perennial streams with connected inside ditches. One new permanent crossing	Coyote
33-5-25.1 Upper Baker Crk	Maintenance	N	Aggregate	One crossing on perennial stream with connected inside ditches.	Baker
33-5-26.4 Clark Ck Spur	Perm Reconstruction	N	Aggregate	One new permanent constructed crossing on perennial stream.	Clark
33-5-35.0 St Paul Mtn Rd	Maintenance	N	Aggregate	There are three crossings on perennial streams with connected inside ditches.	Clark
33-6-24.0 Miller Gulch	Maintenance	N	Aggregate	There are three crossings on perennial streams with connected inside ditches.	Wolf
34-4-5.0 Baker Crk	Maintenance	N	Aggregate	One crossing on perennial stream with connected inside ditches.	Baker
34-5-1.3 Boise Grave Sp	Maintenance	N	Aggregate	One crossing on perennial stream with connected inside ditches.	Grave
34-5-2.1 Eastman Gulch	Maintenance	N	Aggregate	There are two crossings on perennial streams with connected inside ditches.	Eastman
34-5-3.0 Spotted	Maintenance	N	Aggregate	One crossing on perennial stream with connected inside ditches.	Eastman
+ Hydrologically connected means any road segment that has a continuous surface flow path between any part of the road prism and a natural stream channel. (Furniss et al., 2013).					

Table C-21 Coho Critical Habitat Crossings within the Last Chance Project Area

Structure #	Road #	Stream Name	HUC 10	Road Surface
1	33-5-10.0	Wolf Creek Trib.	Grave Creek	Aggregate
2	32-5-23.0	Wildcat Creek	Middle Cow Creek	Aggregate
3	32-5-26.0	Bull Run Creek	Middle Cow Creek	Bituminous
5	32-4-1.0	Hauck Ranch Creek	Upper Cow Creek	Aggregate
6	34-5-10.0	Grave Creek	Grave Creek	Bituminous
7	34-5-10.0	Grave Creek	Grave Creek	Bituminous
8	34-5-10.0	Grave Creek	Grave Creek	Bituminous
9	32-4-35.0	Cedar Spring	Grave Creek	Natural
10	32-4-35.2	Headwaters Grave Creek	Grave Creek	Aggregate
11	34-5-10.0	Grave Creek	Grave Creek	Bituminous
12	34-5-10.0	Grave Creek	Grave Creek	Bituminous
13	33-4-15.0	Last Chance Creek	Grave Creek	Aggregate
14	34-5-10.0	Grave Creek	Grave Creek	Bituminous
15	32-4-4.0	Whitehorse Creek	Middle Cow Creek	Bituminous
16	32-4-22.0	Whitehorse Creek	Middle Cow Creek	Aggregate
17	32-4-20.0	Starveout Creek	Middle Cow Creek	Aggregate
18	32-5-35.1	Quines Creek	Middle Cow Creek	Aggregate
19	32-4-4.0	Whitehorse Creek	Middle Cow Creek	Bituminous
20	32-4-20.0	Starveout Creek	Middle Cow Creek	Aggregate
21	32-5-25.6	Bull Run Creek	Middle Cow Creek	Aggregate
22	32-4-4.0	Whitehorse Creek	Middle Cow Creek	Bituminous
23	33-5-10.0	Wolf Creek Trib.	Grave Creek	Aggregate
25	33-6-24.0	Miller Gulch	Grave Creek	Aggregate
26	33-6-24.0	Miller Gulch	Grave Creek	Aggregate
28	33-4-21.3	Grave Creek	Grave Creek	Aggregate
29	33-4-15.0	Last Chance Creek	Grave Creek	Aggregate
30	34-4-28.0	Ditch Creek	Evans Creek	Aggregate

Table C-22: Summary of Seasonal Restrictions and Operational Periods under Alternative 2 (Operations permitted during Dry Conditions)

Table C-23: Summary of Seasonal Restrictions and Operational Periods under Alternative 3 (Operations permitted only during the Dry Season, May 15 – October 15 with extensions through November under dry conditions)

APPENDIX D: ADDITIONAL INFORMATION

D.1. Project Area Location

The Last Chance project area totals 56,885 acres and is located within the following watersheds:

- Grave Creek watershed - 56% of this watershed is within the project area (55,700 project acres of the 104,574-acre watershed)
- Middle Cow Creek Watershed – 42% of this watershed is within the project area (45,364 project acres of the 113,200-acre watershed)
- Upper Cow Creek Watershed – 2% of this watershed is within the project Area (1,229 project acres of the 116,682-acre watershed)

D.2. Tree Harvesting and Yarding Systems

Harvest operation systems are comprised of pairing different harvesting mechanisms with various yarding mechanisms. Harvesting mechanisms are comprised of mechanical and manual harvesting methods. Mechanical methods include the use of harvesters or feller-bunchers which cut, fall and/or process logs prior to removal from the treatment unit. Manual harvesting methods include the use of chainsaws in which trees are felled, limbed and bucked within the treatment unit. Mechanical harvesting is generally limited to slopes of 70 percent, unless the slope greater than 70 percent is determined to be safe and operationally feasible given environmental conditions. In general manual harvesting is utilized on slopes over 50 percent and generally paired with skyline yarding (see below).

Yarding within the Inner Riparian Zone would be avoided when possible but could be allowed when there is no operationally feasible or economically viable alternative. Where trees are cut for yarding corridors in the Inner Riparian Zone, they would be retained either on-site as cut trees, yarded to- and retained in adjacent stands as down woody material, moved for placement in streams for fish habitat restoration, or sold if associated with features other than streams.

<u>Ground-based Yarding</u>

Ground-based yarding systems utilize tracked or wheeled tractors to transport logs from the interior of units to landing areas. Trees are either manually or mechanically felled and processed, depending on resource protection concerns. The equipment utilized with this system operates on newly designated skid trails or existing skid trails when possible. Mechanized harvesting operations would occur on slopes up to 50 percent, only with the use of specialized ground-based equipment (harvesters or feller-bunchers) with self-leveling cabs. Tractor swing routes may be utilized to enable yarders to “walk” up designated skid trails.

<u>Tethered-Assist Ground-based Yarding</u>

Tethered-assist (synonymous with “cable-assist”) yarding systems utilize tracked or wheeled equipment attached via cables to an anchor point or secondary piece of equipment to cut and/or transport logs from the interior of units to landing areas. Mechanized felling operations would use specialized equipment (harvesters or feller-bunchers) that have self-leveling cabs and are attached to a tether-assist winch mechanism. A winch is used to assist the tethered equipment as it moves up or down corridors reducing the amount of soil disturbance caused by ground-based equipment on steeper slopes. Tethered operations would generally occur on ground that is 35% to 70% slope with average corridor spacing of 60 feet apart and running perpendicular to the slope.

Skyline Yarding

Skyline cable yarding systems are in a fixed position, usually attached to a yarder or a tower from which cables, carriages, and winches originate. The yarder, tower, and cables utilized in this system may require the use of tail hold and/or guylines to remain erect. The carriage is a load-carrying device from which logs are suspended and rides into the interior of the unit and returns to the landing along the skyline cable. The tail end of the cable yarding corridors may be on average 150 feet apart; cable yarding corridors may converge near the landing. Often no additional disturbance is created if the landing is located on an existing road and services one or two corridors.

Some areas would require full suspension yarding across streams and would be identified prior to implementation. Under these circumstances, cable yarding corridors would be previously approved to ensure limited impacts to Inner Riparian Zone. Full suspension yarding would require the entire tree to be lifted in complete suspension across an area. All trees within the Inner Riparian Zones required to be cut for yarding operations would be left on site as course woody debris, or yarded to the adjacent stand if necessary for safety or operations, and not yarded to the landing.

Helicopter Yarding

Helicopter yarding uses a helicopter to transport logs from the interior of a unit to a landing. Trees are cut and usually limbed within the interior of the unit. A mechanized harvester may be used on slopes less than 50 percent to process and pre-bunch logs prior to yarding. A person within the unit attaches a cable to a group of trees which are then lifted and transported to a nearby landing location.

Landings

All of the yarding systems described above require some form of landing. Existing disturbance areas would be utilized as the first choice when possible but new landings would be needed. The landing is the area at the end of- or along the road where cut and sold trees are aggregated, processed into logs, sorted and loaded onto log trucks. For skyline systems and ground-based systems landings would generally be ¼ acre in size and placed within or adjacent to the boundary of proposed treatment units. In situations where multiple yarding corridors or skid trails converge at one landing, landing size may be expanded to ½ acre. These areas would be winterized if they are needed for multiple operating seasons and fully decommissioned once operations, including the burning of landing piles, is conducted. In general, landings would be located outside of the Inner Riparian Zone.

Helicopter landings are generally 1 acre in size. Selected helicopter landings would generally be within ½ mile of treatment units, would be placed where the vegetation is mainly in shrub form or where vegetation is lacking or where vegetation would be cut, placed on or near ridge tops, and at large road junctions. Because helicopter landings are expected to be located near ridges and where vegetation is lacking, they are generally located outside of all Riparian Zones.

D.3. Transportation Management

Alternative 2 and 2a proposes 241 miles of road renovation, 28 miles of road construction, and potential entry into 14 existing rock quarries. Existing roads that are in a decommissioned or long-term closure status are proposed to be renovated for the project. Some of these roads, on BLM-administered lands, may be returned to a decommissioned or long-term closure status after use. All activities may occur during dry conditions with a seasonal waiver approved by the Authorized Officer.

Alternative 3 proposes no new road construction. Transportation management in Alternative 3 would provide 51 miles of road renovation, and potential entry into 6 existing rock quarries. Like Alternative 2, existing roads that were previously in a decommissioned or long-term closure status are proposed to be renovated for the project. Some of these roads, on BLM-administered lands, may be put back into a decommissioned or long-term closure status after use. All activities would occur during the dry season.

Road Construction

Roads allow long-term access to previously inaccessible areas for forest management treatments. New roads would be added to the road system network. These access roads would be designed and constructed to low volume road standards that would facilitate safe and efficient timber operations. Where topography allows, roads would be located on stable areas such as ridges, stable benches, and gentle to moderate slopes. On slopes greater than 60 percent, end hauling of material would occur and would be disposed of on stable locations outside of riparian areas that would minimize risk of sediment delivery to streams and other waterways. New construction activities would include clearing, grubbing, removing, and disposing of all vegetation and debris from within established clearing limits, construction of a road prism by excavating, compacting fill, leveling, and grading. If required, work would also include the installation of drainage features designed to the 100-year flood event plus debris allowances. Roads may have native surfaces or be rocked depending on season of use.

Road Renovation

Road renovation is work done to an existing road to restore it to its original design standard. This work would involve but is not limited to: road surfaces would be bladed/graded to obtain adequate road surface runoff, road surfaces would be scarified to remove road surface rutting or rilling, slump removal, repairing of road failures, ditches would be cleared of debris and obstructions, catch basins would be cleaned or enlarged, brush growing within a 4-foot radius of culvert inlets or outlets would be removed, installation of new culverts to reduce road-related erosion, undersized culverts or culverts that have met or exceeded their lifespan would be removed and replaced, maintaining and/or constructing water dips to reduce road-related erosion, vegetation would be removed for roadside vegetation management, and roads may be surfaced or spot rocked.

Road renovation also includes work done to a road that was overgrown or previously decommissioned (placed in a long-term closure status) to restore it to its original design standard. This work may include clearing, grubbing, disposing of vegetation and debris from within the road prism, repairing the roads subgrade and running surface, correcting existing drainage patterns, replacing culverts where necessary, installation of culverts from drainages where culverts were previously removed, resurfacing or spot rocking where needed, and other typical maintenance activities described above.

Roadside vegetation management involves the removal of larger vegetation and trees that have grown along BLM roads that prevents maintenance equipment from improving proper road drainage patterns and hinders driver sight distance. The large vegetation and trees impede blading/grading activities resulting in berms being created on the outside shoulder of the road, which causes run-off water to flow down the road surface in a concentrated flow instead of allowing run-off water to disperse off the road at the earliest possible point. The removal of encroaching trees includes trees greater than 7-inch DBH and would occur 15 feet horizontal distance from the edge of the outside shoulder of the road on the fill slope side and 15 feet horizontal distance from the ditch flowline or the hinge point of the roads subgrade and cut bank if no ditch exists. In cases where the resulting tree stumps would interfere with road blading/grading activities, stumps would either be ground down to a depth of six inches below the roads running surface (stump grinding) or the tree roots would be separated from the tree trunk as best possible, and the trunk would be removed (popped) and the subgrade would be repaired.

Road surfacing involves the placement of crushed rock material over the full width of the running surface and to the desired length of the identified road. Surfacing is accomplished through preparation of the road running surface via grading and reshaping, proper placement of crushed rock material, and compaction of the new surfacing material on the prepared road. Spot rocking involves the placement of crushed rock material on the road in smaller areas identified as having inadequate surface material, as well as a need to help control erosion and maintain the roads running surface. This would restore the road surface and road condition making it suitable for year-round haul and access. Native surface roads may be improved with an aggregate surface to allow for winter haul, upgrades would occur during the dry season.

Road Decommissioning

Road decommissioning would be accomplished in a variety of ways based upon evaluation of circumstances specific to each road. The road segment would be closed to vehicles on a long-term basis but may be used again in the future. Prior to closure the road it would be left in an erosion-resistant condition by establishing cross drains, eliminating diversion potential at stream channels, and stabilizing or removing fills on unstable areas. (USDI/BLM, 2016b, p. 311-312). At a minimum, decommissioning would include leaving roads in a well-drained condition and blocking access to vehicular use with barriers such as trenches, rocks, or logs. It may also include removing drainage structures, mulching with straw or logging slash, or seeding with native grasses to further discourage off-highway vehicle use. Road decommissioning would be subject to stipulations by holders of reciprocal rights-of-way, easements, or other legal interests.

Existing Developed Rock Quarries

The BLM has identified fourteen potential rock quarries in the Last Chance planning area (see Table D-1) and proposes to allow entry into and purchase of in place quarry rock from the BLM per 43CFR3600.

Quarry entries include the removal of and/or processing of quarry rock for use in road maintenance activities. Removal and/or processing of quarry rock consists of ripping, blasting (drilling and shooting), and breaking down larger rock material with a mobile crusher. Blasting operations would follow the Forest Management Programmatic BO (FOMBO) and the Routine Actions and Maintenance BO (RAMBO) Table (see Table D-1 and D-2) to determine appropriate charge weights and setback distances based on distance to Coho habitat. Each charge weight listed in the table refers to the charge within a single drilled hole or the total charge within a group of holes to be blasted simultaneously and includes the requirement that the separate holes/charges to be blasted would utilize a micro delay of 8 milliseconds or longer to stagger detonation of the charges in time. Setback distance from listed fish habitat is measured horizontally from the center of the drill hole to the edge of the stream or river. This would ensure that the decibel rankings specified by NMFS would not be exceeded. It would also ensure that peak particle velocities transmitted through seismic waves would not rise to a level that would impact fish.

Each entry would primarily provide crushed rock for placement on roads in the Last Chance planning area supporting forest management and the associated maintenance by providing a local source of rock that reduces rock haul costs associated with a timber sale. The quarries could also provide oversized boulders for use in road repairs, or armoring, within the planning area.

Disturbance areas would be limited to the quarry floor area for heavy equipment including a mobile rock crusher, the rock benches/slopes which would be developed for quarry rock, quarry access spurs for heavy equipment to access the quarry benches or the top area of the quarry, clearing and grubbing of vegetation (if present) up to 50 feet past the rock faces or slopes of the site and stripping and stockpiling of overburden. All described impactive disturbance areas are within the existing quarry acreage. If additional area is proposed, it would be considered a quarry expansion and would require additional consultation and NEPA analysis prior to entry.

A quarry entry plan of operations is a required submittal prior to authorization and entry into said quarries. Typical final quarry configuration would have benches no less than 15 feet wide, faces no more than 30 feet tall, and proper drainage to ensure resource protection.

Table D-1: Last Chance Quarry Table

Quarry Name	Quarry No.	Road No.	Location (TRS)	Current Acres	Distance to Coho Stream (FT)	Excavation and Processing	Alt 3
King Mtn	3	33-5-26.0	T33S R5W Sect 24	3.13	7,910	Blast/Crush	No
Woodford Quarry	13	32-5-33.4	T32S R5W Sect 33	4.99	5,260	Blast/Crush	Yes
Sholey Gulch #1	29	33-5-21.1	T33S R5W Sect 28	1.82	3,790	Rip/Blast/Crush	No
Quartzmill Eastman #2	32	34-5-2.1	T34S R5W Sect 03	2.04	5,050	Blast/Crush	No
Miller Gulch Quarry	36	33-5-32.0	T33S R5W Sect 32	2.55	1,930	Blast/Crush	No
Bumkins	37	33-5-10.2	T33S R5W Sect 15	0.94	1,280	Rip/Blast/Crush	Yes
Levens Gulch	39	33-5-10.3	T33S R5W Sect 09	1.65	2,050	Rip/Blast/Crush	Yes
Bull Run Pit	45	32-5-25.0	T32S R5W Sect 25 T32S R4W Sect 31	3.53	115	Blast/Crush	Yes
Starveout Quarry	52	32-4-20.0	T32S R4W Sect 33	3.74	1,700	Blast/Crush	Yes
Unnamed 111	111	32-5-25.4	T32S R4W Sect 30	2.29	3,430	Rip/Pit Run	Yes
Lil Boulder	355	33-4-9.3	T33S R4W Sect 09	3.13	5,020	Blast/Crush	No
Unnamed 359	359	33-4-29.0	T33S R4W Sect 19	1.32	8,530	Rip/Pit Run	No
Unnamed 360	360	33-4-30.0	T33S R4W Sect 19	1.09	6,880	Rip/Pit Run	No
Grave Ford	361	33-4-21.0	T33S R4W Sect 21	4.00	80	Rip/Pit Run	No

Table D-2: Expanded Blasting Setback Table

Horizontal Setback Distance (ft) from Listed Fish Habitat	Maximum Charge Weight (lbs)/with ≥8 ms delay
155	3
200	5
282	10
397	20
564	40
689	60
797	80
889	100
1,053	140
1,089	150
1,260	200
1,991	500
2,815	1,000
6,299	5,000
8,907	10,000
10,909	15,000

Table D-3: Roads

Road Number	Segment	Road Work	Miles	Current Closure Status	Final Closure Status	Alt 3
32-4-01.0	A	Renovation	2.35	Open	Open	No
32-4-01.0	B	Renovation	1.10	Open	Open	No
32-4-01.0	C1	Renovation	0.48	Open	Open	No
32-4-04.0	A	Renovation	2.93	Open	Open	No
32-4-04.0	B1	Renovation	0.28	Open	Open	No
32-4-13.0		Renovation	1.00	Open	Open	No
32-4-19.1		Renovation	0.58	Open	Open	No
32-4-19.2		Renovation	0.61	Open	Open	Yes
32-4-19.4		Renovation	0.28	Open	Open	No
32-4-19.5		Renovation	0.05	Open	Open	No
32-4-19.6		Renovation	0.24	Open	Open	Yes
32-4-20.0	A	Renovation	0.10	Open	Open	Yes
32-4-20.0	B	Renovation	0.65	Open	Open	Yes

