Sentinel Forest Vegetation Management and Timber Sale Project

Draft Project Assessment
February 2025

Photo: Looking toward Green Ridge from near Camp Creek, Proposed Sentinel Project Area, The Confederated Tribes of Warm Springs, Oregon (Jimenez 2023).

The Confederated Tribes of Warm Springs, Oregon
Branch of Natural Resources
and the
United States Department of the Interior,
Bureau of Indian Affairs

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PURPOSE AND NEED

There is a need for promoting economic benefit to the Confederated Tribes of Warm Springs, Oregon (CTWS) by facilitating a commercial timber sale from its local forest resource. There is also a need for addressing landscape resiliency by maintaining areas in more robust conditions, including minimizing the adverse effects from insects, disease, intertree competition, drought, and wildfire.

The CTWS preforms forestland management under an agreement with the United States Department of the Interior (DOI) - Bureau of Indian Affairs (BIA), through a self-governance compact authorized by Federal Public Law 93-638 and as amended by the Indian Self-Determination Contract Reform Act of 1994 (108-Statute 4250).

As such, the CTWS Branch of Natural Resources (BNR) hereby proposes the Sentinel Forest Vegetation Management and Timber Sale Project (Sentinel Project), located within the Metolius Forest Planning Unit (the "South End"); see Figure-1. A proposed commercial timber harvest would provide portions of the approved calculated allowable cut for planning period 2022-2031. Project proposals also include noncommercial activities such as precommercial thinning,[1] hazardous fuels reduction,[2] and transportation system maintenance and modification.

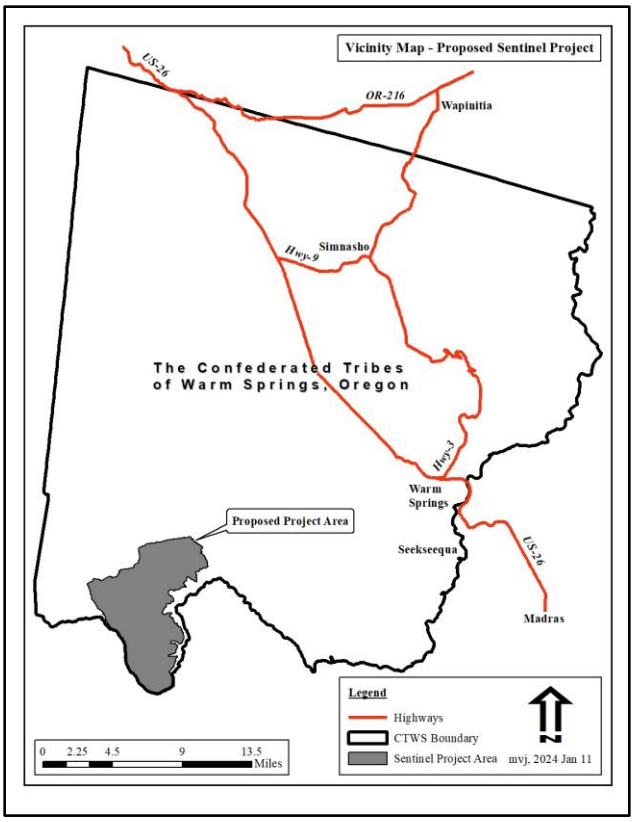

Figure-1 Vicinity Map

Planning for this project assessment (PA) incorporates processes guided by the Integrated Resources Management Plan for the Forested Area and Rangelands (IRMP 2012). Specifically, a project interdisciplinary team (PIDT) procedure was followed whereby various resource specialists assessed potential land management effects upon identified resources given a defined set of proposed actions within a distinct area and time.

Resource assessments are presented under the document headings of Water, Fisheries, Wildlife, Cultural Resources, Soil, Fire, Timber, Range, Transportation, and Economics and Employment. Assessments assess the following proposed actions:

[1] **Precommercial Thin (PCT):** A noncommercial tree thinning targeting the removal of younger and smaller individuals, not for immediate financial return, but for reducing residual stocking by concentrating growth on the more preferred trees (Society of American Foresters 2016).

[2] **Hazardous Fuels Reduction (HFR):** A maintenance and restoration treatment aimed at reducing the amount of flammable material in a fire-prone system. Hazardous fuels reductions do not necessarily fire-proof a stand, but afford wildland firefighters with more response time in a less risky work environment, while increasing suppression success and reducing adverse fire impacts and costs.

- Commercial timber harvest of approximately 20.58 million board feet across 1,475 acres;
- Precommercial thinning (PCT) across approximately 1,325 acres;
- Hazardous fuels reduction (HFR) across approximately 2,330 acres;
- Reclassifying selected areas of general forest to Conditional Use status across approximately 1,055 acres; and,
- Reducing average open-road densities from 3.90 to 3.40 miles per section.