Road Number	Segment	Road Work	Miles	Current Closure Status	Final Closure Status	Alt 3
32-4-20.0	C1	Renovation	0.47	Open	Open	No
32-4-20.0	D1	Renovation	1.94	Open	Open	No
32-4-20.0	D2	Renovation	0.88	Open	Open	No
32-4-20.3	A	Renovation	0.98	Open	Open	Yes
32-4-20.3	B	Renovation	1.12	Open	Open	No
32-4-22.0	A	Renovation	2.03	Open	Open	No
32-4-22.0	B	Renovation	0.10	Open	Open	No
32-4-23.1		Renovation	0.08	Decommission	Decommission	No
32-4-23.2	A	Renovation	0.16	Open	Open	No
32-4-23.3		Renovation	0.37	Open	Open	No
32-4-24.0		Renovation	0.44	Open	Open	No
32-4-25.0		Renovation	2.35	Open	Open	No
32-4-25.1		Renovation	0.45	Open	Open	No
32-4-25.6		Renovation	0.57	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	No
32-4-29.1		Renovation	0.19	Open	Open	Yes
32-4-29.3		Renovation	0.21	Open	Open	Yes
32-4-30.0	A	Renovation	0.42	Open	Open	Yes
32-4-30.0	B	Renovation	0.84	Open	Open	Yes
32-4-30.2		Renovation	0.17	Decommission	Open	Yes
32-4-30.3		Renovation	0.12	Decommission	Open	Yes
32-4-30.4	A	Renovation	0.73	Open	Open	Yes
32-4-30.4	B	Renovation	0.15	Open	Open	Yes
32-4-30.4	C	Renovation	0.29	Open	Open	Yes
32-4-30.4	D	Renovation	0.17	Open	Open	Yes
32-4-31.0		Renovation	0.15	Open	Open	No
32-4-31.2		Renovation	0.45	Open	Open	Yes
32-4-31.4		Renovation	0.11	Open	Open	No
32-4-31.5		Renovation	0.27	Open	Open	Yes
32-4-32.2		Renovation	0.25	Open	Open	No
32-4-32.3		Renovation	0.19	Open	Open	No
32-4-32.4	A	Renovation	0.88	Open	Open	No
32-4-32.4	B	Renovation	2.13	Open	Open	No
32-4-32.4	C	Renovation	1.49	Open	Open	No
32-4-32.5		Renovation	0.43	Open	Open	No
32-4-33.0	A1	Renovation	0.88	Open	Open	No
32-4-33.0	A2	Renovation	0.36	Open	Open	No
32-4-33.0	B	Renovation	0.77	Open	Open	No
32-4-33.1	A1	Renovation	0.34	Open	Open	No
32-4-33.1	A2	Renovation	1.10	Open	Open	No

Road Number	Segment	Road Work	Miles	Current Closure Status	Final Closure Status	Alt 3
32-4-33.1	A3	Renovation	0.52	Open	Open	No
32-4-33.1	B1	Renovation	0.38	Open	Open	No
32-4-33.1	B2	Renovation	0.79	Open	Open	No
32-4-33.3		Renovation	0.85	Open	Open	No
32-4-35.0	A1	Renovation	0.23	Open	Open	No
32-4-35.0	A2	Renovation	0.21	Open	Open	No
32-4-35.0	A3	Renovation	0.60	Open	Open	No
32-4-35.0	B	Renovation	0.06	Open	Open	No
32-4-35.1	A	Renovation	0.92	Open	Open	No
32-4-35.1	B	Renovation	2.59	Open	Open	No
32-4-35.2		Renovation	0.40	Open	Open	No
32-5-13.0		Renovation	0.78	Open	Open	No
32-5-13.1		Renovation	0.22	Open	Decommission	No
32-5-13.2		Renovation	0.07	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	No
32-5-22.0	A	Renovation	2.01	Open	Open	Yes
32-5-22.0	B	Renovation	0.93	Open	Open	Yes
32-5-22.0	C	Renovation	0.30	Open	Open	Yes
32-5-22.0	D1	Renovation	0.41	Open	Open	Yes
32-5-22.0	D2	Renovation	0.15	Open	Open	Yes
32-5-22.0	D3	Renovation	1.66	Open	Open	Yes
32-5-22.0	E	Renovation	0.90	Open	Open	Yes
32-5-23.0	A	Renovation	0.33	Open	Open	Yes
32-5-23.0	B	Renovation	1.06	Open	Open	No
32-5-23.0	B	Renovation	0.06	Open	Open	Yes
32-5-23.0	C	Renovation	1.73	Open	Open	No
32-5-23.1		Renovation	0.36	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	No
32-5-23.1		Renovation	0.41	Open	Open	Yes
32-5-23.2		Renovation	0.82	Open	Open	Yes
32-5-23.4		Renovation	0.08	Open	Open	Yes
32-5-23.6		Renovation	0.04	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	No
32-5-25.0	A	Renovation	1.79	Open	Open	Yes
32-5-25.0	B	Renovation	1.12	Open	Open	No
32-5-25.0	C	Renovation	0.94	Open	Open	No
32-5-25.1		Renovation	0.24	Open	Open	Yes
32-5-25.2		Renovation	0.82	Open	Open	Yes
32-5-25.3	A	Renovation	0.69	Open	Open	Yes
32-5-25.3	B	Renovation	0.33	Open	Open	Yes
32-5-25.4		Renovation	0.37	Open	Open	Yes

Road Number	Segment	Road Work	Miles	Current Closure Status	Final Closure Status	Alt 3
32-5-25.5		Renovation	0.27	Open	Open	Yes
32-5-25.5		Renovation	0.17	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	Yes
32-5-25.6		Renovation	0.70	Decommission	Decommission	No
32-5-25.7		Renovation	0.06	Open	Temporary / Seasonal / Limited	Yes
32-5-25.8		Renovation	0.23	Open	Temporary / Seasonal / Limited	Yes
32-5-26.0	A	Renovation	0.65	Open	Open	Yes
32-5-26.0	B1	Renovation	0.57	Open	Open	Yes
32-5-26.0	B2	Renovation	0.87	Open	Open	Yes
32-5-26.0	C1	Renovation	1.11	Open	Open	Yes
32-5-26.0	C2	Renovation	0.66	Open	Open	Yes
32-5-26.0	D	Renovation	0.65	Open	Open	Yes
32-5-26.0	E	Renovation	2.23	Open	Open	Yes
32-5-27.0		Renovation	0.24	Decommission	Decommission	Yes
32-5-27.2		Renovation	0.60	Open	Open	Yes
32-5-29.0		Renovation	0.79	Decommission	Open	No
32-5-33.0		Renovation	0.34	Decommission	Decommission	No
32-5-33.1		Renovation	0.46	Decommission	Decommission	Yes
32-5-33.2	A	Renovation	0.41	Open	Open	No
32-5-33.2	B	Renovation	0.87	Open	Open	No
32-5-33.2	C	Renovation	0.39	Decommission	Open	No
32-5-33.2	C	Renovation	0.22	Open	Open	No
32-5-33.3	A	Renovation	0.49	Open	Open	No
32-5-33.3	B	Renovation	0.49	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	No
32-5-33.3	B	Renovation	0.04	Open	Open	No
32-5-33.4		Renovation	0.48	Open	Open	Yes
32-5-33.5	A	Renovation	0.11	Open	Open	Yes
32-5-33.5	B	Renovation	0.33	Open	Open	Yes
32-5-33.5	C	Renovation	0.75	Open	Open	Yes
32-5-33.6		Renovation	0.48	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	Yes
32-5-35.0	A1	Renovation	0.19	Open	Open	Yes
32-5-35.1	A	Renovation	0.07	Temporary / Seasonal / Limited	Open	Yes
32-5-35.1	B	Renovation	0.63	Temporary / Seasonal / Limited	Open	No
32-5-35.2	A	Renovation	1.76	Open	Open	No
32-5-35.2	A	Renovation	1.01	Open	Open	Yes
32-5-35.3		Renovation	0.46	Open	Open	Yes

Road Number	Segment	Road Work	Miles	Current Closure Status	Final Closure Status	Alt 3
32-5-35.3		Renovation	0.26	Open	Open	No
33-3-18.0	C	Renovation	0.47	Open	Open	No
33-3-18.0	D	Renovation	0.27	Open	Open	No
33-4-02.0	A	Renovation	0.42	Temporary / Seasonal / Limited	Open	No
33-4-02.0	B	Renovation	0.14	Temporary / Seasonal / Limited	Open	No
33-4-03.0	A1	Renovation	0.19	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	No
33-4-03.0	A2	Renovation	0.40	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	No
33-4-03.1		Renovation	0.97	Open	Open	No
33-4-03.2		Renovation	0.86	Open	Open	No
33-4-03.3	A	Renovation	0.38	Open	Open	No
33-4-03.3	B	Renovation	0.18	Open	Open	No
33-4-03.7	A	Renovation	0.20	Open	Open	No
33-4-03.7	B	Renovation	0.62	Open	Open	No
33-4-03.7	C	Renovation	0.83	Open	Open	No
33-4-04.0	A	Renovation	1.56	Open	Open	No
33-4-04.0	B	Renovation	2.18	Open	Open	No
33-4-04.0	C	Renovation	0.53	Open	Open	No
33-4-04.1	A	Renovation	0.67	Open	Open	No
33-4-04.1	B	Renovation	0.05	Open	Open	No
33-4-04.2	A	Renovation	0.31	Open	Open	No
33-4-04.2	B	Renovation	0.20	Open	Open	No
33-4-09.0	A1	Renovation	0.28	Open	Open	No
33-4-09.0	A2	Renovation	0.14	Open	Open	No
33-4-09.1	A1	Renovation	0.67	Open	Open	No
33-4-09.1	A2	Renovation	0.20	Open	Open	No
33-4-09.1	A2	Renovation	0.03	Open	Open	No
33-4-09.2		Renovation	0.37	Open	Open	No
33-4-09.3		Renovation	0.15	Open	Open	No
33-4-09.4		Renovation	0.10	Open	Open	No
33-4-10.1	B	Construction	0.16		Temporary / Seasonal / Limited	No
33-4-10.1	A	Renovation	0.68	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	No
33-4-10.1	C	Renovation	0.60	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	No
33-4-11.0	A	Renovation	0.66	Open	Open	No
33-4-11.1		Renovation	0.69	Open	Open	No
33-4-11.2	A	Renovation	0.19	Open	Open	No

Road Number	Segment	Road Work	Miles	Current Closure Status	Final Closure Status	Alt 3
33-4-11.2	B	Renovation	0.72	Temporary / Seasonal / Limited	Open	No
33-4-11.3		Renovation	0.46	Open	Open	No
33-4-15.0	A	Renovation	1.21	Open	Open	No
33-4-15.0	B1	Renovation	1.56	Open	Open	No
33-4-15.0	B2	Renovation	0.20	Open	Open	No
33-4-15.1	A	Renovation	0.73	Open	Open	No
33-4-15.1	B1	Renovation	0.42	Open	Open	No
33-4-15.1	B2	Renovation	0.85	Open	Open	No
33-4-15.1	C	Renovation	1.00	Open	Open	No
33-4-15.14		Renovation	0.12	Open	Open	No
33-4-15.15		Renovation	0.04	Open	Open	No
33-4-15.16		Renovation	0.15	Open	Open	No
33-4-15.3	A1	Renovation	0.35	Open	Open	No
33-4-15.5	A	Renovation	0.94	Open	Decommission	No
33-4-15.5	B	Renovation	0.95	Open	Open	No
33-4-15.6		Renovation	0.54	Open	Decommission	No
33-4-15.7		Renovation	0.30	Decommission	Decommission	No
33-4-15.8		Renovation	0.48	Decommission	Open	No
33-4-15.8		Renovation	0.08	Decommission	Decommission	No
33-4-15.8		Renovation	0.12	Decommission	Decommission	No
33-4-15.9		Renovation	0.31	Decommission	Decommission	No
33-4-17.0	A	Renovation	0.54	Open	Open	No
33-4-17.0	B	Renovation	0.15	Open	Open	No
33-4-17.2	A1	Renovation	0.31	Open	Open	No
33-4-17.2	A2	Renovation	0.16	Open	Open	No
33-4-17.3		Renovation	0.21	Open	Open	No
33-4-17.4		Renovation	0.22	Open	Open	No
33-4-19.0	A1	Renovation	0.35	Open	Open	No
33-4-19.0	A2	Renovation	0.14	Open	Open	No
33-4-21.0	A	Renovation	0.36	Open	Open	No
33-4-21.0	B	Renovation	0.18	Open	Open	No
33-4-21.0	C	Renovation	0.07	Open	Open	No
33-4-21.1	A1	Renovation	0.92	Open	Open	No
33-4-21.1	A2	Renovation	0.50	Open	Open	No
33-4-21.2	A	Renovation	0.21	Open	Open	No
33-4-21.2	B	Renovation	0.18	Open	Open	No
33-4-21.3		Renovation	0.06	Open	Open	No
33-4-22.0	A1	Renovation	0.75	Open	Open	No
33-4-22.0	A2	Renovation	0.24	Open	Open	No

Road Number	Segment	Road Work	Miles	Current Closure Status	Final Closure Status	Alt 3
33-4-22.0	B	Renovation	0.66	Open	Open	No
33-4-22.0	C	Renovation	0.11	Open	Open	No
33-4-29.0	A	Renovation	0.37	Open	Open	No
33-4-29.0	B	Renovation	0.77	Open	Open	No
33-4-29.0	C	Renovation	0.43	Open	Open	No
33-4-29.0	D1	Renovation	0.30	Open	Open	No
33-4-29.0	D2	Renovation	0.76	Open	Open	No
33-4-29.1		Renovation	0.14	Open	Open	No
33-4-30.0	A1	Renovation	0.08	Open	Open	No
33-4-30.0	A2	Renovation	0.97	Open	Open	No
33-4-30.0	A3	Renovation	0.12	Open	Open	No
33-4-30.1		Renovation	0.71	Open	Temporary / Seasonal / Limited	No
33-4-31.0	A	Renovation	0.38	Open	Temporary / Seasonal / Limited	No
33-4-31.0	B	Renovation	0.27	Open	Temporary / Seasonal / Limited	No
33-4-31.0	C	Renovation	0.50	Open	Temporary / Seasonal / Limited	No
33-4-31.1		Renovation	0.45	Open	Open	No
33-4-32.0	A	Renovation	0.56	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	No
33-4-32.0	B	Renovation	0.13	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	No
33-5-01.1	A	Renovation	0.33	Open	Open	No
33-5-01.1	B	Renovation	0.26	Open	Open	No
33-5-02.0	A	Renovation	0.12	Open	Temporary / Seasonal / Limited	Yes
33-5-03.1		Renovation	0.20	Open	Open	No
33-5-03.2	A	Renovation	0.85	Open	Open	No
33-5-03.2	B	Renovation	0.18	Open	Open	No
33-5-03.2	C	Renovation	0.61	Open	Open	No
33-5-03.3		Renovation	0.20	Open	Open	No
33-5-03.4		Renovation	0.26	Open	Open	No
33-5-03.5		Renovation	0.57	Open	Open	No
33-5-03.5		Renovation	0.07	Open	Open	No
33-5-03.6		Renovation	0.15	Open	Open	No
33-5-04.0		Renovation	0.39	Open	Open	Yes
33-5-04.1	A	Renovation	0.61	Open	Open	No
33-5-04.1	A	Renovation	0.02	Open	Open	Yes
33-5-04.1	B	Renovation	0.63	Open	Open	No
33-5-04.3		Renovation	0.47	Open	Open	No

Road Number	Segment	Road Work	Miles	Current Closure Status	Final Closure Status	Alt 3
33-5-05.0		Renovation	0.13	Temporary / Seasonal / Limited	Decommission	Yes
33-5-05.1		Renovation	0.60	Open	Open	Yes
33-5-05.2		Renovation	0.31	Open	Open	Yes
33-5-09.0	A	Renovation	0.06	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	No
33-5-09.0	B	Renovation	0.30	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	No
33-5-09.0	C	Renovation	0.74	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	No
33-5-09.2		Renovation	0.30	Open	Open	No
33-5-10.0	A	Renovation	0.20	Open	Open	Yes
33-5-10.0	B	Renovation	0.40	Open	Open	No
33-5-10.0	C	Renovation	0.33	Open	Open	No
33-5-10.0	D	Renovation	0.64	Open	Open	No
33-5-10.0	E	Renovation	0.64	Open	Open	No
33-5-10.0	F	Renovation	0.86	Open	Open	No
33-5-10.0	G	Renovation	0.26	Open	Open	No
33-5-10.0	H	Renovation	0.60	Open	Open	No
33-5-10.0	I	Renovation	1.04	Open	Open	No
33-5-10.0	J	Renovation	1.30	Open	Open	No
33-5-10.0	K	Renovation	0.29	Open	Open	No
33-5-10.1	A	Renovation	1.22	Open	Open	No
33-5-10.1	B	Renovation	1.63	Open	Open	No
33-5-10.2		Renovation	1.82	Open	Open	No
33-5-10.3	A	Renovation	3.19	Open	Open	Yes
33-5-10.3	B	Renovation	0.49	Open	Open	Yes
33-5-10.4	A	Renovation	0.72	Open	Open	No
33-5-10.4	B	Renovation	0.85	Open	Open	No
33-5-10.5		Renovation	0.31	Decommission	Decommission	No
33-5-10.6		Renovation	0.88	Open	Open	No
33-5-10.7		Renovation	0.08	Open	Open	No
33-5-10.8		Renovation	0.48	Decommission	Decommission	No
33-5-11.1		Renovation	0.43	Decommission	Decommission	No
33-5-13.2		Renovation	0.53	Open	Open	No
33-5-14.0		Renovation	0.39	Open	Open	No
33-5-14.3		Renovation	0.02	Open	Open	No
33-5-14.4	A1	Renovation	0.13	Open	Open	No
33-5-14.4	A2	Renovation	0.21	Decommission	Decommission	No
33-5-14.4	B	Renovation	0.16	Decommission	Decommission	No
33-5-15.0		Renovation	0.13	Open	Open	No

Road Number	Segment	Road Work	Miles	Current Closure Status	Final Closure Status	Alt 3
33-5-15.1		Renovation	0.22	Open	Decommission	No
33-5-15.3		Renovation	0.26	Open	Open	No
33-5-21.0	A	Renovation	0.70	Open	Open	No
33-5-21.0	B	Renovation	1.52	Open	Open	No
33-5-21.0	C	Renovation	0.49	Open	Open	No
33-5-21.0	D	Renovation	1.31	Open	Open	No
33-5-21.1		Renovation	2.04	Open	Open	No
33-5-22.0		Renovation	1.52	Open	Open	No
33-5-22.1		Renovation	1.21	Open	Open	No
33-5-22.2		Renovation	0.52	Open	Open	No
33-5-22.3		Renovation	0.35	Open	Open	No
33-5-22.4		Renovation	0.36	Open	Open	No
33-5-23.3	A	Renovation	0.06	Open	Open	No
33-5-23.3	B	Renovation	0.66	Open	Open	No
33-5-23.4		Renovation	0.42	Open	Open	No
33-5-25.0	A	Renovation	0.29	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	No
33-5-25.0	B	Renovation	0.86	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	No
33-5-25.1		Renovation	0.11	Open	Decommission	No
33-5-25.2		Construction	0.39		Open	No
33-5-26.0	A	Renovation	1.21	Open	Open	No
33-5-26.2	A	Renovation	1.69	Open	Open	No
33-5-26.2	B	Renovation	0.12	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	No
33-5-26.4		Renovation	0.47	Open	Open	No
33-5-27.0		Renovation	0.19	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	No
33-5-31.3		Renovation	0.46	Open	Open	No
33-5-32.0	A	Renovation	0.63	Open	Open	No
33-5-34.0		Renovation	0.29	Decommission	Decommission	No
33-5-34.1		Construction	0.86		Open	No
33-5-34.2		Construction	0.28		Open	No
33-5-35.0		Renovation	1.89	Open	Open	No
33-5-35.1	A	Renovation	0.71	Open	Open	No
33-5-35.1	B	Renovation	0.37	Open	Open	No
33-5-35.2		Renovation	1.10	Open	Open	No
33-5-35.3		Renovation	0.03	Open	Open	No
33-5-35.4		Renovation	0.17	Open	Decommission	No
33-5-35.5		Renovation	1.19	Open	Open	No
33-5-36.0		Renovation	0.32	Decommission	Decommission	No

Road Number	Segment	Road Work	Miles	Current Closure Status	Final Closure Status	Alt 3
33-5-36.1		Renovation	0.28	Open	Open	No
33-5-36.2	A	Renovation	0.36	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	No
33-5-36.2	B	Renovation	0.05	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	No
33-5-36.2	C	Renovation	0.25	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	No
33-6-24.0	A	Renovation	0.98	Open	Open	No
33-6-24.0	B1	Renovation	2.17	Open	Open	No
33-6-24.0	B2	Renovation	0.37	Open	Open	No
34-4-05.0	A	Renovation	1.86	Open	Open	No
34-4-05.0	B	Renovation	1.90	Open	Open	No
34-4-06.2	B	Construction	0.33		Temporary / Seasonal / Limited	No
34-4-06.2	A	Renovation	0.07	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	No
34-4-28.0	A	Renovation	1.24	Open	Open	No
34-4-28.0	B	Renovation	0.19	Open	Open	No
34-4-28.0	C	Renovation	0.46	Open	Open	No
34-4-28.0	D	Renovation	0.57	Open	Open	No
34-4-28.0	E	Renovation	0.64	Open	Open	No
34-4-28.0	F	Renovation	0.68	Open	Open	No
34-4-28.0	G	Renovation	0.14	Open	Open	No
34-4-28.0	H	Renovation	0.98	Open	Open	No
34-4-28.0	I	Renovation	0.59	Open	Open	No
34-4-28.0	J	Renovation	1.15	Open	Open	No
34-4-28.0	K	Renovation	0.57	Open	Open	No
34-5-01.0	A	Renovation	1.29	Open	Open	No
34-5-01.0	B	Renovation	0.68	Open	Open	No
34-5-01.0	C	Renovation	1.27	Open	Open	No
34-5-01.1		Renovation	0.38	Open	Temporary / Seasonal / Limited	No
34-5-01.3	A	Renovation	0.38	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	No
34-5-01.3	B	Renovation	1.90	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	No
34-5-02.1	A	Renovation	0.63	Open	Open	No
34-5-02.1	B	Renovation	3.30	Open	Open	No
34-5-03.0		Renovation	1.66	Open	Open	No
34-5-03.2		Renovation	0.89	Open	Open	No
34-5-04.0		Construction	0.74		Open	No
34-5-07.0	H	Renovation	1.72	Open	Open	No

Road Number	Segment	Road Work	Miles	Current Closure Status	Final Closure Status	Alt 3
34-5-10.0	A1	Renovation	3.05	Open	Open	Yes
34-5-10.0	A2	Renovation	0.36	Open	Open	Yes
34-5-10.0	A3	Renovation	0.64	Open	Open	Yes
34-5-10.0	A4	Renovation	0.94	Open	Open	Yes
34-5-10.0	A5	Renovation	0.28	Open	Open	Yes
34-5-10.0	A6	Renovation	0.93	Open	Open	Yes
34-5-10.0	B1	Renovation	0.45	Open	Open	Yes
34-5-10.0	B2	Renovation	1.52	Open	Open	Yes
34-5-10.0	B3	Renovation	2.50	Open	Open	Yes
34-5-10.0	B3	Renovation	0.76	Open	Open	Yes
34-5-10.0	B5	Renovation	0.46	Open	Open	Yes
34-5-10.0	C1	Renovation	0.64	Open	Open	No
34-5-10.0	C1	Renovation	0.35	Open	Open	Yes
34-5-10.0	C2	Renovation	0.48	Open	Open	No
34-5-10.0	C3	Renovation	0.83	Open	Open	No
NS-01		Renovation	0.44	Decommission	Decommission	No
NS-02		Renovation	0.05	Decommission	Decommission	No
NS-03		Renovation	0.23	Decommission	Decommission	No
NS-04		Renovation	0.20	Decommission	Decommission	No
NS-05		Renovation	0.15	Decommission	Decommission	No
NS-06		Renovation	0.02	Decommission	Decommission	Yes
NS-07		Renovation	0.07	Decommission	Decommission	Yes
NS-08		Renovation	0.06	Decommission	Decommission	Yes
NS-09		Renovation	0.06	Decommission	Decommission	No
NS-10		Renovation	0.28	Decommission	Decommission	No
NS-11		Renovation	0.09	Decommission	Decommission	Yes
NS-12		Renovation	0.20	Unknown	Temporary / Seasonal / Limited	No
NS-13		Renovation	0.56	Unknown	Temporary / Seasonal / Limited	No
NS-14		Renovation	0.25	Decommission	Decommission	No
NS-15		Renovation	0.21	Open	Open	No
NS-16		Renovation	0.09	Open	Open	No
NS-17		Renovation	0.08	Open	Open	Yes
NS-18		Renovation	0.60	Decommission	Decommission	Yes
NS-19		Renovation	0.35	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	Yes
NS-20		Renovation	0.53	Decommission	Decommission	No
NS-21		Renovation	0.45	Decommission	Decommission	No
NS-22		Renovation	0.06	Decommission	Decommission	No
NS-23		Renovation	0.16	Decommission	Decommission	No

Road Number	Segment	Road Work	Miles	Current Closure Status	Final Closure Status	Alt 3
NS-24		Renovation	0.14	Open	Open	No
NS-25		Renovation	0.85	Open	Open	No
NS-26		Renovation	0.49	Open	Open	No
NS-27		Renovation	0.11	Decommission	Decommission	No
NS-28		Renovation	0.25	Decommission	Decommission	No
NS-29		Renovation	0.12	Open	Open	No
NS-30		Renovation	0.18	Open	Open	No
NS-31		Renovation	0.15	Decommission	Decommission	No
NS-32		Renovation	0.44	Decommission	Decommission	No
NS-33		Renovation	0.19	Decommission	Decommission	No
NS-34		Renovation	1.26	Open	Open	No
NS-35		Renovation	0.32	Decommission	Decommission	No
NS-36		Renovation	0.14	Decommission	Decommission	No
NS-37		Renovation	0.05	Decommission	Decommission	No
NS-38		Renovation	0.19	Open	Open	No
NS-39		Renovation	0.02	Decommission	Decommission	No
NS-40		Renovation	0.57	Decommission	Decommission	No
NS-41		Renovation	1.16	Decommission	Decommission	No
NS-42		Renovation	0.85	Decommission	Decommission	No
NS-43		Renovation	0.61	Open	Open	No
NS-44		Renovation	0.31	Open	Open	No
NS-45		Renovation	0.21	Open	Open	No
NS-46		Renovation	0.26	Open	Open	No
NS-47		Renovation	0.29	Open	Open	No
NS-48		Renovation	0.50	Decommission	Decommission	No
NS-49		Renovation	0.02	Decommission	Decommission	No
NS-50		Renovation	0.25	Decommission	Decommission	No
NS-51		Renovation	0.14	Decommission	Decommission	No
NS-52		Renovation	0.02	Decommission	Decommission	No
NS-53		Renovation	0.18	Open	Open	No
NS-54		Renovation	0.19	Open	Open	No
NS-55		Renovation	1.09	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	No
NS-56		Renovation	0.35	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	No
NS-57		Renovation	1.01	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	No
NS-58		Renovation	0.13	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	No
NS-59		Renovation	0.88	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	No

Road Number	Segment	Road Work	Miles	Current Closure Status	Final Closure Status	Alt 3
NS-60		Renovation	0.16	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	No
NS-61		Renovation	0.05	Open	Open	No
NS-62		Renovation	0.92	Open	Open	No
NS-63		Renovation	0.10	Decommission	Decommission	No
NS-64		Renovation	0.20	Temporary / Seasonal / Limited	Temporary / Seasonal / Limited	No
NS-65		Renovation	0.09	Decommission	Decommission	No
NS-66		Renovation	0.48	Decommission	Decommission	No
NS-67		Renovation	0.40	Decommission	Decommission	No
NS-68		Renovation	0.26	Decommission	Decommission	No
NS-69		Renovation	0.01	Open	Open	No
NS-70		Renovation	0.09	Decommission	Decommission	No
PR 01-03		Construction	0.05		Decommission	No
PR 02-02		Construction	0.04		Decommission	No
PR 03-04		Construction	0.17		Open	No
PR 03-05		Construction	0.06		Open	No
PR 03-06		Construction	0.22		Open	No
PR 03-08		Construction	0.23		Temporary / Seasonal / Limited	No
PR 03-10		Construction	0.36		Temporary / Seasonal / Limited	No
PR 04-01-A		Construction	0.47		Open	No
PR 05-04-A		Construction	0.58		Decommission	No
PR 05-04-B		Construction	0.79		Open	No
PR 05-05		Construction	0.08		Open	No
PR 11-01		Construction	0.18		Decommission	No
PR 13-03		Construction	0.10		Open	No
PR 14-03-A		Construction	0.42		Decommission	No
PR 14-03-B		Construction	0.23		Decommission	No
PR 15-08-A		Construction	0.27		Decommission	No
PR 15-08-B		Construction	0.17		Open	No
PR 15-10		Construction	0.32		Open	No
PR 17-01-A		Construction	0.48		Open	No
PR 17-01-B		Construction	0.45		Decommission	No
PR 17-01-C		Construction	0.13		Decommission	No
PR 21-01		Construction	0.34		Temporary / Seasonal / Limited	No

Road Number	Segment	Road Work	Miles	Current Closure Status	Final Closure Status	Alt 3
PR 22-07		Construction	0.25		Open	No
PR 23-02		Construction	0.41		Open	No
PR 23-05		Construction	0.33		Open	No
PR 24-05-A		Construction	0.37		Open	No
PR 24-05-B		Construction	0.21		Open	No
PR 24-05-C		Construction	0.24		Open	No
PR 25-01		Construction	0.18		Open	No
PR 26-01		Construction	0.28		Decommission	No
PR 26-02		Construction	0.30		Open	No
PR 27-08		Construction	0.13		Open	No
PR 29-03		Construction	0.17		Open	No
PR 29-07-A		Construction	0.17		Open	No
PR 29-07-B		Construction	0.34		Decommission	No
PR 29-09		Construction	0.26		Decommission	No
PR 31-02-A		Construction	0.87		Open	No
PR 31-02-B		Construction	0.28		Open	No
PR 31-02-C		Construction	0.28		Open	No
PR 31-05		Construction	0.73		Open	No
PR 31-06-A		Construction	0.29		Temporary / Seasonal / Limited	No
PR 31-06-B		Construction	0.16		Temporary / Seasonal / Limited	No
PR 31-10		Construction	0.22		Open	No
PR 32-01		Construction	0.53		Open	No
PR 33-03		Construction	1.07		Decommission	No
PR 33-04		Construction	0.12		Temporary / Seasonal / Limited	No
PR 34-02-A		Construction	1.03		Open	No
PR 34-02-B		Construction	0.05		Decommission	No
PR 34-02-C		Construction	0.14		Decommission	No
PR 34-02-D		Construction	0.21		Decommission	No
PR 35-02		Construction	0.14		Open	No
PR 35-04		Construction	0.51		Open	No
TR 01-04		Construction	0.11		Temporary / Seasonal / Limited	No
TR 03-06		Construction	0.31		Decommission	No
TR 03-09		Construction	0.04		Decommission	No

Road Number	Segment	Road Work	Miles	Current Closure Status	Final Closure Status	Alt 3
TR 04-01-A		Construction	0.14		Decommission	No
TR 04-05		Construction	0.08		Decommission	No
TR 05-02-A		Construction	0.20		Decommission	No
TR 05-02-B		Construction	0.05		Decommission	No
TR 05-03		Construction	0.15		Decommission	No
TR 09-08-A		Construction	0.34		Decommission	No
TR 09-08-B		Construction	0.27		Decommission	No
TR 09-08-C		Construction	0.13		Decommission	No
TR 09-09		Construction	0.04		Decommission	No
TR 10-01		Construction	0.16		Decommission	No
TR 10-02		Construction	0.36		Decommission	No
TR 11-04-A		Construction	0.17		Decommission	No
TR 11-04-B		Construction	0.28		Decommission	No
TR 11-04-C		Construction	0.06		Decommission	No
TR 13-03		Construction	0.05		Decommission	No
TR 13-04		Construction	0.17		Decommission	No
TR 15-08		Construction	0.14		Decommission	No
TR 15-10		Construction	0.07		Decommission	No
TR 19-01		Construction	0.17		Decommission	No
TR 19-04		Construction	0.03		Decommission	No
TR 19-06		Construction	0.20		Decommission	No
TR 22-01-A		Construction	0.12		Decommission	No
TR 22-01-B		Construction	0.21		Decommission	No
TR 22-01-C		Construction	0.06		Decommission	No
TR 23-02		Construction	0.15		Decommission	No
TR 23-10		Construction	0.12		Decommission	No
TR 24-02		Construction	0.14		Decommission	No
TR 24-05		Construction	0.05		Decommission	No
TR 24-06		Construction	0.10		Decommission	No
TR 25-02		Construction	0.07		Decommission	No
TR 25-06		Construction	0.02		Decommission	No
TR 25-07		Construction	0.17		Decommission	No

Road Number	Segment	Road Work	Miles	Current Closure Status	Final Closure Status	Alt 3
TR 25-12		Construction	0.22		Decommission	No
TR 27-01		Construction	0.07		Decommission	No
TR 27-08		Construction	0.04		Decommission	No
TR 29-02		Construction	0.08		Decommission	No
TR 29-06		Construction	0.15		Decommission	No
TR 29-08-A		Construction	0.39		Decommission	No
TR 29-08-B		Construction	0.18		Decommission	No
TR 29-08-C		Construction	0.09		Decommission	No
TR 30-03		Construction	0.15		Decommission	No
TR 31-02-A		Construction	0.10		Decommission	No
TR 31-02-B		Construction	0.09		Decommission	No
TR 31-02-C		Construction	0.06		Decommission	No
TR 31-04		Construction	0.03		Decommission	No
TR 31-05		Construction	0.26		Decommission	No
TR 31-08-A		Construction	0.17		Decommission	No
TR 31-08-B		Construction	0.07		Decommission	No
TR 31-08-C		Construction	0.06		Decommission	No
TR 32-01		Construction	0.22		Decommission	No
TR 33-04		Construction	0.04		Decommission	No
TR 33-05		Construction	0.19		Decommission	No
TR 33-06-A		Construction	0.19		Decommission	No
TR 33-06-B		Construction	0.03		Decommission	No
TR 33-06-C		Construction	0.11		Decommission	No
TR 35-04-A		Construction	0.21		Decommission	No
TR 35-04-B		Construction	0.05		Decommission	No
TR 35-10		Construction	0.37		Decommission	No
TR 35-12		Construction	0.12		Decommission	No

D.4. Watershed Analysis

The Last Chance Project Area is located within Douglas, Jackson, and Josephine Counties of Oregon, east of I-5, from Sunny Valley to Quines Creek. The project units are located within Grave Creek, Middle Cow Creek, and Upper Cow Creek watersheds. Middle and Upper Cow drain into the South Umpqua and Grave Creek is tributary to the Rogue River.

The Grants Pass Field Office (GPFO) is proposing forest management activities including vegetation treatments such as VRH, commercial thinning, selection harvest, non-commercial understory reduction, hazardous fuels reduction, and tree tipping on approximately 32,272 acres of BLM-administered lands within the Last Chance project area. Forest management treatments consist of both commercial and non-commercial treatments. For a complete description of the actions planned for managing the forests in this Project Area by alternative see the 1.3 Purpose and Need and 2.0 Alternatives in the Last Chance EA.

The Last Chance project area has a climate characterized by moderate temperatures, wet winters, and dry summers. About 80 percent of the precipitation occurs between October and May. Elevation bands for precipitation zones vary depending on the location within the Last Chance project area. Rain predominates precipitation in the lower elevations (77% of the Last Chance project area) while winter precipitation in the higher elevations usually occurs as snow (< 1%). Shallow snow-packs often build-up in the transition snow zones (22%). elevation range and are typically melted by rain and warm winds throughout the winter between storms.

Methods for Analytical Analysis

The analytical questions or issues are either not analyzed in detail (Appendix B) or analyzed in detail in Chapter 3. To make these determinations adequately and scientifically, hydrology metrics need to be calculated based on watershed size and the location of proposed actions.

This analysis makes use of Geographical Information System (GIS) to determine changes to water yield, potential enhancement of peak flows, estimates for road density, roaded areas for proposed haul routes on aggregate roads, maintenance actions, and other surface disturbances is calculated for the 10-digit (5th level) watersheds, 12-digit and 14-digit subwatersheds within the Last Chance project area (Table 4.1). These methodologies are based on peer reviewed science and analysis from the Final EIS for Western Oregon Volume 1&2 (USDI/BLM, 2016a, pp. 369-768).

Resource effects were determined by measurement indicators selected and identified based on the following assumptions outlined is (Chapter 3: Hydrology and Water Quality). The locations and attributes of water features are based on GIS data using BLM corporate data, collected field points using GPS units, and/or other field notes. The accuracy and precision of this data evolves as better information becomes available.

Changes in streamflow, water yield, duration, peak flow susceptibility, summer low flows and other potential impacts to aquatic habitat, stream function, water quality and other streamflow dependent water resources are evaluated using the best peer-reviewed hydrology science to determine if potential impacts are within the changes anticipated within the range of alternatives analyzed for the Final EIS for Western Oregon (USDI/BLM, 2016a, pp. 384-411).