The PA is not a decision document, but provides managers and deciding officials with a summary of anticipated project-specific effects (positive and negative) to forestland resources, anticipated occurring by implementing a proposed project. Potential effects, or impacts are assessed according to what could occur if no action is taken and the project *is not* implemented (Alternative-A), compared to what could occur if action is taken and the project *is* implemented (Alternative-B). Assessments also aid in considering environmental, cultural, and economic trade-offs. For this project, two management alternatives are considered, a No Action and a Proposed Action.

The Resource Management Interdisciplinary Team (RMIDT) reviews and considers assessments, before seeking further input from the Tribal community through a subsequent 30-day review. After the review period, RMIDT would then produce a decision document. If the project is approved and proceeds, RMIDT would provide any further guidance for project implementation. RMIDT recommendations are presented to the Bureau of Indian Affairs (BIA) Superintendent. If in agreement and support of the project, the Superintendent would document a decision in a Finding of No Significant Impact (FONSI), to be attached to the decision document and associated Forest Officer's Report (FOR), with proposed activities beginning in about late 2025. The CTWS Tribal Council is the final decisive authority concerning project approval and/or modification.

PUBLIC INPUT (SCOPING)

Tribal public input into the planning process was primarily through opportunities for interactive community meetings and Tribal Council Committees involvement with the PIDT and RMIDT. Background information for the proposed project, announcements of meetings, and an informational interview was broadcast to the local community by KWSO Radio Warm Springs, Oregon. Broadcasts began October 4, 2023 and regularly continued for approximately one week. Public announcement and information flyers were posted throughout the community, as well as being delivered to the Spilyay-Tymoo newspaper. Flyers were also delivered for distribution to Tribal Council.

A community meeting was held on October 13, 2023 at the Community Center Social Hall, proceeded by a BNR field tour of the proposed project area on October 12, 2023, facilitating tribal member observation, discussion, and input. Turnout was low with one general public participant on the field tour and no general public participants at the Social Hall. However, voicings from participating Tribal members were regularly expressed by BNR employees and Committee persons. Four Committees were actively involved in the planning process; namely, Culture and Heritage, Fish and Wildlife (On-Reservation), Land Use, and Timber.

As project planning and assessments continue, additional thoughts and concerns are communicated to the PIDT and are addressed as a part of the process. Table-1 summarizes representative issues and concerns expressed during planning; topic headings are listed alphabetically and are addressed by the PIDT.

Table-1: Tribal Public Input

Topic	Input	Feedback
Economics	Concerned timber is being harvested and who is profiting; where is the money going?	Revenues for the CTWS are heavily dependent upon and largely generated through timber proceeds. Timber harvests also provide for employment, including multiple peripheral businesses aiding the local economy. Achieving a balance between resource utilization and conservation is a continuing challenge for the technical staff and ultimately the Tribal public, deciding officials, and managers. It is virtually impossible to satisfy all parties; many opposing values and voicings are locally expressed, along with high demands on the land. IRMP standards and best management practices help alleviate permanent impacts to the Tribe's natural resources. A benefit of having an established management plan is its ability to limit the autotomy of any one person or interest group, striving for balance. Nevertheless, with mixed emotions and reactions, it is the Tribe's direction to continue with timber harvest as a means of generating revenue. Revenue generated by timber sales is under the Tribe's accounting and policy procedures. Specific details are outside the scope of the PIDT and technical staff. It is understood that the CTWS Tribal Council regularly discloses budgets and expenditures and is at Tribal discretion. Federal oversight is also conducted by the Bureau of Indian Affairs (BIA).

Topic	Input	Feedback
Timber Harvest	Concerned timber harvest levels are not sustainable; how are the harvest levels determined?	A sustainable harvest level is an important goal of the CTWS. The determined amount is modeled and calculated for the commercial forest base using up-to-date inventory data and state-of-the-art information technology. Calculations are conducted by trained and experienced specialists. Calculations were formally performed by local staff, but due to staffing issues, services are now contracted out to a private entity. The result is reviewed by local staff and presented to Tribal Council for subsequent review and approval. Ideally, a sustainable level is where harvest is approximately equal to growth. This is the biological allowable cut; that is, the level the forest is capable of growing and being sustainably harvested. Political and economic needs and constraints further modify the biological cut, lowering the overall timber harvest of the entire forestland. For instance, roughly one-third of the forest is considered net commercial forest; the remaining two-thirds are in various resource set-asides. According to inventory data, the overall forest base is currently growing faster than harvest. The harvest level is typically recalculated every five years or as needed. For example, the 2020 Lionshead Fire burned nearly 90,000 acres on the CTWS. This triggered a recalculation of the allowable cut. The overall forest harvest level was then reduced to approximately 18.1 million board feet per year from approximately 26 million. Three Forest Planning Units were also suspended from active timber harvest as a result of the Fire; Seekseequa, Shitike, and Mill Creek. Also, suspending about one-half of the Badger Planning Unit. Tribal Council at its discretion may amend the recommended harvest level for meeting Tribal objectives. The process includes factors for what is biologically sustainable and what is politically and economically desirable, and then considers the trade-offs. The current direction is continuing with timber harvests while seeking a balance between resource protection and resource utilization.