Landings would be located along existing roads, temporary routes, and/or cable-tractor swing routes or within unit boundaries where possible. Cable and ground-based landings are estimated on average as 1/4 acre and helicopter landings are analyzed as 1 acre on average. Project related areas of disturbances for new haul routes were estimated based on a 20-foot buffer which assumes an average disturbance width of 40 feet on proposed new or reconstructed roads.

The existing ECA was estimated from 2020 aerial photography for baseline or current conditions and found to be just over 5,932 acres or about 10.4 percent of the Last Chance project area. Calculations for

ECA for Alternative 2 and 3 includes a 20-foot buffer or 40-foot width for existing, proposed constructed and reconstructed roads. Road maintenance is not expected to result in new clearings not considered in the baseline estimates. Quarries footprints would be included in the ECA footprint since some vegetation clearing could occur. These buffers are applied in GIS and are included in all the ECA calculations (see Table D4.1 shows totals by analysis area).

Hydrology and Water Quality Tables.

Table D4.1: ECA Analysis for proposed ground disturbance

Analysis Area Name^	Analysis Area (acres) *	Current ECA (acres)	Alt 2: Proposed ECA (acres)*	Percent Disturbance	Alt 3: Proposed ECA	Percent Disturbance
McGinnis Creek - Upper Cow	1,229	7	4	4.05%	50	4.05%
Whitehorse Creek - Middle Cow	7,957	57	20	4.73%	376	4.73%
Quines Creek - Middle Cow	13,481	95	2	3.48%	469	3.48%
Fortune Branch - Middle Cow	2,234	15	8	4.86%	109	4.86%
Last Chance – Grave Creek	16,025	123	4	3.84%	614	3.84%
Shanks Creek - Grave Creek	5,622	38	5	3.72%	209	3.72%
Rat Creek - Grave Creek	891	9	0	4.96%	44	4.96%
Wolf Creek - Grave Creek	9,447	79	7	4.44%	419	4.44%

^These are the portions of the 12-digit (6th level) subwatershed areas within the Last Chance Project Area

* Roaded Area, calculated by assuming an average disturbance width of 45 feet

Table D4.2: ECA based on Digitizing Canopy Openings based on 2016 Aerial Photography with Analysis Areas based 12-dgit (6th level) subwatersheds.

Analysis Areas	Rain Zone		Transient Snow		Seasonal Snow		Total Acres*
	Acres	%	Acres	%	Acres	%	
Middle Starvout Creek (below Jones Creek, above Hogum Creek)	15,573	99.60%	57	0.40%	0	0	15,630
Middle Hogum Creek (below Boulder Creek, above Fizzleout Creek)	14,036	99.20%	106	0.80%	0	0	14,142
Jones Creek (Starvout Creek)	16,685	99%	230	1%	0	0	16,915
Boulder Creek (Starvout Creek)	12,115	100%	0	0	0	0	12,115

Upper Hogum Creek (above Boulder Creek)	21,950	99.80%	35	0.20%	0	0	21,986
Upper Starvout Creek (above Jones Creek)	21,600	100%	0	0	0	0	21,600
Lower Bull Run (below Little Bull Run, above Quines Creek confluence)	11,140	100%	0	0	0	0	11,140
McCollum Creek	15,573	99.60%	57	0.40%	0	0	15,630
Upper Bull Run (above Little Bull Run)	14,036	99.20%	106	0.80%	0	0	14,142
Woodford Creek	16,685	99%	230	1%	0	0	16,915
Middle Quines Creek (below Tennessee Gulch, above Bull Run)	12,115	100%	0	0	0	0	12,115
Grave Creek above Last Chance Creek	21,950	99.80%	35	0.20%	0	0	21,986
Little Bull Run	21,600	100%	0	0	0	0	21,600
Last Chance Creek	11,140	100%	0	0	0	0	11,140
Upper Quines Creek (above Tennessee Gulch)	15,573	99.60%	57	0.40%	0	0	15,630
Tennessee Gulch	14,036	99.20%	106	0.80%	0	0	14,142
Sourdough Gulch	16,685	99%	230	1%	0	0	16,915
Wolf Creek (Grave Creek) below Bummer Gulch, above Hole in the Ground	12,115	100%	0	0	0	0	12,115
Wolf Creek (Grave Creek) below Hole in the Ground, above Board Tree Creek	21,950	99.80%	35	0.20%	0	0	21,986
Wolf Creek (Grave Creek) above Bummer Gulch	21,600	100%	0	0	0	0	21,600
Grave Creek below Last Chance Creek, down to (and including) Little Boulder Creek	11,140	100%	0	0	0	0	11,140
Wolf Creek (Grave Creek) below Board Tree Creek, above Sourdough Gulch	15,573	99.60%	57	0.40%	0	0	15,630
Bummer Gulch (Grave Creek)	14,036	99.20%	106	0.80%	0	0	14,142

Hole in the Ground (Wolf Creek)	16,685	99%	230	1%	0	0	16,915
Slate Creek (Grave Creek)	12,115	100%	0	0	0	0	12,115
Boulder Creek (King Mountain)	21,950	99.80%	35	0.20%	0	0	21,986
Grave Creek below Little Boulder Creek, above Slate Creek	21,600	100%	0	0	0	0	21,600
Coyote Creek below Foley Gulch, above Colby Gulch	11,140	100%	0	0	0	0	11,140
Post Gulch	15,573	99.60%	57	0.40%	0	0	15,630
Clark Creek (Grave Creek)	14,036	99.20%	106	0.80%	0	0	14,142
Robinson Gulch	16,685	99%	230	1%	0	0	16,915
Coyote Creek above Post Gulch	12,115	100%	0	0	0	0	12,115
Coyote Creek below Post Gulch, above Scholey Gulch	21,950	99.80%	35	0.20%	0	0	21,986
Baker Creek	21,600	100%	0	0	0	0	21,600
Grave Creek below Slate Creek, above Baker Creek	11,140	100%	0	0	0	0	11,140
Coyote Creek below Scholey Gulch, above Miller Gulch	15,573	99.60%	57	0.40%	0	0	15,630
Coyote Creek below Robinson Gulch, above Foley Gulch	14,036	99.20%	106	0.80%	0	0	14,142
Kennedy Gulch	16,685	99%	230	1%	0	0	16,915
Coyote Creek below Miller Gulch, above Robinson Gulch	12,115	100%	0	0	0	0	12,115
Colby Gulch	21,950	99.80%	35	0.20%	0	0	21,986
Scholey Gulch	21,600	100%	0	0	0	0	21,600
Miller Gulch (Coyote Creek)	11,140	100%	0	0	0	0	11,140
Eastman Gulch	15,573	99.60%	57	0.40%	0	0	15,630
Tom East Creek (Shanks Creek-Grave Creek)	14,036	99.20%	106	0.80%	0	0	14,142
Salmon Creek	16,685	99%	230	1%	0	0	16,915
Quartz Mill Gulch (Grave Creek)	12,115	100%	0	0	0	0	12,115

Grave Creek below Baker Creek, above Boulder Creek (King Mountain)	21,950	99.80%	35	0.20%	0	0	21,986
Benjamin Gulch	21,600	100%	0	0	0	0	21,600
Grave Creek below Boulder Creek (King Mountain), above Clark Creek	11,140	100%	0	0	0	0	11,140
Grave Creek below Clark Creek, above Eastman Gulch	15,573	99.60%	57	0.40%	0	0	15,630
Grave Creek below Eastman Gulch, above Quartz Mill Gulch	14,036	99.20%	106	0.80%	0	0	14,142
Grave Creek below Quartz Mill Gulch, above Tom East Creek	16,685	99%	230	1%	0	0	16,915
Grave Creek below Burgess Gulch, above Salmon Creek	12,115	100%	0	0	0	0	12,115
Grave Creek below Benjamin Gulch, above Burgess Gulch	21,950	99.80%	35	0.20%	0	0	21,986

Soils Tables

Table D4.3: Summary of Last Chance Quines project alternatives included in soil specialist report.

Category		**Acres**
	Total Project Area	**56,843**
Alternate 2 &2b	Commercial Units	8,600
	Fuels Units	4,512
	Road Construction and Reconstruction (buffered 45 feet)	272
	Affected Area for Soils (commercial units, fuels units, road construction)	11,425
	Legacy Disturbance in Total Affected Area	144
		Percent of unit area
	Total Potential DSD as % of unit area from legacy, projected logging systems, road building	12
	Total Potential DSD as % of unit area from legacy, road building (no projected logging systems)	6
		Acres
Alternate 3	Commercial Units	1,118
	Fuels Units	4,512
	Road Construction and Reconstruction (buffered 45 feet)	8
	Affected Area for Soils (commercial units, fuels units, roads)	5,163
	Legacy Disturbance in Units	10
		Percent of unit area
	Total Potential DSD as % of unit area from legacy, projected logging systems, road building	6
	Total Potential DSD as % of unit area from legacy, road building (no projected logging systems)	1

Table D4.4: Soil survey taxonomy summary for the Last Chance Quines Shanks project alternatives 2 and 3 expecting ground impacts from road building, road building and reconstruction, fuels maintenance, and commercial extraction. The Natural Resource Conservation Service completed mapping in these survey areas (OR033, OR632, OR649) at a 1:20,000 to 1:24,000 scale with a minimum size delineation of 4.0 acres. For this reason, the map units smaller than 4 acres may be inaccurate.

Soil Types	**Acres**	**% of Total Area**
Alternative 2		
Loamy-skeletal, mixed, mesic Dystric Xerochrepts	2601.80	22.77

Soil Types	Acres	% of Total Area
Fine-loamy, mixed, mesic Typic Haploxerults	2130.99	18.65
Fine-loamy, mixed, mesic Typic Palexerults	2036.15	17.82
Fine-loamy, mixed, mesic Ultic Haploxeralfs	1105.82	9.68
Loamy-skeletal, mixed, frigid Dystric Xerochrepts	1038.43	9.09
Fine, mixed, mesic Ultic Haploxeralfs	915.59	8.01
Loamy-skeletal, serpentinitic, mesic Dystric Xerochrepts	613.08	5.37
Clayey-skeletal, serpentinitic, mesic Lithic Xerochrepts	246.58	2.16
Clayey, kaolinitic, mesic Typic Haploxerults	210.13	1.84
Fine, serpentinitic, frigid Ultic Haploxeralfs	131.95	1.15
Loamy-skeletal, mixed Dystric Cryochrepts	110.78	0.97
Fine-loamy, mixed, mesic Typic Haplumbrepts	73.47	0.64
Loamy-skeletal, mixed, mesic Ultic Haploxeralfs	59.83	0.52
Loamy-skeletal, mixed, frigid Lithic Xerumbrepts	54.40	0.48
Xerorthents	26.59	0.23
Fine-loamy, mixed, mesic Ultic Haploxerolls	26.34	0.23
Clayey, kaolinitic, mesic Typic Palexerults	26.04	0.23
Clayey-skeletal, serpentinitic, mesic Mollic Haploxeralfs	16.06	0.14
Coarse-loamy, mixed, mesic Pachic Haploxerolls	0.60	0.01
Total	**11424.64**	**100.00**
Alternative 3		
Loamy-skeletal, mixed, mesic Dystric Xerochrepts	1481.43	28.69
Fine-loamy, mixed, mesic Typic Palexerults	1342.06	25.99
Fine-loamy, mixed, mesic Typic Haploxerults	683.59	13.24
Fine, mixed, mesic Ultic Haploxeralfs	440.53	8.53
Fine-loamy, mixed, mesic Ultic Haploxeralfs	360.41	6.98
Loamy-skeletal, mixed, frigid Dystric Xerochrepts	335.69	6.50
Loamy-skeletal, serpentinitic, mesic Dystric Xerochrepts	142.87	2.77
Fine, serpentinitic, frigid Ultic Haploxeralfs	105.22	2.04
Clayey, kaolinitic, mesic Typic Haploxerults	98.54	1.91
Loamy-skeletal, mixed, mesic Ultic Haploxeralfs	59.04	1.14
Clayey-skeletal, serpentinitic, mesic Lithic Xerochrepts	57.42	1.11
Loamy-skeletal, mixed, frigid Lithic Xerumbrepts	30.16	0.58

Soil Types	Acres	% of Total Area
Xerorthents	18.13	0.35
Clayey, kaolinitic, mesic Typic Palexerults	8.84	0.17
Total	**5163.93**	100.00

Table D4.5: Timber Production Capability Classification within the Last Chance project area proposed alternatives. The TPCC designations provide information on the limitations of the land. The first letter represents non-forest ("NF"), non-commercial forest land ("NCFL"), no problem areas ("NP"), reforestation problems ("R"), or fragile soils ("F"). The second letter (if starting with "R" or "F") designates areas are either restricted ("R") or non-suitable ("N") and thus excluded from timber production. Non-suitable designations are not biophysically capable of supporting a sustained yield of forest products, whereas restricted designations require operational measures in addition to standard practices. The letters after the dash provide details on why the areas are either restricted or fragile. More information can be found in the BLM Manual Medford District TPCC Handbook (5251-1) and all category symbols are consistent with the updated Data Standard Version 3.0 (IB-OR-2022-003).

TPCC Designation	Description	Acres	Acres as percent of Alternative Area
Alternative 2a &2b (11,446 acres)			
RR-T	Reforestation restricted for high temperatures from solar radiation	4715.81	41.20
RR-M	Reforestation restricted for low moisture (competition from brush and low precipitation)	2627.47	22.95
FR-N RR-T	Fragile soils restricted for low soil nutrients	792.39	6.92
FR-N RR-M		504.59	4.41
RR-KT	Reforestation restricted for surface rock (K)	486.38	4.25
FR-N RR-KT		361.68	3.16
RN-K		357.72	3.13
FN-N	Fragile non-suitable for low soil nutrients	243.41	2.13
RR-KM		219.95	1.92
NF	Non-forest	169.49	1.48
NCFL-LPS	Non-commercial forest lands with low productivity site	163.03	1.42

FR-W RR-T	Fragile restricted for high groundwater table	118.54	1.04
FR-G RR-T	Fragile restricted for steep slopes with high potential for landslides (not on granitic soils)	100.49	0.88
FR-W RR-M		95.56	0.83
FR-E RR-M	Fragile restricted for high erosion potential (granitic or schist soils)	91.00	0.80
FR-NW,RR-T		75.34	0.66
FR-N,RR-KM		49.72	0.43
NF-UTL	Non-forest utilities	45.11	0.39
FN-G	Fragile non-suitable for slope gradient	44.24	0.39
FR-NW,RR-M		38.54	0.34
FR-W,RR-K		38.12	0.33
FR-G,RR-M		34.96	0.31
FR-E,RR-T		25.69	0.22
NCFL-NCSP	Non-commercial forest land with non-commercial species	22.45	0.20
FN-W		12.01	0.10
FR-GN,RR-T		7.84	0.07
NP	No problems for reforestation or soils	2.38	0.02
NF-RCK		2.01	0.02
FR-GN,RR-M		0.16	<0.00
NF-WTR	Non-forest water	0.13	<0.00
Total		**11446.20**	**100.00**
Alternative 3 (5,188 acres)			
RR-T		2441.68	47.06
RR-M		1106.72	21.33
FR-N,RR-T		333.16	6.42

FR-N,RR-M		235.26	4.53
RN-K		177.65	3.42
RR-KT		124.50	2.40
NF		100.61	1.94
FR-W,RR-T		91.74	1.77
FR-G,RR-T		81.52	1.57
FN-N		73.59	1.42
RR-KM		66.83	1.29
FR-NW,RR-T		64.33	1.24
NCFL-LPS		63.75	1.23
FN-G		38.52	0.74
FR-W,RR-M		37.35	0.72
FR-W,RR-K		37.33	0.72
FR-NW,RR-M		31.88	0.61
FR-N,RR-KM		26.17	0.50
FR-N,RR-KT		22.73	0.44
NCFL-NCSP		22.45	0.43
NF-UTL		4.58	0.09
FR-G,RR-M		3.26	0.06
FN-W		1.86	0.04
NP		0.62	0.01
NF-WTR		0.13	<0.00
NF-RCK	Non-forest rockland	<0.00	<0.00
Total		**5188.21**	**100.00**

District Designated Reserves and TPCC

Tables D4.6, D4.7, and D4.8 document the fuels units, proposed road locations, and timber harvest units which have potential DDR-TPCC, TPCC-Withdrawn, or TPCC-Restricted soils derived from GIS that would be field verified prior to implementing actions. The outcome of field verification of these areas, which intersect with fuels, roads, and commercial units, would be disclosed in the subsequent Decision Records.

Table D4.6: Proposed Fuels Management Designated as Withdrawn in the TPCC System

Unit	Acres	TPCC Symbol	Description	Recommendations
I-Shank 23-1	1.7	RSW	These sites have a surface fragment layers that can restrict planting	Apply fuels treatments which may include prescribed fire and would be applied to emulate ecological conditions produced by historic fire regimes.
Lawson 1-1LC	1.1			
Lawson 1-1LD	0.7			
Lawson 1-1LE PWF	2.4			
Westside 17-2	4.6			
King Wolf 5-1A	7.6	FGNW and NF	Fragility problems due to gradient in non-suitable woodland or non-forest	
King Wolf 5-1C	21.6			
King Wolf 5-1B	1.4	LSW	Low site potential in suitable woodland	

Table D4.7: Proposed Road Construction in DDR-TPCC Areas and in Areas Designated as TPCC Withdrawn or TPCC Restricted in Other Land Use Allocations

Legal Location	Feet	TPCC Symbol	Description	Recommendations
32_05_17	813	RSW	Suitable woodland due to surface rock	This classification does not impact road building.
32_05_18	298	NF	Non-Forest	This classification does not impact road building.
32_05_19	313			
32_06_23	675			
33_06_10	45			
32_05_18	298			
32_05_19	313			
32_06_23	675			
33_06_10	45			
32_05_31	996	RTW	Suitable woodland due to temperature	This classification does not impact road building.
32_07_23	80	FGNW	Fragile problem in non-suitable woodland due to gradient.	Road would be built to an 8 to 14% grade and is in the corner of area identified and would be on a ridge. This site does not need special project design features.
33_05_31	475	LSW and NF	Low site potential in suitable woodland and non-forest.	This classification does not impact road building.
33_06_15	1,081	FGNW and NF	Fragile problem in non-suitable woodland due to gradient and areas of non-forest	Road would be built to an 8 to 14% grade and is in the corner of area identified and would be on a ridge. This site does not need special project design features.
34_06_23 & 24	2,318	RMW and TW	Reforestation problem in suitable woodland due to temperature or lack of moisture.	This classification does not impact road building.