GOALS AND OBJECTIVES

Project goals and objectives help frame or shape potential land management actions, along with helping strategize management efforts, including prioritizing proposed actions. Goals and objectives for the proposed Sentinel Project include:

- Producing a viable timber harvest addressing the project area's approved ten-year calculated allowable cut (AC) for planning period 2022-2031.
- Proposing additions to Conditional Use areas near Parker Creek and along the Metolius Rim.
- Strategizing proposed treatment areas by:
  - Evaluating stream classifications and appropriate riparian buffers, including field-verification of features identified using LiDAR[3] technology;
  - Evaluating and protecting previously undocumented water features located during preliminary field review;
  - Conserving and protecting overall water and fisheries resources;
  - Conserving soil resource by minimizing impacts upon treated areas, including limiting operations on steep-slopes;
  - Minimizing impacts to identified wildlife habitat and sensitive species;
  - Avoiding proposed treatments within the 2020 Lionshead Fire footprint affording affected areas time to recover;
  - Conserving healthy older, larger diameter conifers serving as a resilient anchor on the forested landscape;
  - Reducing understory and midstory ladder fuels facilitating a more resilient landscape in a fire-prone system, as well as redistributing limited growing space (sunlight, water, nutrients) onto the residual trees;
  - Retaining healthy sugar pine and western larch as current composition is relatively limited on the landscape;
  - Favoring as residual trees the more resilient conifer species such as Douglas-fir, ponderosa pine, sugar pine, and western larch;
  - Promoting wildfire resiliency through timber density and species management, along with addressing residual fuels (slash);
  - Addressing forest stand health and value through field assessments and targeted treatments;
  - Limiting seed tree (ST)[4] and partial overwood retention (POR)[5] treatments to areas affected by dwarf mistletoe and/or declining overstories;

[3] **LiDAR:** Light Detection and Ranging is a remote sensing method that uses light in the form of a pulsed laser to measure ranges (variable distances) to the Earth. These light pulses combined with other data recorded by the airborne system generate precise, three-dimensional information about the shape of the Earth and its surface characteristics. (URL - https://oceanservice.noaa.gov/facts/lidar.html 2024).

- Distinguishing between commercial and noncommercial treatments for better facilitating implementation of proposed actions, allocation of funding, and administration of contracts;
- Prescribing precommercial thinning (PCT) of existing plantations promoting stand health and longevity;
- Prescribing the piling and burning of activity slash in manual PCT's for limiting fuel build-up and better facilitating wildlife travel;
- Prescribing herbicide application and reseeding of burned slash piles at landings to reduce weed encroachment;
- Prescribing masticated Hazardous Fuls Reductions (HFR) for plantations and various stands where average tree diameters are generally too large for conventional manual thinning;
- Planting conifers incorporating a mix of the more resilient species such as Douglas-fir, ponderosa pine, sugar pine, and western larch;
- Minimizing transportation system access needs and maintenance through strategic and concentrated treatment area design;
- Minimizing need for new road construction and reconstruction, along with avoiding net gain in open road densities; and,
- Avoiding the reopening of two stream crossings; one located on an unnumbered spur at Racing Creek and another located on the J-300 Road at Rainy Creek.

ALTERNATIVES CONSIDERED

This section provides an overview of the two assessed management alternatives proposed for the Sentinel Project; a No Action (Alternative-A) and a Proposed Action (Alternative-B). Potential effects, or impacts are assessed according to what could occur if no action is taken and the project is not implemented (Alternative-A), compared to what could occur if action is taken and the project is implemented (Alternative-B). For this project, two management alternatives are considered, a No Action and a Proposed Action. One action alternative is presented as efforts are focused on producing a balanced approach to project planning. That is, seeking a balance amongst environmental, cultural, and economic considerations and trade-offs.

This section briefly describes the alternatives considered and provides information such as anticipated timber harvest and other forest vegetation treatments, along with probable logging

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[4] **Seed Tree (ST):** Prescribed as a conventional even-aged regeneration treatment providing economic value and occasion for a subsequent healthy and robust future stand (plantation). As this is a "final harvest", the goal is not necessarily retaining trees that will respond in growth and vitality. Treated areas are planted with resilient conifer species; typically, a mix of Douglas-fir, ponderosa pine, sugar pine, western larch, and western white pine. Therefore, it is normal retaining individuals with genetic imperfections (in terms of timber quality). Trees with the potential for spread of disease (like dwarf mistletoe) are harvested or cut and left on-site.