Table D4.8: Proposed Timber Harvest in District Designated Reserves-Timber Productivity Capability Classification

Unit	Acres	Updated TPCC Symbol	Previous TPCC Symbol / Description	Proposed Treatment Types	Project Design Features
11-02	0.5	FMR	RMW – Reforestation Moisture Withdrawn. Low available soil moisture in combination with competing vegetation and low precipitation during the growing season.	Thin stands light to moderately, avoid group selects which require replanting, lop and scatter slash to increase soil moisture holding capacity.	Decrease treatment intensity, avoid group selects, lop and scatter slash.
05-04 19-05 34-01	29.5 2 3	FN-G	FGNW – Fragile Non-suitable Woodland Slope Gradient. Unstable slope or slope with the potential to become unstable. Generally greater than 65 percent concave and 80 percent in convex positions.	Buffer these sites if conditions match those described to the left.	Avoid and buffer sites which are generally greater than 65 percent in concave positions and 80 percent in convex positions – common locations are in inner gorges, above streams, and headwall drainages.
03-08 03-09 03-10 04-01 09-06 09-07 11-06 14-02 17-01 17-02 21-01 22-07 23-09 25-06 25-07 27-01	2 1.5 3.5 6 2 1 5.5 4.5 65.5 14 14 10 4.5 10 22 5	FN-N	FNNW – Fragile Non-suitable Nutrient Woodland. Inherently low nutrients or nutrient imbalance. Extremely/cobbly/gravely textured surfaces.	Minimize ground disturbance. Buffer areas with higher nutrient issues.	Thin stands light to moderately, avoid group selects which require replanting, lop and scatter slash to increase nutrients. Consider the application of fertilizer.

27-03	1				
11-02	0.5	FN-W	FWNW – Fragile Non-suitable Woodland Groundwater. Poorly drained soils which contain water at or near the soil surface for long periods such that vegetation survival and growth are negatively affected.	Buffer these sites if conditions match those described to the left.	Buffer sites found to be saturated.
03-01 04-01 05-04 11-06 22-03 22-07 23-02 23-03 23-08 24-01 24-02 24-03 25-06 27-03 34-01	3.5 29 8.5 3.5 1 1.5 3.5 0.5 2 6 15.5 1 5 3.5 26	NCFL-LPS	LSW – Low site potential in suitable woodland and non-forest.	Promote desired species composition by retaining/culturing minor species such as pine and oak and removing small diameter Douglas-fir. Lop and scatter slash to redistribute nutrients. Consider low intensity prescribed fire on some sites to emulate ecological conditions produced by historic fire regimes.	Retain/culture minor species over small Douglas-fir, lop and scatter slash, low intensity prescribed fire.
05-02 05-04	22.5 4	NCFL-NCSP	NCW – Non-commercial Woodland. Areas generally produce species which are typically utilized as noncommercial products and sold in units other than board feet.	Thin stands and apply prescribed fire to promote minor species such as pine and oaks. Reintroduce fire to favor fire tolerant understory species.	Consider treating these areas to promote desired minor species such as pine and oak.
03-01 04-01 05-01 06-01 09-01	4.5 5 1 0.5 5	NF – Nonforest	NF – Nonforest. Sites within the forest zone that are not capable of maintaining at least 10% stocking of forest	Construction and/or use of cable corridors, skid trails, landings, and roads.	N/A

14-02 22-01 23-09 25-10 26-02 32-01 33-03 33-06 34-01 34-02	1.5 2.5 0.5 2.5 3 0.5 6 11.5 10 17		trees and those sites which have been converted to nontimber uses.		
35-05	1	NF-RCK – Nonforest Rock	NF – Nonforest.	Construction and/or use of cable corridors, skid trails, landings, and roads.	N/A
03-08 03-10 03-12 11-02 11-04	4.5 12.5 6 6 6.5	NF-UTL – Nonforest Utility Site	NF – Nonforest.	Construction and/or use of cable corridors, skid trails, landings, and roads.	N/A
03-01 03-04 04-01 04-02 04-03 04-04 05-03 13-06 14-01 14-03 17-01 23-02 23-03 23-11 24-01 25-07	2.5 0.5 32.5 3.5 1.5 9.5 9.5 7 1 15 14 8 7 1 2 1.5	RN-K	RSW – Suitable Woodland Surface Rock. Surface fragment layer that cannot be manipulated to create planting spots, soil beneath surface layer is not sufficient depth to support conifer growth.	To promote desired species composition thin stands at the light to moderate level and avoid large group selects which would require planting. Lop and scatter slash to redistribute nutrients. Consider low intensity prescribed fire on some sites to emulate ecological conditions produced by historic fire regimes.	Thin stands light to moderately, avoid group selects which require replanting, lop and scatter slash, low intensity prescribed fire.

26-02 31-06 31-08 32-02 34-01	3 35.5 7 0.5 48				
14-01	0.5	RR-KM	RSW/RMW – Suitable Woodland Surface Rock/ Reforestation Moisture Withdrawn RSW - Suitable Woodland Surface Rock. Surface fragment layer that cannot be manipulated to create planting spots, soil beneath surface layer is not sufficient depth to support conifer growth. RMW – Reforestation Moisture Withdrawn. Low available soil moisture in combination with competing vegetation and low precipitation during the growing season.	To promote desired species composition thin stands at a moderate level and avoid large group selects which would require planting. Lop and scatter slash to redistribute nutrients. Consider low intensity prescribed fire on some sites to emulate ecological conditions produced by historic fire regimes. Thin stands light to moderately, avoid group selects which require replanting, lop and scatter slash to increase soil moisture holding capacity.	Thin stands moderately, avoid group selects which require replanting, lop and scatter slash, low intensity prescribed fire. Decrease treatment intensity, avoid group selects, lop and scatter slash.
06-01 11-03 31-08	3.5 0.5 0.5	RR-T	RTW – Reforestation Temperature Withdrawn. High solar radiation in combination with low available soil moisture.	Thin stands moderately, avoid group selects which require replanting, lop and scatter slash to increase soil moisture holding capacity.	Avoid group selects and lop and scatter slash.

D.5. Wildland Fuel Profile

Background

In the frequent fire-adapted dry forest, there are important stand attributes that improve resistance to stand-replacing fire, reducing "the likelihood of atypical large-scale crown fires (Agee and Skinner 2005; Jain et al. 2012; Franklin et al. 2013). In general, stands with higher fire resistance have reduced surface fuel loading, lower tree density, large diameter trees of fire-resistant species, increased height to live crown (Brown et al. 2004; Peterson et al. 2005; USDI BLM 2008a), and discontinuous horizontal and vertical fuels" (USDI BLM 2016a, p. 243). Patchy stand composition in vegetation or fuel patterns representative of frequent-fire dry forest low-mixed fire regime fuel loading contributes toward stand resistance to replacement fire (USDI BLM 2016a, pp. 225-226) by disrupting fuel profiles which may inhibit the spread of crown fires, creating variability in litter fall and surface fuel accumulations, and promoting regeneration of diverse species to respond to disturbance (e.g., wildfire, drought, and insects). In these fire-resistant stands, it is more likely that a "wildfire can burn through…without substantially altering its structure, composition, or function (Franklin et al. 2013)." (USDI BLM 2016a, p. 242). These principles are consistent with those articulated in the Rogue Valley Integrated Fire Plan (RVIFP) (CWPP 2019, Table 5-1, p. 103).

Fire hazard refers to the ease of ignition, potential fire behavior (surface, passive or crown fire), and resistance to control of wildland fuels (i.e., surface, ladder, and canopy fuels), which directly influences suppression tactics, for example, crown fires present the greatest resistance to control (USDI BLM 2016a, p. 254-255, Appendix H. 1321-1322). Crown fires create the greatest amount of ember production and spot fires and present the greatest resistance to control among potential fire behavior types (USDI BLM 2016a, p. 254). The primary fuel characteristics associated with potential fire behavior and crown fire potential are canopy base height, canopy bulk density, and surface fuel loading (Scott and Reinhardt 2001).

Fire resistance is inversely related to fire hazard; when fire resistance increases, fire hazard decreases (USDI BLM 2016a, p. 254-255, Appendix H. 1321-1322).

Methods

The PRMP/FEIS found that implementation of the PRMP/FEIS would reduce the acreage in the low or moderate resistance to stand-replacement fire categories within the dry forest, from nearly 50% to 30%, across the Medford District after 50 years. After 50 years, the majority of acres would be in the *mixed* fire resistance category (USDI BLM 2016a, p. 249), (USDI BLM 2016a, Figure 3-29, p.246).

In the PRMP/FEIS, the BLM assumed that vegetation structural stage is an important component affecting resistance to stand replacing fire, and assigned forest structural stages (USDI BLM 2016a, Appendix C pp. 1203-1206) to a relative ranking of resistance to stand-replacement fire (USDI BLM 2016a, p. 243 Table 3-32), based on assumptions regarding horizontal and vertical fuel profile continuity (USDI BLM 2016a, Appendix H pp. 1320-1321). These categories range from low fire resistance (i.e., greater tendency for a stand-replacement) to moderate to high fire resistance (i.e., less probability of a stand-replacement). Very simply put, a crown fire or a very intense surface fire would result in stand-replacement. The PRMP/FEIS also identified a *mixed* fire resistance category, which indicates the potential to exhibit the full range of resistance categories (low, moderate, or high), for example, the PRMP/FEIS acknowledged that some structural stages in certain landscape locations can harbor conditions more likely to result in lowered fire severity (USDI BLM 2016a, Appendix H pp. 1320-1321). The PRMP/FEIS analysis did "…not account for the complex interaction among fuels (including vertical and horizontal composition and moisture), topography (e.g., slope, topographic position, elevation, and aspect), and weather (e.g., wind, temperature, relative humidity, fuel moisture, and drought) that influence fire behavior, resultant burn severity, and fire effects (Andrews and Rothermel 1983, Scott and Reindhardt 2001) and the specific conditions related to crown fire initiation (stand-replacement fire) and spread (Van Wagner 1977)" (USDI BLM 2016a, p. 243). The PRMP/FEIS concluded that "ultimately, fire behavior in the "mixed category" would result from several factors, including weather, fuel moisture, and topographic influences, along with the vertical and horizontal continuity of the fuel profile" (USDI BLM 2016a, Appendix H p. 1320). In short, fire behavior is a product of fuels, weather, and topography.

To provide an informative analysis of this EA's alternatives effects in the *mixed* relative resistance to stand-replacing fire category, the BLM considered the vertical and horizontal continuity of the wildland fuel profile (i.e., canopy, ladder and surface fuels, and fuel heterogeneity) in detailed analysis of stand-level resistance to compare fuel profiles and predicted fire behavior among alternatives for stands with *mixed* resistance to stand-replacement fire within the Nexus 2.1 crown fire model program (Scott and Reinhardt 2014), which links separate models of surface fire behavior and crown fire behavior to calculate indices of relative crown fire potential (e.g., crowning index [CI] and torching index [TI]).The BLM conducted this analysis under typical fire weather conditions (90th percentile), as assumed in the PRMP/FEIS (p. 228), and average slope across the maximum proposed action footprint (see Affected Environment in Appendix D.5 for more details).

The BLM used a standard approach to derive a relative resistance to stand-replacement fire for mixed relative resistance to stand-replacing fire categories, based on the relationship between indices of relative crown fire potential: crowning index (CI) and torching index (TI) (See Assumptions below).

For cumulative effects, the BLM considered the incremental impact of proposed actions when added to other past, present, and reasonably foreseeable future actions and natural disturbance and climatic factors.

<u>Assumptions</u>

Relative Resistance to Stand-replacement Fire

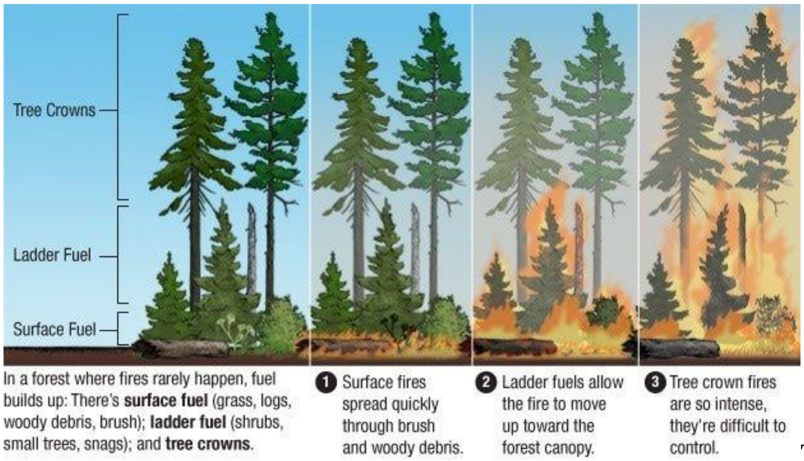
Table 3.5.1: Explanation of the relationship between crowning index (CI), torching index (TI), and relative stand replacement fire resistance.

Crowning Index (CI)	**Torching Index (TI)**	**Relative Stand Replacement Fire Resistance**
<20 mph	<20 mph	LOW
	>20 mph	MODERATE-low*
20 – 30 mph	<20 mph	MODERATE-low
	>20 mph	MODERATE-high
>30 mph	<30 mph	MODERATE-high
	>30 mph	HIGH

*If TI is greater than CI, this indicates that within-stand crown fire initiation is unlikely, however stand canopy connectivity may support crown fire spread from adjacent areas under windspeeds equal or below CI windspeeds (i.e., independent crownfire).

<u>Wildland Fuel Profile</u>

Canopy base height and surface fire intensity are key variables (along with the moisture content of leaves and branches) in determining the transition between surface fire to torching or passive crown fire. Canopy bulk density (or connectivity) then differentiates between passive and active crown fire (VanWagner 1977).



The wildland fuel profile: canopy fuels (canopy connectivity (canopy cover and canopy bulk density), ladder fuels (canopy base height), surface fuels (surface fuel models) (Scott and Burgan 2005) and fuel heterogeneity and thus influence fire resistance and fire hazard. These fuels are illustrated in Figure D.5.1. Figure D.5.1 provides a visual representation of surface fuels, canopy fuels, and ladder fuels.

The BLM incorporates by reference and applies here the same details regarding the wildland fuel profile (Canopy Fuels, ladder fuels, surface fuels, fuel heterogeneity, maintenance, and resistance to other disturbance) that the BLM discussed in the Rogue Gold Environmental Assessment (EA), Appendix H (BLM 2023) and Integrated Vegetation Management for Resilient Lands EA, Appendix 5 (IVM-RL EA) (BLM 2022) to analyze the effects to relative resistance to stand-replacing fire, particularly the category the FEIS identified as *mixed* relative resistance to stand replacement fire in the FEIS (BLM 2016a).

<u>Canopy fuels (Canopy Connectivity (Canopy Bulk Density and Canopy Cover)</u>

Canopy fuels consist of live and dead tree branches and crowns. Tree crowns can be separated or interlocking (i.e., canopy connectivity) and dense or sparse. Large trees, particularly of fire-resistant species, are an important component of fire-resistant stand structure (Martinson and Omi 2013; USDI BLM 2016a, pp. 243, 252).

A necessary input into NEXUS is available canopy fuel. The BLM used a value of 6 tons/acre for all model runs, based on estimates for Douglas-fir and Sierra Nevada mixed conifer, as presented by Scott and Reinhard (2002).

For commercial thinning and group selection actions in *mixed* relative resistance to stand-replacement category, the BLM derived estimated post-harvest canopy cover, based on prescriptive RDI targets and corresponding estimated canopy cover provided by the Silviculturist. The BLM assumes that openings and skips contribute toward the stand-level average canopy cover. The BLM derived corresponding canopy bulk density from canopy cover using LANDFIRE lookup tables (Metlen et al. Appendix 7, Metlen et al 2021) (USDI BLM 2016a, Appendix H). The BLM assumed existing vegetation height in all stands to be greater than 75 feet (25 meters). The BLM assumed canopy fuels would not change following only small diameter thinning and prescribe fire treatments (i.e. non-commercial fuels reduction).

<u>Ladder fuels (Canopy Base Height)</u>

Ladder fuels typically consist of small trees and tall shrubs that span from the forest floor to the overstory canopy. The vertical arrangement of fuels refers to the continuity of fuels from the ground up through the overstory canopy, termed as CBH. Low vertical separation between surface and canopy fuels, or low CBH, is the most common vector for surface fire to transition into crown fire and is commonly identified as the ladder fuel component of the Wildland fuel profile. Canopy base height supplies information used in fire behavior models, to determine the point at which a surface fire would transition to a crown fire.

Removal of ladder fuels increases vertical and horizontal separation or discontinuity in the fuel profile and reduces the probability of surface fire flames ascending into and igniting tree crowns and subsequently decrease the likelihood of tree torching and crown fire initiation (Scott and Reinhard 2001; Van Wagner 1977). Application of prescribed fire, via underburning, can further raise CBH and reduce ladder fuels.

The BLM assumed CBH resulting from the proposed actions (small diameter thinning and prescribed burning) would reflect outcomes indicated by local Medford District monitoring data (USDI BLM 2021b), literature, assumptions in the Rogue Basin Strategy for post-treatment fuel transitions (Metlen et al. 2017; Metlen et al 2021), LANDFIRE post-disturbance rules, and professional local knowledge. In areas of handpile burning, proposed actions would result in CBHs of approximately 8 feet on average following treatment. Areas that are underburned would be expected to have relatively high CBHs of approximately 12 feet on average. Where prescriptions would maintain NSO Nesting-roosting habitat function, CBHs would be relatively low (less than 5 feet on average).

In the 2016 PRMP/FEIS, the BLM incorporated post-harvest tree planting into the vegetation modeling and subsequent post-harvest structural stages (USDI BLM 2016a, Appendix C), thus the 2016 PRMP/FEIS analysis of structural stage resistance to stand-replacement fire, which this analysis tiers to (see Methodology) accounts for presumed post-harvest replanting. Additionally, the moderate-term effects analysis in this issue accounts for re-growth of understory vegetation (i.e., accumulation of surface and ladder fuels), including the varied effects of reforestation within gaps.

Surface fuels (Fire Behavior Fuel Model)

The BLM assumed a range of short-term (up to 20 years) surface fuel model transitions resulting from the proposed actions (small diameter thinning and prescribed burning) that would reflect outcomes indicated by local Medford District monitoring data (USDI BLM 2021), literature, assumptions in the Rogue Basin Strategy for post-treatment fuel transitions (Metlen et al. 2017; Metlen et al 2021), LANDFIRE post-disturbance rules, and professional local knowledge.

Specifically, following commercial thinning or selection harvest and subsequent fuels reduction treatments (small diameter thinning and prescribed burning), the BLM assumed a mix of *low* to *moderate* grass-shrub and hardwood litter surface fuel models in stands with <40 percent canopy cover; and a mix of *low* to *moderate* timber understory and timber litter surface fuel models in stands with >40 percent canopy cover for short-term (up to 20 years) (Table 2).

Table 2: Surface fuel model transitions following commercial thinning or selection harvest and subsequent fuels reduction treatments (small diameter thinning and prescribed burning).