[5] **Partial Overwood Retention (POR):** Typically applied as a final timber harvest retaining approximately four overstory trees per acre (overstory tree spacing about 104 feet). Treatment follows a previous shelterwood treatment implemented fifteen to twenty years earlier or may address an overstory in declining health while conserving a healthier understory.

methods, slash treatments, reforestation needs, and transportation system-related tasks. Included maps delineate the proposed project area with previous timber harvests, the 2020 Lionshead Fire footprint, and proposed actions. Associated tables compare features of the alternatives considered, using effects-indicators, or measures for each resource. This section also presents the recommended alternative, along with a statement on project monitoring.

Alternative-A, No Action

Alternative-A (No Action) presents a baseline for comparing and evaluating anticipated effects when implementing Alterative-B (Proposed Action). Alternative-A does not propose any new ground-disturbing activities. Therefore, no new program timber harvests, forest-stand maintenance, fuels reduction activities, or modifications to Conditional Use areas would occur. Also, the existing transportation system would not be further modified; no roads would be constructed or reconstructed, nor would any additional roads be identified for closing or decommissioning.

Current land uses and activities would continue, such as cultural food gathering, subsistence hunting, dispersed recreation, fire management and suppression, firewood cutting, salvage logging, and scheduled road maintenance. Existing land and resource conditions would remain relatively unaffected by additional land management activities. Modifications to the existing environment would be primarily from natural occurrences and processes such as climate and wildfire.

Previously approved projects, but not yet implemented, are primarily limited to ongoing reforestation efforts. There are currently no program timber harvests approved for the project area. Figure-2a includes previous timber harvest areas within the project area, along with areas identified as avoidance or exclusion areas - places avoided or omitted from active, intensive[6] forest stand management activities. Avoidance areas include riparian zones, wildlife habitat, and Conditional Use areas.

Previous timber harvests documented from 1980 through 2021 account for approximately 67 percent of the total project area - approximately 16,600 harvest acres out of 24,950 project area acres. Identified avoidance areas encompass about 33 percent of the project area - approximately 8,075 avoidance acres out of 24,950 project area acres.

Figure-2b displays the 2020 Lionshead Fire footprint in and around the proposed project area. This wildfire burned nearly 90,000 acres on the CTWS overall and over 10,000 acres within the proposed project area itself. Within the project area, approximately 860 acres were salvage logged in 2021, recovering potentially lost revenue from fire damaged timber.

[6] **Intensive** forestland management includes activities such as timber harvesting and thinning, hazardous fuels reductions, prescribed burning, site preparation, and seedling planting. These prescribed and implemented practices aim at intensively or actively meeting land management goals and objectives. In contrast, extensive practices are more passive or limited in regards to engaged activities, such as avoiding identified water, wildlife, cultural, and Conditional Use areas.

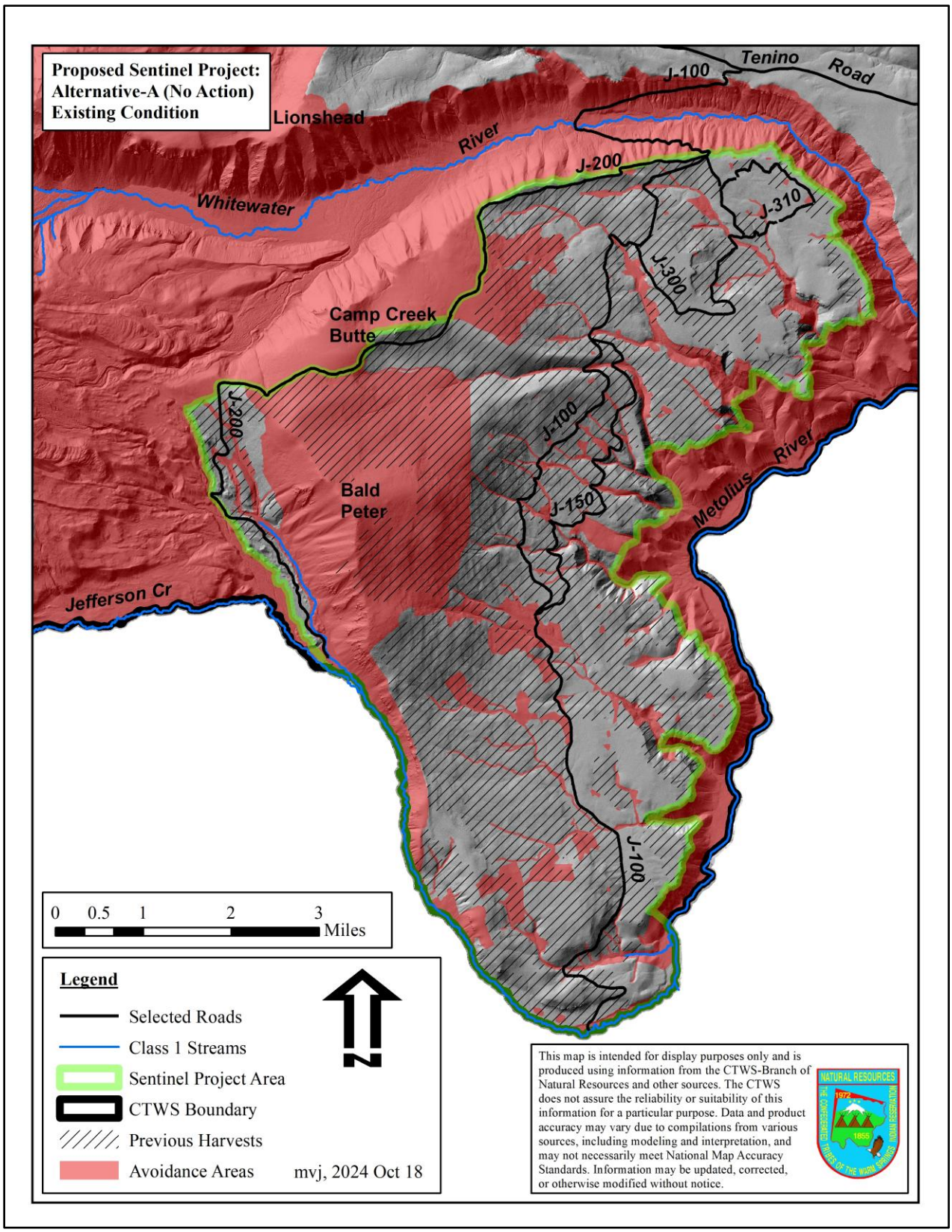


Figure-2a: Alternative-A, No Action

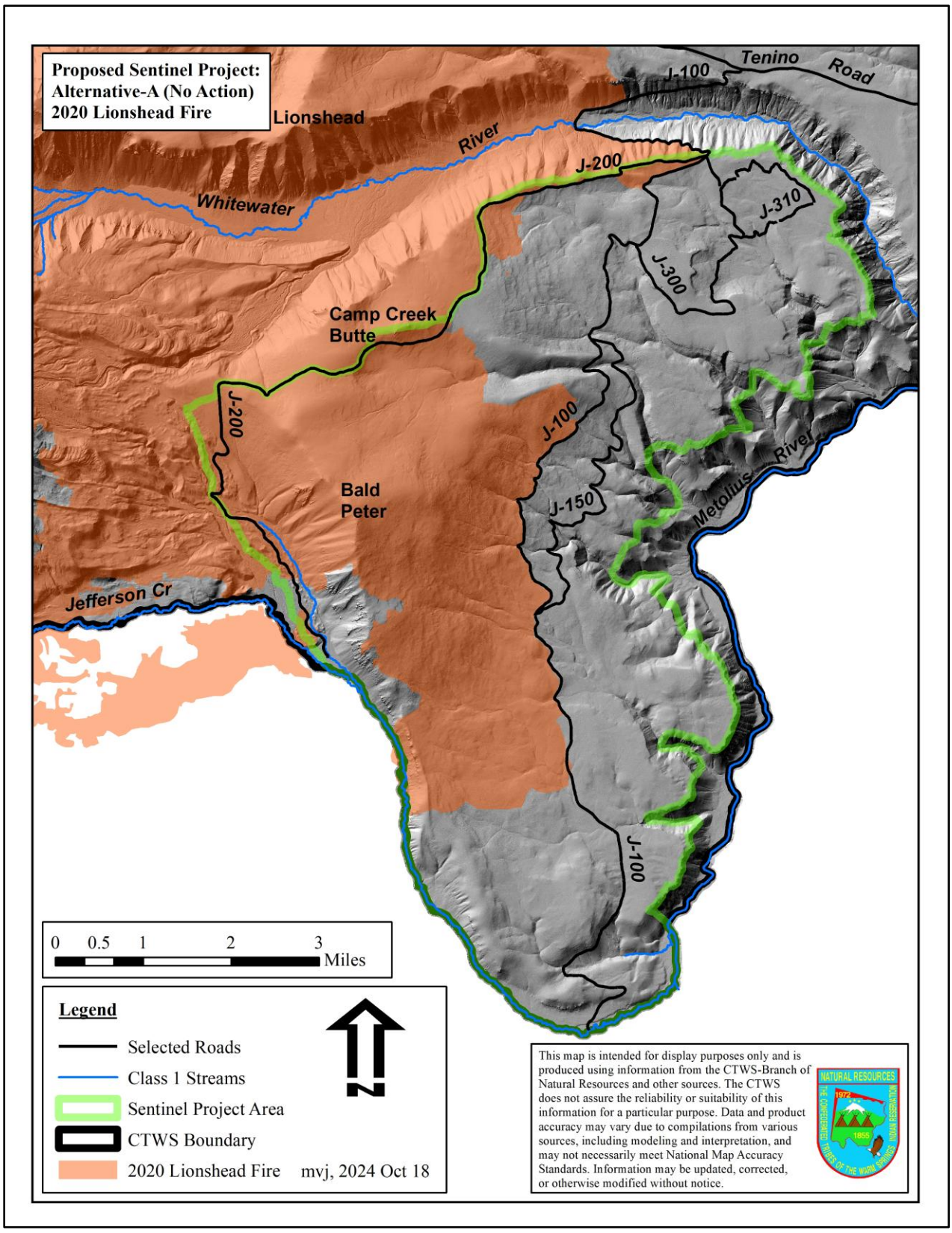


Figure-2b: 2020 Lionshead Fire

Alternative-B, Proposed Actions

The proposed actions of Alternative-B incorporate guidance from the IRMP and other management instructions and policies, addressing a range of considerations as issues, sites, and complexities vary. Table-2 presents estimates serving as measures, or indicators for the proposed actions. Indicators help communicate anticipated differences between alternatives or proposed actions. Definitions for proposed treatments are summarized in Appendix-A Glossary. Proposals include both extensive and intensive management actions, as well as commercial and noncommercial actions. Alternative-B maps (Figures 3a, 3b, 3c, and 3d) delineate the proposed project area and accompanying proposed forest vegetation treatments and proposed additions to Conditional Use. Figure-3a displays all proposed actions, both extensive and intensive.

The extensive part of the proposed action is reclassifying portions of general forestland to Conditional Use status located near Parker Creek and along the Metolius Rim. The Parker Creek area has experienced widespread bark beetle infestation, along with multiple wildfires and subsequent timber salvage harvests. The area is considered far and removed with costly transportation difficulties; commercial timber in the area is also limited. Reclassifications along the Metolius Rim are based on field verification and mapping exercises distinguishing flatter uplands from steeper canyonlands and volcanic rimrock. Other factors influencing proposed amendments include water protection, wildlife habitat, and logging feasibility, especially considering the lower probability of harvesting timber from more removed and steeper areas. Amendments would reclassify approximately 1,055 acres of general forest ground to Conditional Use. Removing this ground from general forestland classification would not appreciably affect the overall allowable cut of the CTWS, especially as the areas are being currently avoided from active management actions. Refer to Figure-3b for extent of proposed Conditional Use additions.