Existing Surface Fuel Loading Description Categories (Model)	Canopy Cover		
	<40%	>40-60%	>60%
Low load grass (101,102)	No change	N/A	
Low load grass-shrub (121,141)			
Moderate load grass-shrub (122,123,142)	Low load grass-shrub (GS1/121)		

High load shrub (145,147)	Moderate Load grass-shrub (GS2/122)	
Low load mixed conifer - hardwood (181,182,161)	Mix 1/3 each: Low load (GS1/121); Moderate load conifer-hardwood (TL6/186) & Moderate Load grass-shrub (GS2/122)	No Change
Moderate load mixed conifer - hardwood (162,183,186,188)		
High load conifer (184,185,187)		Mix 1/3 each: Low-load Mixed conifer -understory (161/TU1); Moderate load litter (183/TL3); Moderate load mixed conifer-understory (162/TU2)*
Very High load mixed conifer-hardwood (165,189)		

Maintenance

In forested systems, generally treatment maintenance would not be needed in the short-term (up to 20-years). This is supported by local plot data and locally conducted Fuel Treatment Effectiveness Monitoring (FTEM) of recent wildfire and treatment interactions on nearly 9,000 acres of previously treated areas burned in a wildfire between 2008-2022, where treatments were found to be effective in some areas for up to 14 years (USDI BLM 2021b) and up to 17 years in fuel treatments intersected in the Rum Creek wildfire (2022). Elsewhere, Lydersen and others (2014) found that treatments were effective up to 22 years and other recent findings indicate treatment effectiveness lasts up to two decades (Hood et al. 2023, and Brodie et al. 2024). These findings are consistent with and add to a growing body of evidence throughout western states that demonstrates that vegetation management (mechanical and prescribed fire) has successfully moderated fire behavior and fire effects and has contributed toward more resilient future forest structure and improved safe and effective fire management and response opportunities, even in some instances under extreme fire weather conditions (USDI BLM 2016a, p. 228).

The treatment maintenance timeframe is consistent with estimates of local historic fire-intervals, as Metlen and others (2018) found 90 percent of historic fire return intervals to be between 3 and 30 years, with median return intervals of 8 years. Maintenance treatments would be needed approximately every 10-20 years after initial entry treatments in long departed ecosystems, to maintain high resistance to stand-replacement fire. Maintenance treatments would be needed approximately every 20-30 years after initial entry treatments, to maintain moderate resistance to stand-replacement fire. While higher levels of overstory cover, are associated with increased potential for crown fire, the additional cover may restrict or delay understory regeneration and allow more time between maintenance treatments, thus maintenance would be needed more frequently in stands with canopy cover less than 40%, and less frequently in stands with canopy cover greater than 40% (Agee 2000, USDI BLM 2021b) (Table 3).

Table 3: Number of maintenance actions estimated over 50 years by stand-level replacement fire resistance category and canopy cover.

Stand-level resistance	Objective	Maintenance Frequency	Canopy Cover	
			<40%	>40%
High and Moderate-high	Low load surface fuels & High canopy base	10-20 years	4	2

Moderate-low	Moderate surface fuels & moderate canopy base	20-30 years	1.5	1.5

Fuel Heterogeneity

There is considerable evidence that many historic frequent-fire dry forests were comprised of a fine-scale patchy composition of openings and clumps (Churchill et al. 2013; Hessburg et al. 2015; Larson and Churchill 2008; Taylor 2010; Larson and Churchill 2012; Lydersen et al. 2013; Churchill et al. 2017; Pawlikowski et al. 2019), creating vegetation or fuel patterns representative of frequent-fire dry forest low-mixed fire regime fuel loading (USDI BLM 2016a, pp. 225-226). Among the many ways that variable and complex fine-scale heterogeneous patterning contributes toward stand resistance to replacement fire are heterogenous fuel profiles which may inhibit the spread of crown fires, patchy regeneration of diverse species to respond to disturbance, and variability in litter fall and surface fuel accumulations.

Reference conditions from western sites with low-mixed severity fire regimes provide valuable context for southwestern Oregon to inform ecological relevant fine-scale patterning of forests functioning under a frequent low- mixed severity wildfire disturbance regime. Reference conditions provide a robust guide for management targets related to fine-scale spatial pattering attributed to frequent low-mixed severity fire dry forest. As Churchill and other (2017) eloquently explained “the rationale for using reference conditions to guide management targets in dry forests is that historical forest conditions persisted through centuries of frequent disturbances and significant climatic fluctuation while sustaining native biodiversity and other ecosystem services.”

In a review of literature characterizing fine-scale spatial patterning of reference conditions (IVM-RL EA, Appendix 5 BLM 2022) reflective of low to mixed severity fire regimes, gap sizes were typicaly less than 2 acres and generally less than 1 acre. In stem-maps of reference conditions, canopy gaps are typically in complex ameba-like shapes (Pawlikowski et al. 2019; Churchill et al. 2013; Lydersen et al. 2013; Metlen et al. 2013). However, recent characterization of fine-scale spatial patterning for reference conditions has focused on characterizing tree clusters, rather than delineating and identifying gaps, thus it can be challenging to reflect the entire spectrum of historic gap size range, especially in open forest stands. Work still needs to be done to quantify openings in reference patterns to provide more explicit guidelines for creating relevant functional openings in implementation.

Analytical Assumptions Fire Behavior Input Background

The Nexus 2.1 crown fire assessment software developed by Scott and Reinhardt (2014) and available from Pyrologix http://pyrologix.com/downloads/, is a useful tool to compare crown fire potential for different forest stands and was used to compare the effects of alternative proposed actions for combined commercial, small-diameter, and prescribed fire actions on crown fire potential. Nexus links separate models of surface and crown fire behavior, to calculate indices of relative crown fire potential (e.g., CI and TI).

CI (mph): “The open (20 foot) wind speed at which active crown fire is possible for the specified fire environment” (Scott and Reinhardt 2001). Crowning index can be used to compare relative susceptibility of stands to crown fire. An increase in the CI corresponds to a decreased likelihood of an active crown fire moving through a stand, particularly one impacting a given stand from an adjacent area. Crowning index provides an index for relative comparison-Fule et al. (2004) note, “…it would be unrealistic to expect that CI values are precise estimates of the exact windspeed at which any real crownfire would be sustained. However, it is reasonable to compare CI values across space and time to assess crown fire susceptibility in relative terms.”

Torching index (mph): “The open (20-foot) wind speed at which crown fire activity can initiate for the specified fire environment” (Scott and Reinhardt 2001). An increased torching index would result in a decreased likelihood of torching initiating within the stand. Torching events within a stand can lead to an active crown fire depending on weather, surface, and canopy fuel conditions. As with CI, torching index may be interpreted as the relative susceptibility forests may have to tree torching also called “passive crown fire”.

Weather

The FEIS, which this issue tiers to, acknowledges the potential sheltering effect that canopy has on surface winds, fuel moisture, and potential fire behavior (USDI/BLM 2016a, Appendix H p. 1320). The difference in fine dead fuel (<0.25 inches in diameter) moisture between “shaded” and “unshaded” areas (i.e., greater than 50 percent canopy cover vs. less than 50 percent canopy cover) is well established in predictive fire behavior modeling (Rothermel 1983; Nexus2, NWCG PMS 437 – referenced as NWCG 2014 in FEIS). Additionally, the sheltering effect of canopy on surface wind speeds is also well-established in predictive fire behavior modeling (Nexus2, NWCG PMS 437). The BLM accounted for these differences of fine dead fuel moisture between “exposed” and “shaded” conditions and sheltering effect of canopy on surface wind speeds in the fire behavior modeling inputs in detailed analysis of alternatives on stand-level fire resistance (or fire hazard). Thus, effects to proposed action on fuel moisture and windspeed have been accounted for in Issue 3.

Fire behavior was modeled under 90th percentile fire weather fuel moisture conditions (Table H-1) fuel moisture and other weather values were determined from analysis EVANS Remote Automated Weather Station (RAWS) data representing eight fire seasons (May to November 2002-2022). For this analysis, a 20 foot windspeed of 15 mph was used for modeling.

According to NEXUS recommendations and guidance for estimating wind speeds in the Fire Behavior Field Reference Guide (NWCG 2021), the BLM applied a standard wind adjustment factor of 0.1 to canopy cover greater than 50 percent, 0.15 for canopy cover of 30-50 percent, and 0.2 for canopy cover 20-30 percent. For canopy cover >50 percent fine dead fuel (or 1 hour fuel) moisture was adjusted to 7 percent to reflect sheltering effect on fine dead fuel moisture (Rothermel 1983; NWCG 2021, Scott and Reinhardt 2014). Increased surface wind speeds in openings could contribute toward localized increased surface winds and fire behavior, however as described in the methods and assumptions, the sheltering effects of canopy fuels have been incorporated into the fire behavior modeling for stand average canopy cover.

Table H-1. Dry (90th Percentile) Fuel Moisture Scenario Inputs for Dead and Live Fuels. These Values are Consistent with an 80 ºF Day.

Fuel Type	Dead fuel Size class/ Live Fuel Type	Percent Moisture
Dead Fuels	0 – 0.25 inch (1 hr.)	5(exposed)/7(shaded)
	0.25 – 1.0 inch (10 hr.)	6
	1.0 – 3.0 inch (100 hr.)	8
Live Fuels	Live Woody	67
	Live Herbaceous	35

<u>Topography</u>

Slope is an important input for fire behavior predictions. Slope is variable across the Treatment Area. The mean slope of 84 percent was used in model predictions.

Affected Environment

***Fire Activity** – current and historic*

There were a total of 93 wildfire ignitions in the planning area between 2000 and 2022. Recently, most (71 percent) wildfire ignitions within the Last Chance project area have been human caused (Map D.5.1). Lightening caused less than half of all wildfire ignitions. (Table 4).

Table 4 Wildfire ignitions (2000-2022) by cause and jurisdictional ownership in the project planning area. Data is from Oregon Department of Forestry (ODF).

	Human		Lightning	
Ownership and Fire Size Class	**Number of Fires**	**% of Total**	**Number of Fires**	**% of Total**
BLM	**27**	**29%**	**20**	**22%**
Non-BLM	**39**	**42%**	**7**	**8%**
Grand Total	**66**	**71%**	**27**	**29%**

Within the project area, landscape patterns of wildfire size distribution and occurrence have shifted over time (Map D.5.1, Table X-3). Before the fire suppression and intensive management practices of the twentieth century, the project area would have been characterized by high frequency, low severity fires that would have reduced fuel loadings and maintained a mosaic of open stand conditions different from what we see today. "Historically, frequent low- to mixed- severity fire interacted with the complex landscape, vegetation, and climate to create and maintain patchy, mixed seral stages of shrubland, woodland, and mixed conifer/hardwood forests, in both open and closed conditions" (USDI BLM 2016a, p. 225).

Despite frequent fire activity effectively ending in 1850 in southwest Oregon (Metlen et al. 2018), fire records from 1900 to 1939 still display considerable fire activity compared to more recent time periods. Between 1900 and 1939, the total number of recorded fires greater than 10 acres was approximately two and a half times greater than any recent period between 1940 to present (Figure A-2, Table H-3). The total wildfire acres between 1940 and 1979 was about 17 percent of acres burned between 1900 and 1939, and wildfire acres between 1980 and 1999 account for approximately 8 percent of the acres between 1900 and 1939. Although there has been an increase in total wildfire acres during the past twenty years (2000-2018), this area still only equates to 35 percent of the acres burned from 1900-1939.

For wildfires greater than 10 acres, average wildfire size has also decreased over time (Table H-3). Fires burning between 1900-1939 occurred prior to widespread use of mechanized equipment in fire suppression and establishment of Cave Junction Smoke Jumper Base in 1940 (Atzet 1996). Comparatively, fires burning between 1940 – 1979 were under fuel conditions conducive to effective fire suppression, with the full support of mechanized fire suppression, and during a relatively cooler climatic period than in recent years (Halofsky et al. 2022). Fires burning between 1980 – 1999 were farther removed from fuel conditions under a functioning fire regime and a slightly warming climate, while fires burning between 2000-2022 were in fuels accumulated from years of missed fire cycles, intensely managed landscapes, and under warming climatic conditions (Westerling et al. 2006), which contributes to the higher total wildfire acres and average wildfire size during that time period (Table H-3).

Table H-3: Number of wildfires, wildfire acres, and average wildfire size for wildfires greater than 10 acres, burning into the Last Chance project boundary, by eras.

Fire Era (Years)	Total Wildfires	Total Wildfire Acres	Average Wildfire Size
1900 – 1939	21	22,103	1,052
1940 – 1979	8	3,730	466
1980 – 1999	5	1,858	371
2000 – 2022	2	7,679	3,840

Within the Last Chance FMP, thousands of acres of hazardous surface and ladder fuel reduction treatments (handpile burning and underburning) have been implemented in the recent past (Table H-4). However, all of these treatments occurred 20+ years ago and a portion are being proposed for maintenance under this project.

Table H-4. Previous acres of Underburn and Handpile burn treatments implemented within the Last Chance maximum proposed action footprint and Last Chance FMP Planning Area. Acres represent treatment type, not footprint acreage. Typically underburn and handpile burn acre overlap spatially. All treatments occurred >20 years ago.

	ROGO maximum proposed action footprint	Rogue Gold Planning Area	Grand Total
Underburn/Broadcast burn	884	100	984
Hand Pile Burn	4,094	1,171	5,265
Grand Total	4,978	1,271	6,249

Much of the Last Chance planning area lies within a quarter mile of Communities at Risk[23] (CaR), a focused area within the Wildland Urban Interface (CWPP 2019; Metlen et al. 2017) and Wildland Developed Areas (WDA) (WWRA 2013). Approximately 15% of the maximum proposed action extent (1,620 acres) is within the CaR (USDI BLM 2016a, Appendix H, Figure H-5 and) and 43% of proposed action acreage is within the Wildland Developed Areas (BLM 2016a).

Table H-5. Table showing how much of the proposed action footprint and total planning area is within a 1/4mi. of Community and within 1 mile of Wildland Developed Areas (BLM 2016). Approximately 15% of the maximum proposed action extent (1,620 acres) is within the CaR (Figure H-5 and Appendix A) and 43% of proposed action acreage is within the Wildland Developed Areas (WWRA 2013).

	Last Chance Proposed Action Footprint Overlap	Total Last Chance Planning Area Overlap

[23] Communities at Risk (CaR) are defined in the Rogue Valley Integrated Community Wildfire Protection Plan as a “geographic area within and surrounding permanent dwellings (at least 1 home per 40 acres) with basic infrastructure and services, under a common fire protection jurisdiction, government, or tribal trust or allotment for which there is a significant threat due to wildfire (CWPP 2019).

¼ mi around Communities at Risk	1,620 acres	13,970 acres
1 mi around Wildland Developed Areas	4,808 acres	32,538 acres

Figure H-5: Wildfire activity within the analytic area for various fire eras: All ODF ignitions (1980 – 2018). Potential wildfire Operational Delineation (POD) boundaries, Quarter mile buffer around Communities at Risk from Wildfire (lavendar hashed poly). Maximum proposed action acreage (black),on-commercial units are in blue. See also in Appendix A.

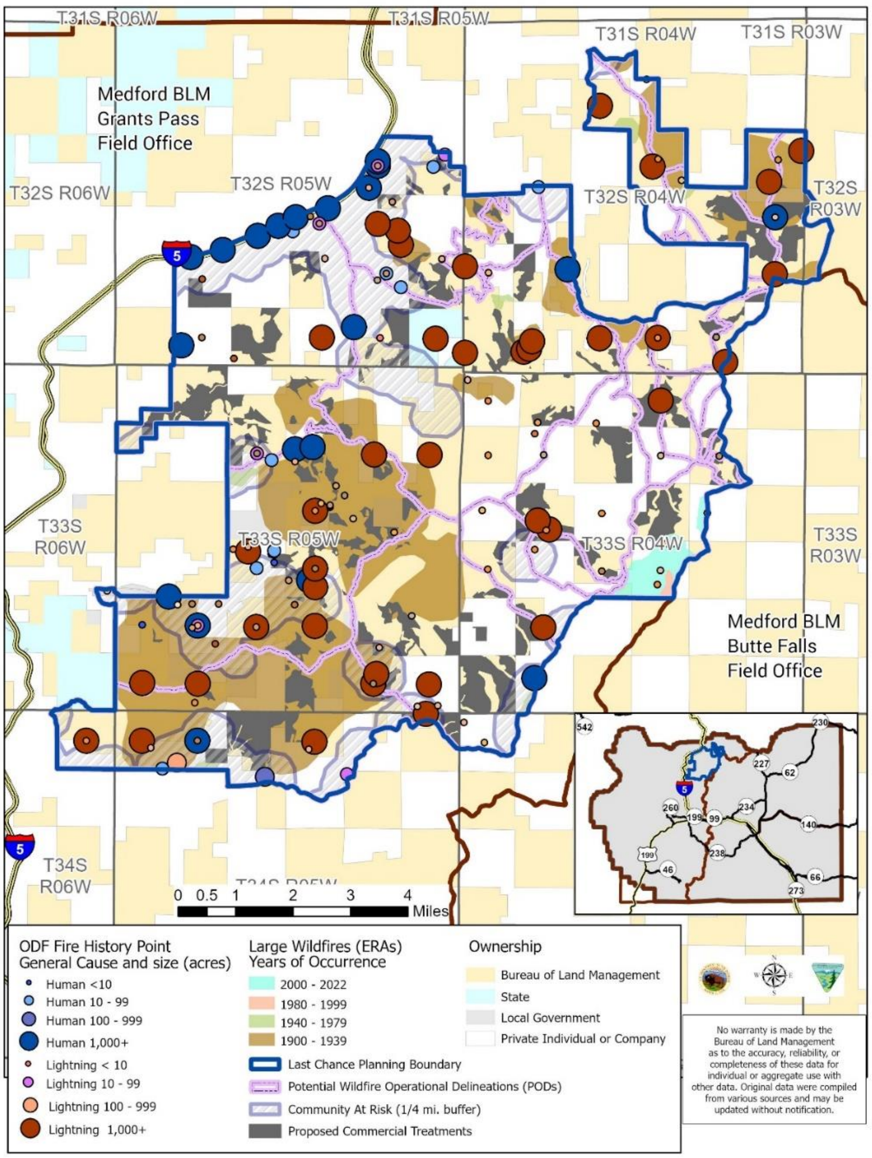


Table 3-4: Estimated Canopy Bulk Density (kgm3) and approximate canopy cover distribution across all proposed units. *Data acquired from LANDFIRE (LF 2020).*

Canopy Bulk Density (kgm3)	Approximate Canopy Cover (%)	Acres	Percent Distribution
0	Non-forested	193	2%
0.05	10-30	275	2%
0.06-0.08	40-50	1085	10%
0.09-0.11	50-60	1110	10%
>0.12	>60	8421	76%

Table 3-5: Current distribution of canopy base height (feet) across maximum footprint extent of proposed action units. *Canopy base height data acquired from LANDFIRE (LF 2020).*

Non-forested	195	2%
0 to <2	427	4%
2 to <5	2660	24%
5 to <8	4007	37%
8 to <12	2829	26%
12+	966	9%

Table 3-6: Approximate acres of surface fuel fire behavior models grouped by loading category descriptions and corresponding Standard Fire Behavior Fuel Models codes (in parentheses) (Scott & Burgan 2005) across the maximum footprint extent of proposed actions. Bolded fuel model codes have the highest frequency across the proposed action area within each category. *Data is from data acquired from LANDFIRE (LF 2020).*

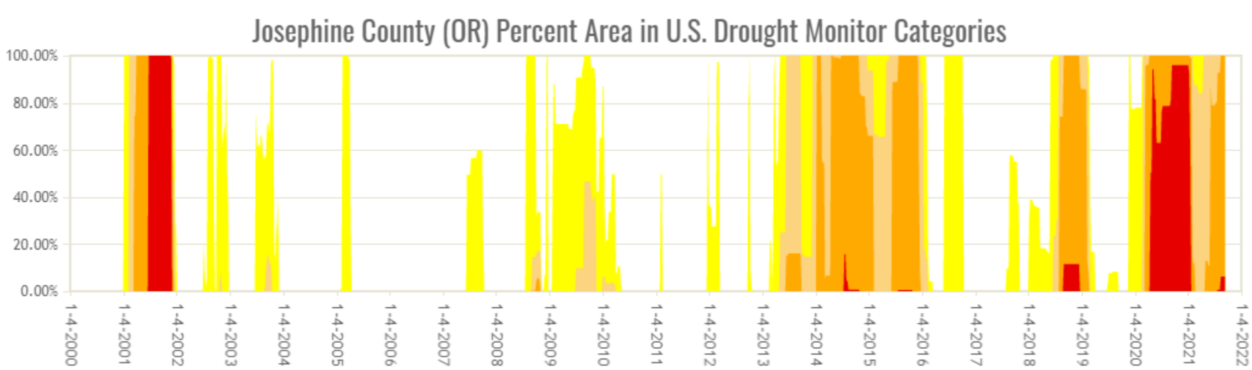
Fuel Loading Description Categories (Fire Behavior Fuel Models)	Acres	Percent Distribution
Non-burnable (**91**, 98, 99)	101	0.9%
Low load grass (101, **102**)	26	0.2%
Low load grass-shrub (**121**)	25	0.2%
Moderate load grass-shrub (**122**, 142)	219	2%
Low load mixed conifer – hardwood (**161**, 181, 182)	33	0.3%
Moderate load mixed conifer - hardwood (162,**183**, 186, 188)	605	5%
High load conifer (184, **185**, 187)	559	5%
Very High load mixed conifer-hardwood/understory (**165**,189)	9517	86%

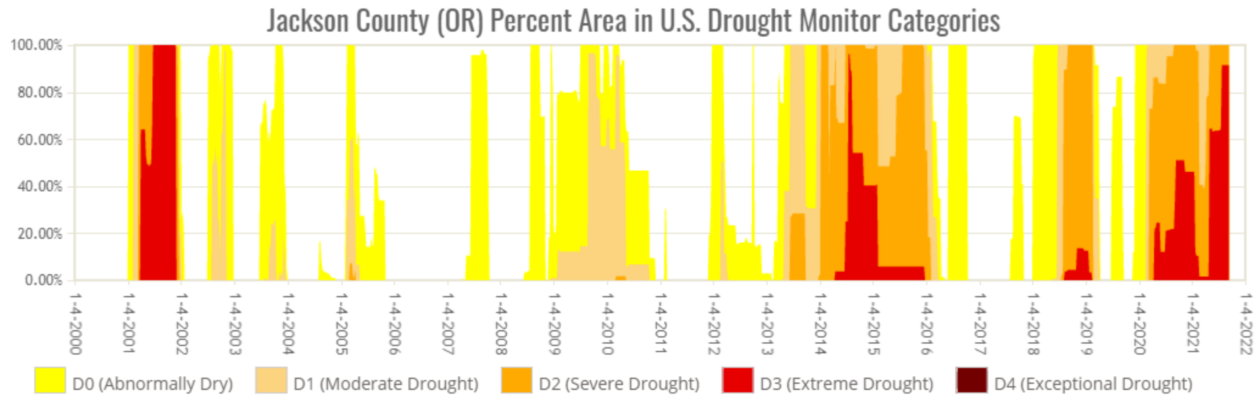
Ongoing changes to climate in southwestern Oregon include increasing temperatures, increasing drought frequency and severity, reduced snowpack, as well as fewer but more extreme precipitation events

(Halofsky et al. 2022). Climate models generally project either no change in annual precipitation or a slight increase (citation?). Because of the large projected temperature increases, the modeled precipitation increases would still lead to a net water loss compared to 1970–1999 given higher evapotranspiration rates." P.32-33 The Climate Change section of the PRMP/FEIS (USDI BLM 2016a, pp. 165-211), to which this EA tiers, analyzes issues associated with climate change. Issue 3 in the PRMP/FEIS, "How would climate interact with BLM management actions to alter the potential outcomes for key natural resources" (USDI BLM 2016a, p. 180), describes potential impacts to tree species (including adaptive genetic variation) and insects and pathogens, and describes the assumptions applied to the climate modelling for use in the ROD/RMP. Issue 3 of the PRMP/FEIS describes the complications and unknowns in predicting the effects of climate change. Douglas fir is anticipated to decline, particularly in lower elevations and this trend has been observed in recent years (Bennet et al. 2023). Douglas-fir tree mortality would likely increase, due to the interactions of changing climate with disturbance events such as drought, fire, insects, and diseases. Species composition would likely shift, and growth rates and overall site productivity would decline (USDI BLM 2016a, pp. 193-196). "Not only does drought reduce tree growth and increase the likelihood and severity of fire, but prolonged or severe moisture stress can also increase the susceptibility of trees to insects and pathogens" (Bennett 2018, p. 7). Tree species differ in their vulnerability ratings to climate-induced stress (USDI BLM 2016a, p. 187). Insects and pathogen outbreaks may increase with hotter temperatures and more frequent periods of drought. Some pathogens, such as *Armillaria* root disease and various canker species which infect water-stressed hosts may become more problematic. Insect development and survival is also impacted by increased temperature. The response of pathogens that depend on insects for spread would likely be complex, depending on how the particular insect vector responds to changing climate (USDI BLM 2016a, pp. 178-188).

The trend for Jackson and Josephine Oregon counties over the past two decades indicates that projections of increased drought are on track (Figure H-6). A recent USDA forest health report for Oregon finds that aerial survey and site visit trends "indicate that drought stress is one of the main causes of tree dieback and decline" (USDA 2020, p. 5).

Figure H-6. U.S. Drought Monitor Category Graphs Displaying Percent Area in Various Drought Categories for Josephine and Jackson Counties from January 2000 to September 2021. Data acquired from https://droughtmonitor.unl.edu/DmData/TimeSeries.aspx





Based on trends in the last 30 years, humans and lightning would continue to provide wildfire ignition sources (USDI BLM 2016a, Table 3-22 p. 227), and future trends suggest the suitability for large wildfire growth would increase (USDI BLM 2016a, Appendix D, Figure D-8 p. 1241; Davis et al. 2017). In recent years, total annual area burned has increased, and so has the total area burned at high severity. Several analyses in recent decades have shown a positive correlation between annual area burned and area burned severely (in large patches) in the PNW (Cansler and McKenzie 2014, Dillon et al. 2011, Reilly et al. 2017). Fire suppression efforts are expected to continue; however, these efforts are not 100 percent successful. In fact, less than 1 percent of fires in the recent past account for the majority of acres burned by wildfire (USDI BLM 2016a, p. 227). These large fires tend to burn during more extreme fire weather conditions, potentially resulting in high fire severity (Long et al. 2017), when fire behavior and growth potential exceed or challenge suppression resource availability and capabilities. However, successful suppression efforts would continue to exclude fire and disturbance regimes would continue to be altered; these aspects, coupled with other expected climatological changes, such as increased background tree mortality, due to longer periods of hot drought (USDI BLM 2016a, p. 185), increase the likelihood for larger proportions of high severity fire (Mote et al. 2019).

<u>Environmental Effects</u>

Direct and Indirect Short-Term (up to 20 years) Effects Common to All Action Alternatives

Wildland fuel profile

<u>Canopy fuels (canopy connectivity (canopy cover and canopy bulk density) and large trees)</u>

Large trees would be protected. Thinning of canopy fuels would decrease the likelihood of tree-to-tree crown fire spread under typical fire weather indices (Scott and Reinhardt 2001). Thinning would also increase stand diameter, thus improving resistance to stand-replacing fire, as thinned stands with remaining large trees have been shown to have less severe fire effects when intersected by wildfires (USDI BLM 2016a, p. 228; Martinson and Omi 2013, Lydersen et al. 2014).

<u>Surface fuels and Ladder fuels</u>

Surface fuels consist of grasses, shrubs, small trees, litter, and woody material on the forest floor and up to six feet from the surface (Scott and Burgan 2005) and are usually measured in tons per acre. Fine surface fuels consist of small diameter surface fuels (<3 inches), litter, grass, and shrubs and would ignite easily and burn rapidly at times producing high rates of spread and high flame lengths. Wildfires in light surface fuels react quickly to diurnal changes in relative humidity and wind. Large surface fuels consist of larger (>3 inches in diameter) limbs, down woody debris, logs, and stumps that ignite and burn more slowly. Large surface fuels are more influenced by seasonal weather patterns and less influenced by changes in daily wind and moisture. Fire Behavior Fuel Models (FBFM) (Scott and Burgan 2005) are used to represent surface fuels and estimate potential surface fire behavior flame lengths and rates of spread under various environmental conditions (fuel moisture and wind scenarios). Surface fire behavior has a direct effect on fire severity, mortality, suppression tactics, and the initiation of crown fire. Rates of spread and flame lengths are key components affecting fire size and resistance to control. Surface fire behavior has a direct effect on fire severity, mortality, suppression tactics, and the initiation of crown fire, lower surface fuel loading produces lower flame lengths.

Thinning of small diameter trees and handpile burning of activity fuels would reduce surface fuels and increase canopy base heights. The changes to the wildland fuel profile would increases vertical and horizontal separation or discontinuity in the fuel profile and help to keep flames from ascending into tree crowns (tree torching) and from spreading through the tree canopy (crown fire) (Scott and Reinhard 2001; Van Wagner 1977). Application of prescribed fire, via underburning, can further raise CBH and reduce ladder fuels. (see assumptions).

In areas thinned to open canopy conditions (e.g., <40 percent canopy cover), regeneration of a diverse understory is expected (Wayman and North 2007) and could contribute toward more rapid live fuel loading accumulation or shift fuel models from moderate timber litter to moderate timber understory or grass-shrub in the moderate-term (10-30 years) (USDI BLM 2021, Agee et al. 2000). While this shift in surface fuel type could increase rates of surface fire spread from low-load surface fuel types (Appendix D.5 Assumptions – Wildland fuel profile – surface fuels), these rates of spread would be approximately 5.75 times less than those presented by crown fires in stands with greater than 50 percent cover under 10 mph 20-foot windspeeds (USDI BLM 2016a, Appendix H).

Heterogeneity (Species Composition and structural diversity)

Proposed actions to create openings and leave untreated skips would introduce heterogeneity in uniform stands, promote a disruption of horizontal fuel connectivity and alter patterns of litter fall and surface fuel accumulation. Increased spatial heterogeneity would contribute toward disrupting vertical and horizontal fuel continuity, alter potential fire behavior (Finney 2001), improve stand-level fire resistance and the ability to respond to other disturbances and climatic influences (Jain et al. 2012).

The sheltering effect vegetation has on surface wind speeds is well established in predictive fire behavior modeling (Albini and Baughmann 1979; NWCG 2021) and has been incorporated in the weather inputs in analysis of this issue based on projected post-harvest canopy cover (Appendix D.5). Thus, thinning and group selection openings may indirectly increase surface wind gusts.

An increase in variable sized openings would promote species diversity and growing space for fire adapted species, such as pine and oak. Grulke and others (2020) found that two years following patchy harvest, low vigor trees were not present, while in even-aged and untreated areas low-vigor trees persisted in the same timeframe.

The area in un-thinned skips, would contribute toward heterogeneity through retention of continuous canopy fuels, low CBHs, and existing surface fuel loading. These skips would result in lower relative stand-level fire resistance to group torching of trees during a wildland fire or a prescribed fire. However, these untreated areas, either burned or unburned, would contribute toward heterogeneous vegetative patterns at the stand scale.

Cumulative Effects

Vegetation growth is dependent on a variety of factors including variables such as, but not limited to, available sunlight and moisture, which can be influenced by large climatic patterns, soil structure, and nutrient cycling (Wayman and North 2007). As part of its standard, ongoing silvicultural program practices, the BLM would monitor and evaluate natural regeneration in treated stands to ensure stocking rates meet RMP direction and plant trees as appropriate under future projects (USDI FEIS, Appendix H). This accumulation of fuel would contribute toward reducing stand-level fire resistance over time and require frequent low-moderate intensity disturbance to maintain low-moderate loading surface fuel profiles, remove regrowth of ladder fuels, and raise CBH.

Alternative 2 would require 45% of acres to be frequently treated to maintain high to moderate-high stand-level resistance, requiring frequent entry on 5,239 acres. Moderate maintenance would be required on 14 percent of acres to maintain moderate-high resistance on and moderate maintenance on. Alternative 3 would require a balance of moderate frequency maintenance to sustain a balance of high and moderate stand level resistance, while Alternative 3 would require the most frequent maintenance to sustain high stand-level resistance.

Relative Stand-level Resistance Rating

Detailed side by side comparison of alternative fire behavior model inputs, outputs and relative resistance rating, fire type and distribution of acres.

Table 2**:** Short-Term Effects on relative resistance to stand-replacement fire categories and approximate percentage of acreage distribution by alternative for proposed actions (i.e., com commercial harvest, small-diameter thinning, and prescribed fire). Table also displays fire modeling inputs and assumptions for canopy cover, wind adjustment factors, canopy bulk density, canopy base height, and surface fuel model. Table also displays Fire Behavior Modeling outputs for Crowning Index, Torching Index, and Fire Type.

		Fire Behavior Model Inputs			Fire Behavior Model Outputs					
!ťűŜtyl-űtØŜ	Estimated Canopy Cover (wind adjustment factor)	Canopy Bulk Density (kg/m3)	Canopy Base Height (ft)	Surface Fuel Model	Crowning Index (mph)	Torching Index (mph)	Fire Type	Relative Resistance Rating (hazard)	Acreage	Percent Distribution of Acres (%)
	Alternative 1 - No Action - 11,686 acres									
bh ! /¢hb	40-50 (0.15)	0.06	10	TL3	26.3	>100	Surface	Moderate-high*	935	8%
	50-60 (0.1)	0.09	>12	TL5	18.4			Moderate-low*	935	8%
			10	TL9		26			935	8%
	>60% (0.1)	0.12	8	TU5	12.1	0	Active	Low	8,765	75%
			<5							
	Alternative 2 - 8,240 acres of commercial harvest and 3,446 fuels (small diameter thinning only) proposed action									
/2YYŜtŏtl-f	30-40% (0.15)	0.05	8	TL6	31.6	58	Surface	High*	1,746	15%
				GS1		17		Moderate-high	1,746	15%
				GS2		0	Passive		1,746	15%
	40-50 (0.15)	0.06	8	TU1/TL3	26.3	>100	Surface	Moderate-high*	711	6%
				TU2		21			356	3%
	>60% (0.1)	0.12	8	TU1/TL3	12.1	>100	Conditional	Moderate-low*	172	1%
			<5	TU2	12.1	0	Active	Low	770	7%
	Stand Establishment (variable retention harvest)							Moderate-low (high)	787	7%
b2yπ /2YYŜŏtl-f óy2 2ØŜtfl-Ǉ ǿkŏ2YYŜtŏtl-fú	40-50 (0.15)	0.06	8	TU1/TL3	26.3	>100	Surface	Moderate-high*	345	3%
				TU2		21			172	1%
	50-60 (0.1)	0.09	8	TU1/TL3	18.4	>100		Moderate-low*	345	3%
				TU2		46			172	1%
	>60% (0.1)	0.12	8	TU1/TL3	12.1	>100	Conditional		1,378	12%
			<5	TU2		0	Active	Low	873	7%
	Alternative 2.b - 8,240 acres of commercial harvest and 3,446 fuels (small diameter thinning only) proposed action *No stand-establishment; 40-60+ canopy cover same as Alt 2									
/2YYŜtŏtl-f	30-40% (0.15)	0.05	8	TL6	31.6	58	Surface	High*	2,009	17%
				GS1		17		Moderate-high	2,009	17%
				GS2		0	Passive		2,009	17%
	Alternative 3 - 1,051 acres of commercial harvest and 10,627 acres of fuels (small diameter thinning only) proposed action									
/2YYŜtŏtl-f	50-60 (0.1)	0.09	8	TU1/TL3	18.4	>100	Surface	Moderate-low*	694	6%
				TU2		46			347	3%
b2yπ /2YYŜŏtl-f óy2 2ØŜtfl-Ǉ ǿkŏ2YYŜtŏtl-fú	40-50 (0.15)	0.06	8	TU1/TL3	26.3	>100	Surface	Moderate-high*	1,063	9%
				TU2		21			531	5%
	50-60 (0.1)	0.09		TU1/TL3	18.4	>100		Moderate-low*	1,063	9%
				TU2		46			531	5%
	>60% (0.1)	0.12		TU1/TL3	12.1	>100	Conditional		4,570	39%
				TU2		46			624	5%
			<5	TU2		0	Active	Low	1,501	13%

Table 6: - A Side-by-Side comparison of estimated maintenance frequency needed to maintain high to moderate stand-level relative fire resistance over 50 years on maximum proposed action acres by action alternative for incremental cumulative effects of foreseeable actions.

Alternative Target Canopy Cover (%)	Relative Stand-level Fire Resistance Rating	Maintenane Frequency (average number of entries over 50 years	Percent distribution among proposed action acreage
Alternative 2 - 8,240 acres of commercial harvest and 3,446 fuels (small diameter thinning only) proposed action			
30-40%	**HIGH& Moderate-High**	**15-20 yr (2.5)**	**45%**
40-50%	**Moderate-high**	**15-20 yr (2)**	**14%**
>50%	**Moderate-low**	**20-30 (1.5)**	**18%**
>60%	**LOW**	**N/A**	**14%**
Stand Establishment	**Moderate-low**	**20-30 (1.5)**	**7%**
Alternative 2.b - 8,240 acres of commercial harvest and 3,446 fuels (small diameter thinning only) proposed action			
30-40%	**HIGH& Moderate-High**	**15-20 yr (2.5)**	**52%**
40-50%	**Moderate-high**	**15-20 yr (2)**	**14%**
>50%	**Moderate-low**	**20-30 (1.5)**	**18%**
>60%	**LOW**	**N/A**	**14%**
Alternative 3 - 1,051 acres of commercial harvest and 10,627 acres of fuels (small diameter thinning only) proposed action			
30-40%	**HIGH& Moderate-High**	**10-20 yr (2.5)**	**0%**
40-50%	**Moderate-high**	**10-20 yr (2)**	**14%**
50-60%	**Moderate-low**	**20-30 (1.5)**	**67%**
>60%	**LOW**	**N/A**	**13%**

APPENDIX E: GLOSSARY

A

Abiotic: Non-living elements of an environment.

Activity Fuel: The combustible material resulting from or altered by forestry practices such as timber harvest or thinning, as opposed to naturally created

fuels.