Intensive actions are active treatments and include a portfolio of vegetation treatments. Active treatments would concentrate on approximately 5,130 acres while striving for limited adverse impacts to forestland resources. Proposed treatments typically favor the more resilient timber species such as Douglas-fir, ponderosa pine, sugar pine, and western larch; reduce intertree competition and ladder fuels; and, redistribute limited growing space (sunlight, water, and nutrients) onto to the healthier and more desirable tree-individuals and groups (clumps). Objectives would also promote the conservation of healthy mature tree-individuals and groups, promoting late-old structure (LOS).[7]

These active treatments address forest stand health and viability along with resilience to disturbance events, such as from climate, wildfire, insects, and diseases; along with, facilitating a viable timber sale generating economic revenue and opportunities for the CTWS. Alternative-B assesses a net timber harvest of approximately 20.58 million board feet across 1,475 acres, providing portions of the approved calculated allowable cut for planning period 2022-2031.

Commercial timber harvest treatments include partial overwood retentions (POR), seed trees (ST), shelterwoods (SW), and shelterwood-lights (SWL), which would be packaged as timber sale blocks; refer to Figure-3c. Commercial treatments account for approximately 29 percent of the overall proposed treatment areas - approximately 1,475 harvest acres out of 5,130 total active

[7] **Late-Old Structure (LOS):** Refers generally to tree individuals or groups and/or forested stands displaying structural characteristics associated with an "old growth" or mature forest - for example, larger bole diameters and greater ages with more complex stand structures.

treatment areas. Approximately 38 percent of the commercial treatments are re-entries into previously harvested areas - approximately 555 re-entry acres out of 1,475 harvest acres.

Noncommercial treatments include about 2,330 acres of hazardous fuels reduction (HFR) and 1,325 acres of precommercial thinning (PCT) - refer to Figure-3d. Noncommercial proposals account for approximately 71 percent of the total proposed treatment area - approximately 3,655 noncommercial acres out of 5,130 total treatment acres. As HFRs and PCTs manipulate smaller trees, activities are investments in forest maintenance and fuels management necessitating subsidized or allocated funds for implementation, typically executed as separate activities and contracts.