Affected Environment: The area impacted by the Proposed Action.

Allowable Sale Quantity (ASQ): The timber volume that a forest can produce continuously under the intensity of management described in the RMP for lands allocated for permanent timber production (USDI 2016, p. 299).

Alternative: Other options to the proposed action by which the BLM can meet its purpose and need.

Analysis Areas: Varies by resource and include areas that could potentially be affected by the action alternatives. In some cases, the Analysis Area is confined to the Treatment Area and in others, the Analysis Area extends beyond the Project Area.

Aquatic: Living or growing in or near the water.

Authorized Officer: The Federal employee who has the delegated authority to make a specific decision.

B

Basal Area (BA): The cross-sectional area of a single stem including the bark, measured at breast height (4.5 ft. above the ground); the cross-sectional area of all stems of a species or all stems in a stand measured at breast height and expressed per unit of land area.

Baseline: The starting point for analysis of

environmental consequences.

Best Management Practices (BMPs): Methods, measures, or practices designed to prevent or reduce water pollution (USDI 2016, p. 300).

Biotic: Living elements of an environment.

C

Canopy Class: The position of the canopy of an individual tree relative to the canopies of other trees in a stand. Classes are defined by relative height and the amount of sunlight a canopy receives.

Canopy Cover: A measure of the percent of ground covered by a vertical projection of the tree crowns (USDI 2016, p. 301).

Coarse woody debris/down woody material: The portion of a tree that has fallen or been cut and left in the woods. Usually refers to pieces at least 20 inches

in diameter (USDI 2016, p. 304).

Codominant Trees: Trees with crowns forming the general level of the crown canopy and receiving full light above but comparatively little from the side.

Commercial (Harvest) Treatments: Refers to stand harvesting involving the removal of some or all cut trees from the stand for timber volume and an assessed monetary value. The implementation of commercial harvest is through a variety of mechanisms, including timber sale contracts, stewardship agreements, or other types of contracts (2016 ROD/RMP, p. 62).

Crown Ratio: The ratio between the length of the green crown of a tree and its total height expressed as a percentage.

Culmination of mean annual increment: The age in the growth cycle of a tree or stand at which the mean annual increment (MAI) for which some attribute, e.g., wood volume of a tree or stand growth is at maximum. At culmination, MAI equals the periodic annual increment (PAI).

Cultural Resources: Those resources of historical and archaeological significance.

Cumulative Effects: Those effects on the

environment that result from the incremental effect of the action when added to past, present, and reasonably foreseeable future actions regardless of what agency or person(s) undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.

D

Dispersal: The movement of an individual from their origin to a new site.

Dispersal Habitat: Forest stands with average tree diameters of greater than 11 inches, and conifer overstory trees having closed canopies (greater than 40% canopy cover) with open space beneath the canopy to allow owls to fly (USDI 2016, p. 303).

Diversity: The aggregate of species assemblages (communities), individual species, the genetic variation within species, and the processes by which these components interact within and among themselves. The elements of diversity are 1) community diversity (habitat, ecosystem), 2) species diversity, and 3) genetic diversity within a species. All three change over time.

Dominant Trees: Trees with crowns extending above the general level of the crown canopy and receiving full light from above and partly from the side

Duff: The partially decomposed organic material of the forest floor beneath the

litter of freshly fallen twigs, needles, and leaves.

E

Ecosystem: A system made up of a community of animals, plants, and micro-organisms and its interrelated physical and chemical environment.

Edge Effect: The modified environmental conditions or habitat along the margins of forest stands or patches.

Effects Analysis: Predicts the degree to which the environment would be affected by an action.

Endangered Species: Any animal or plant species in danger of extinction throughout all of a significant portion of its range. The U.S. Fish and Wildlife Service list these species.

Environmental Assessment (EA): A concise, public document containing a federal agency's analysis of the significance of potential environmental consequences of a proposed action. The EA need not contain the level of analysis contained in an Environmental Impact Statement (EIS). An EA is used to determine whether an EIS is needed or a "finding of no significant impact" (FONSI) is warranted.

Ephemeral Stream: A stream that flows only in direct response to precipitation, and whose channel is at all times above the water table.

Erosion: The detachment and movement of soil or rock fragments by water, wind, ice, or gravity.

F

Fauna: The animals of a specified region or time.

Finding of No Significant Impact (FONSI): A

finding that explains that an action will not have a significant effect on the environment and, therefore, an EIS will not be required.

Fire Regime: The characteristic frequency, extent, intensity, severity, and seasonality of fires within an ecosystem.

Flora: The plants of a specified region or time.

Fuel load: the oven-dry weight of fuel per unit area.

Fully Decommission: The road surface would be decompacted so that the former compacted surface would be rendered loose and friable to a depth of 12 to18 inches or to a point where 10-inch diameter stones are the dominant substrate (whichever is shallower). Slash, boulders, and other debris would be placed along the roads "entire length" as determined by availability of materials to provide ground cover and discourage mechanized use. Blockage at the entrance would consist of placing logs, slash, boulders, berms, and other material so the

entrance is camouflaged for a minimum distance of 100 feet and vehicle access is precluded. Seeding with approved native seed species and mulching with weed-free straw or approved native materials would occur within Riparian

Reserves and within 100 feet of the roads entrance. All drainage structures would be removed.

G

GTRN (Ground Transportation Road Network): Roads over which the BLM has jurisdiction and maintenance responsibilities.

H

Habitat: A specific set of physical conditions in a geographic area(s) that surrounds a single species, a group of species, or a large community. In wildlife management, the major components of habitat are food, water, cover, and living space.

Habitat Fragmentation: The breakup of extensive habitat into small, isolated patches that are too limited to maintain their species stocks into the indefinite future.

Hand Pile and Burn: Is piling of fuels by hand and burned in place (2016 ROD/RMP, p. 312)

Harvest Land Base (HBL): Those lands on which the determination and declaration of the Annual Productive Capacity/ASQ is based.

Hydrology: The science dealing with the properties, distribution, and circulation of water.

I

Impact: Synonymous with "effects." Includes ecological, aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative. Impacts may also include those resulting

from actions which may have both beneficial and detrimental (adverse) effects. Impacts may be considered as direct, indirect, or cumulative.

Implementation Action: An action that implements land use plan decisions.

Intermediate Trees: Trees shorter than dominant or codominant trees with crowns below or barely reaching into the main canopy.

Intermittent Stream: Seasonal stream; a stream that flows only at certain times of the year when it receives water from springs or from some surface source, such as melting snow in mountainous areas.

K

L

Landing: A cleared area in the forest to which logs are yarded or skidded for loading onto trucks for transport.

Late-Successional Forest: Forest seral stages which include mature and old-growth age classes.

Lichen: A composite organism formed from the symbiotic association of a fungus and an alga.

Long-Term Closure: The road would be effectively blocked and winterized prior to the wet season. Blockage at the entrance would consist of placing logs, slash, boulders, earthen berms, and other material so the entrance is camouflaged for a minimum distance of 100 feet and vehicle use is precluded. Prior to closure the road will be left in an erosion-resistant condition.

Lop and Scatter: To cut vegetation and scatter it randomly around an area. All top and side branches must be free of the central stem so that such stem is reduced to the extent that it is within eighteen (18) inches of the ground at all points. Slash includes all woody material (brush, limbs, tops, unmerchantable stems, or chunks) severed, uprooted, or broken from live plants. All slash shall be arranged in a discontinuous pattern across the forest floor. All slash shall be lopped to no more than eight (8) feet in length.

M

Machine Piling: is the piling of activity fuels with machinery (2016, ROD/RMP p. 307)

Mass Movement: Soil and rock movement

downslope (e.g. slumps, earth flows).

Mitigating Measures: Constraints, requirements, or conditions imposed to reduce the significance of or eliminate an anticipated impact to environmental, socioeconomic, or other resource value from a proposed land use.

Mixed-Conifer Forest: A mix of tree species that include Douglas-fir, ponderosa pine, sugar pine, incense cedar, and white fir.

Monitoring: A process of collecting information to evaluate if objective and anticipated or assumed results of a management activity or plan are being realized, or if implementation is proceeding as planned.

N

Non-Commercial Treatments: (hazardous fuels reductions) For this project, non-commercial treatments include cutting vegetation and trees smaller than 8 inches diameter at breast height (DBH) through fuels reduction treatments. Some stands may require both commercial and non-commercial treatments based on the forest condition.

Nonvascular: Plants with specialized methods of transporting water and nutrients without xylem or phloem (e.g. mosses, hornworts, liverworts, algae).

Noxious Plants: Those plants which are injurious to public health, agriculture, recreation, wildlife, or any public or private property.

O

O&C Lands: Public lands managed by the BLM under the O&C Act of 1937 for permanent forest production, in accord with the principle of sustained yield. Lands administered under the O&C Act must also be managed in accordance with other environmental laws.

Off-Highway Vehicles (OHV): Any motorized vehicle designed for or capable of cross-country travel over land, water, sand, snow, ice, marsh, swampland, or other terrain.

Organic Matter: Plant and animal residues

accumulated or deposited at the soil surface; the organic fraction of the soil that includes plant and animal residues at various stages of decomposition; cells and tissues of soil organisms, and the substances synthesized by the soil population.

ORGANON: An individual tree growth computer model developed at Oregon State University, College of Forestry for areas of the Pacific Northwest.

P

Perennial Stream: A stream that flows continuously. Perennial streams are generally associated with the

water table in the localities through which they flow.

Permeability: The ease with which gases, liquids, or plant roots penetrate or pass through bulk mass of soil or a layer of soil.

Pile Burn[ing]: Activity fuels, once piled by hand or machine are burned in place (2016 ROD/RMP p. 309).

Plant Association Group: Potential natural

vegetation for a site under climax conditions (i.e. undisturbed by fire, insects, disease, flood, wind, erosion, or humans). The associations are primarily described by the presence and abundance of plant species. Environmental variables such as soil are used to classify and often reflect the pattern of vegetation.

Plant Community: An association of plants of various species found growing together in different areas with similar site characteristics.

Preferred Alternative: The alternative BLM

believes would reasonably accomplish the purpose and need for the proposed action while fulfilling its statutory mission and responsibilities, giving consideration to economic, environmental, technical, and other factors. This alternative may or may not be the same as the proposed action.

Prescribed Fire: Controlled application of fire to natural fuels under conditions of weather, fuel moisture, and soil moisture that will allow confinement of the fire to a predetermined area and, at the same time, will produce the intensity of heat and rate of spread required to accomplish certain planned benefits to one or more objectives for wildlife, livestock, and watershed values. The overall objectives are to employ fire scientifically to realize maximum net benefits at minimum environmental damage and acceptable cost.

Prey species: An animal taken by a predator as food.

Project Area: Overall area of consideration that was reviewed for the development of the Last Chance Forest Management Project.

Proposed Action: A proposal for BLM to authorize, recommend, or implement an action to address a clear purpose and need.

Public Lands: Any lands administered by a public entity, including (but not limited to) the Bureau of Land Management and the US Forest Service.

Q

Quadratic Mean Diameter (QMD): The diameter of the tree of average basal area in a stand at breast height.

R

Ravel: Loose rock material on a hillslope, usually of gravel or cobble size.

Record of Decision (ROD): The decision document associated with an environmental impact statement.

Relative Density (RD): The degree of crowding in a forest stand. When two stands result in the same relative density they can be thought of as being at the same degree of crowding, although they may differ in age, tree size, or site quality.

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

Resource Road: Roads that provide a point of access to public lands and connect with local or collector roads. (RMP 2016, p. 311).

Right-Of-Way (ROW): Federal land authorized to be used or occupied for the construction, operation, maintenance, and termination of a project, pursuant to a ROW authorization.

Riparian Area: An area containing an aquatic ecosystem and adjacent upland areas that directly affect it.

Riparian Habitat: The living space for plants, animals, and insects provided by the unique character of a riparian area.

Riparian Reserve (RR): A federally designated buffer around streams, springs, ponds, lakes, reservoirs, fens, wetlands, and areas prone to slumping, on federal lands only. The Northwest Forest Plan's Aquatic Conservation Strategy defines riparian reserve widths for the above water bodies.

Road Decommissioning (long term): The road segment will be closed to vehicles on a long-term basis, but may be used again in the future. Prior to closure the road will be left in an erosion-resistant condition by establishing cross drains, eliminating diversion potential at stream channels, and stabilizing or removing fills on unstable area. Exposed soils will be treated to reduce sediment delivery to streams. The road will be closed with an earthen barrier or its equivalent. This category can include roads that have been or will be closed due to a natural process (abandonment) and my be opened and maintained for future use (2016, ROD/RMP p. 311, 312).

S

Salvage Harvest: The removal of dead trees or of trees damaged or dying because of injurious agents other than competition, to recover their economic value.

Scope: The extent of an analysis in a NEPA document.

Scoping: The process by which BLM solicits internal and external input on the issues and effects that will be addressed in planning, as well as the degree to which those issues and effects will be analyzed in the NEPA document.

Sediment Yield: The quantity of soil, rock particles, organic matter, or other dissolved or suspended debris that is transported through a cross-section of stream during a given period.

Seed Tree: A tree of favorable genetic traits and healthy condition that is identified for protection in order to promote the continuation of its genetics.

Selection Harvest: Is a method of uneven-aged management involving the harvesting of single trees from stands (single-tree selection) or in groups up to four (4) acres in size (group selection) without harvesting the entire stand at any one time (2016 ROD/RMP, p. 312).

Sensitive Species: Those species that (1) have appeared in the Federal Register as proposed for classification and are under consideration for official listing as endangered or threatened species or (2) are on an official state list, or (3) are recognized by a land management agency as needing special management to prevent their being placed on Federal or state lists.

Seral Stage: A temporal or intermediate stage in the process of succession.

Silviculture: The science of controlling the establishment, growth, composition, health, and quality of forests and woodlands to meet diverse needs.

Silvicultural System: A planned sequence of treatments or prescriptions over the entire life of a forest stand needed to meet management objectives.

Skid: To drag a log from within a harvest unit to a collection point (landing).

Slash: The residual vegetation (e.g. branches, bark, tops, cull logs, and broken or uprooted trees) left on the ground after logging.

Snag: Any standing dead, partially dead, or defective (cull) tree at least 10″ DBH (diameter at breast height) and at least 6 feet tall (USDI 1995, p. 114).

Soil Series: The lowest or most basic category of the U.S. system of soil classification.

Species: A group of related plants or animals that can interbreed to produce offspring.

Special Status Species (SSS) include:

Proposed species – species that have been officially proposed for listing as threatened or endangered by the Secretary of the Interior. A proposed rule has been published in the Federal Register.

Listed Species – species officially listed as threatened or endangered by the Secretary of the Interior under the provisions of the ESA. A final rule for the listing has been published in the Federal Register.

Endangered Species – any species which is in danger of extinction throughout all or a significant portion of its range.

Threatened Species – any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Candidate Species – species designated as candidates for listing as threatened or endangered by the FWS and/or NMFS. A list has been published in the Federal Register.

Stand Density Index (SDI): Measures density of the stand from the number of trees and the quadratic mean diameter of the stand.

State Listed Species: Species listed by a state in a category implying but not limited to potential endangerment or extinction. Listing is by either legislation or regulation.

Sub-watershed: The sixth level in the hydrologic unit hierarchy. A sub-watershed is a subdivision within a fifth level watershed.

Succession: A series of dynamic changes by which one group of organisms succeeds another through stages leading to potential natural community or climax.

Suppressed Trees: Trees with crowns entirely below the general canopy receiving no direct light from either above or from the side.

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.

Sustained Yield Unit (SYU): An administrative unit for which an allowable sale quantity is calculated; in western Oregon, the six sustained yield units correspond to the Coos Bay, Eugene, Medford, Roseburg, and Salem Districts, and the western portion of the Klamath Falls Field Office.

T

Temporary Road Construction: A short-term use road authorized for the development of a project that has a finite lifespan (e.g., a timber sale spur road). Temporary roads are not part of the permanent designated transportation network and must be reclaimed when their intended purpose has been fulfilled (2016 ROD/RMP p. 315).

Thinning: A silvicultural treatment made to reduce the density of trees primarily to improve tree/stand growth and vigor, or recover potential mortality of trees, generally for commodity use. See *pre-commercial thinning*, *commercial thinning*, *variable-density thinning* (2016 ROD/RMP p. 315).

Tiering: Using the coverage of general matters in broader NEPA documents in subsequent, narrower NEPA documents, allowing the tiered NEPA document to narrow the range of alternatives and concentrate solely on the issues not already addressed.

Topography: The configuration of a surface area including its relief, or relative elevations, and position of its natural and anthropogenic features.

Total Maximum Daily Loads (TMDLs): Pollution load limits calculated by DEQ for each pollutant entering a water body. TMDLs describe the amount of each pollutant a waterway can receive and still not violate water quality standards. Both point and nonpoint source pollution are accounted for in TMDLs as one group of organisms that allows for future discharges to a water body without exceeding water quality standards.

Transient Snow Zone (TSZ): The area where a mixture of snow and rain occurs, sometimes referred to as the rain-on-snow zone. The snow level in this zone fluctuates throughout the winter in response to alternating warm and cold fronts. Rain-on-snow events originate in the transient snow zone.

Treatment Area: Describes where action is

proposed, such as units where forest thinning is proposed and where road construction or road improvements are proposed.

Tree-tipping: Mechanically tipping or pulling over trees with root wads attached, generally into or near a stream, to simulate natural wood recruitment.

Turbidity: The cloudy condition caused by

suspended solids, dissolved solids, natural or human developed chemicals, algae, etc. in a liquid; a measurement of suspended solids in a liquid.

U

Underburn: A fire that consumes surface fuels but not the overstory canopy.

Underburning: Is prescribed burning under a forest canopy.

Understory: That portion of trees or other woody vegetation which forms the lower layer in a forest stand which consists of more than one distinct layer.

Understory: That portion of trees or other woody vegetation, which form the lower layer in a forest stand, which consists of more than one distinct layer.

Uneven-Aged Stand: A stand composed of at least three (3) distinct age classes intimately mixed or in aggregated groups producing a multi-layered canopy structure managed as a discrete operational unit.

V

Vascular: Plants having phloem- and xylem conducting elements that facilitate the moving of water and nutrients.

Vertebrate Species: Any animal with a backbone or spinal column. Characterizing watershed and ecological processes to meet specific management and social objectives.

W

Watershed: All land and water within the confines of a drainage divide.

Watershed Analysis: A systematic procedure for Watershed analysis provides a basis for ecosystem management planning.

Wetlands: Lands including swamps, marshes, bogs, and similar areas, such as wet meadows, river overflows, mud flats, and natural ponds.

Wildland-Urban Interface (WUI): The area where structures and other human development meet or intermingle with undeveloped wildland.

Windthrow: A tree or trees uprooted or felled by the wind.

Y

Yarding: The act or process of conveying logs or whole trees to a landing, particularly by cable, tractor, or helicopter.

APPENDIX F: MAPS

Map 2: Last Chance Forest Management Project Vicinity – Past Projects