Hazardous Fuel Reduction areas would be mechanically treated through mastication. Mastication refers to a "chewing" action. Mastication breaks down woody material into smaller pieces and then distributes chipped or mulched material onto the ground surface.[8] Trees up to ten inches diameter would be thinned and chipped employing cutting heads, typically mounted on tracked equipment. Chipped material is left in place or reduced with subsequent prescribed burning.

Precommercial thins target the cutting of younger and smaller trees, not for immediate financial return, but for reducing residual stocking, concentrating future growth on the retained and more preferred trees (Society of American Foresters 2016). Trees up to ten inches diameter are typically thinned. Cut material, or slash, is prescribed for bucking into lengths of about five to six feet, piled, and latter burned. Treating this slash would both reduce fuel loads as well as better facilitate wildlife travel.

Proposed active treatments are also prioritized from low to high. Prioritization aids in balancing environmental and economic considerations by assisting in the allocating and expending of limited industrial and fiscal resources. Priorities are a relative measure based on parameters including forest-stand stocking and health/value. For instance, a higher priority stand would generally display poorer timber health, higher timber value, and be capable of generating more resilient stand conditions in relatively shorter time. Treatment priorities for this project proposal do not contain areas considered as strictly "low"; approximate treatment priorities include: Low to Moderate ≈ 135 acres; Moderate ≈ 815 acres; Moderate to High ≈ 1,995 acres; and, High ≈ 2,180 acres.

The selection of timber harvest or logging methods involves varied considerations such as soil, slope, water, timber types, transportation systems, mechanical capabilities, economic values, and areas of special interest or concern. For the Sentinel Project, logging methods are ground-based; there are no areas identified for cable or tethered systems. For planning purposes, the typical slope-break differentiating conventional ground-based harvest from specialized steep-slope harvest is 35 percent. That is, slopes greater than 35 percent are typically assigned specialized equipment, such as shovel-logging operations. Proposed treatment areas also have "mixed" ground. Mixed ground harvests represent areas where most of the ground is less than 35 percent but have intermittent slope-pitches of greater than 35 percent, typically logged using a track-mounted, ground-based machine designed for steep pitches, like shovel operations. For example, an approximately seventy-acre harvest block has intermittent steep-slope pitches across five of those seventy acres.

[8] URL - https://blogs.oregonstate.edu/treetopics/2019/10/16/dont-want-to-burn-other-options-for-treating-slash-after-a-timber-harvest 2024.

Slash treatments are also a part of the proposal, facilitating site-preparation for reforestation and/or hazardous fuels reduction objectives. For instance, areas anticipating conifer seedling planting or heavier fuel loads would pile and burn activity slash and fuels using mechanical means, typically piled using a track-mounted shovel-type machine fitted with grapples. Manually thinned PCTs are prescribed for hand-piling and burning of slash for fuels and wildlife objectives. For this project, areas prescribed for planting embody roughly 1,365 acres using a mixture of resilient timber species such as Douglas-fir, ponderosa pine, sugar pine, and western larch. Planting is prescribed for all seed tree, shelterwood, and shelterwood-light treatments.

Following completion of timber harvest operations, herbicide may be applied to all landings for reducing the spread of weeds. "Plateau" herbicide would be applied to landings immediately following the burning of slash piles, at a rate of approximately seven ounces per acre. In addition, reseeding of all landings would occur; using a mix of Idaho fescue (*Festuca idahoensis*), bluebunch wheatgrass (*Pseudoroegneria spicata*), and bottlebrush squirreltail (*Elymus elymoides*) at a rate of about eight pounds per acre. Reseeding would occur either in the fall or the spring, following the burning of slash piles.

Access to proposed treatment areas would be limited to existing open roads and reconstruction of selected closed roads. Any new road construction would be limited to temporary stub roads only, deemed necessary for accessing treatment areas and facilitating product transport to existing open-road networks. All reconstructions and stubs require blocking and/or decommissioning following execution of proposed actions, including post-harvest activities, such as site-preparation and reforestation. See the Project Design Features section for additional transportation system information.

Table-2: Alternative-B, Proposed Actions Summary

Timber Harvest Volume (net million board feet)	20.58
Total Treatment Area (net acres)	5,130
Treatment Area by Type (net acres)	
Hazardous Fuels Reduction, HFR	2,330
Partial Overwood Retention, POR	105
Precommercial Thin, PCT	1,325
Seed Tree, ST	270
Shelterwood, SW	580
Shelterwood-Light, SWL	520
Commercial Treatment Area by Harvest System (net acres)	
Tractor	875
Shovel	70
Shovel/Tractor Mix (terrain intermixed with slopes greater than 35%)	530
Fuels/Slash/Brush Treatment by Type (net acres)	
Masticate, MST - HFRs	2,330
Whole-Tree, WT - PORs	105
Machine Pile/Burn, MPB - STs, SWs, SWLs	1,370
Buck/Pile/Burn Slash, BPB - PCTs	1,325
Pile/Burn Landings, PBL - Commercial Blocks (one landing per ten acres)	150
Conifer Planting (net acres) - STs, SWs, SWLs	1,370
Transportation Task by Type, Length (miles)	
New Roads Constructed	0.00
Roads Reconstructed	4.05
Roads Maintained	67.10
Roads Closed	15.60
Roads Eradicated	0.70
Conditional Use Additions, Parker Creek and Along Metolius Rim (acres)	1,055

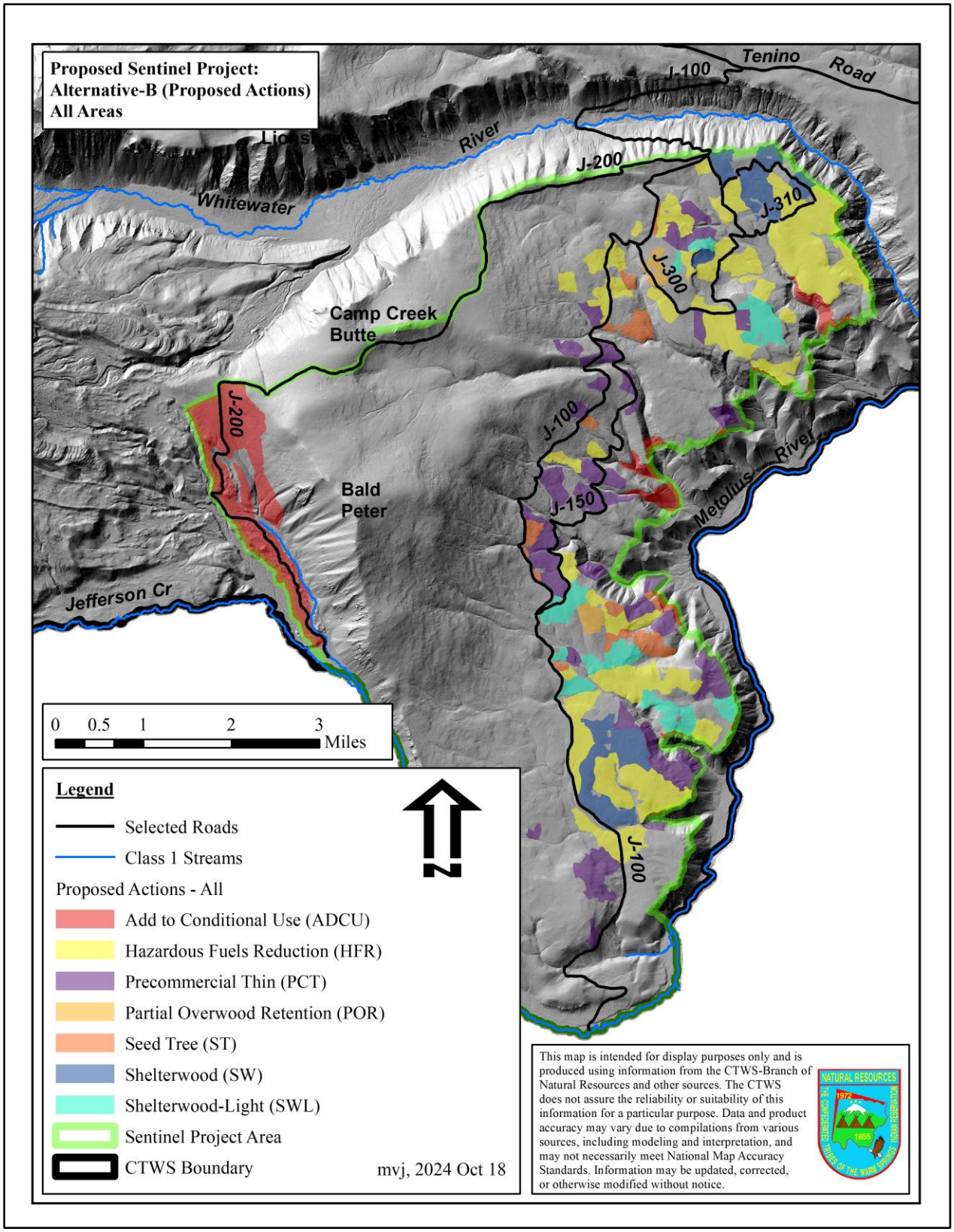


Figure-3a: Alternative-B, Proposed Action - All Areas

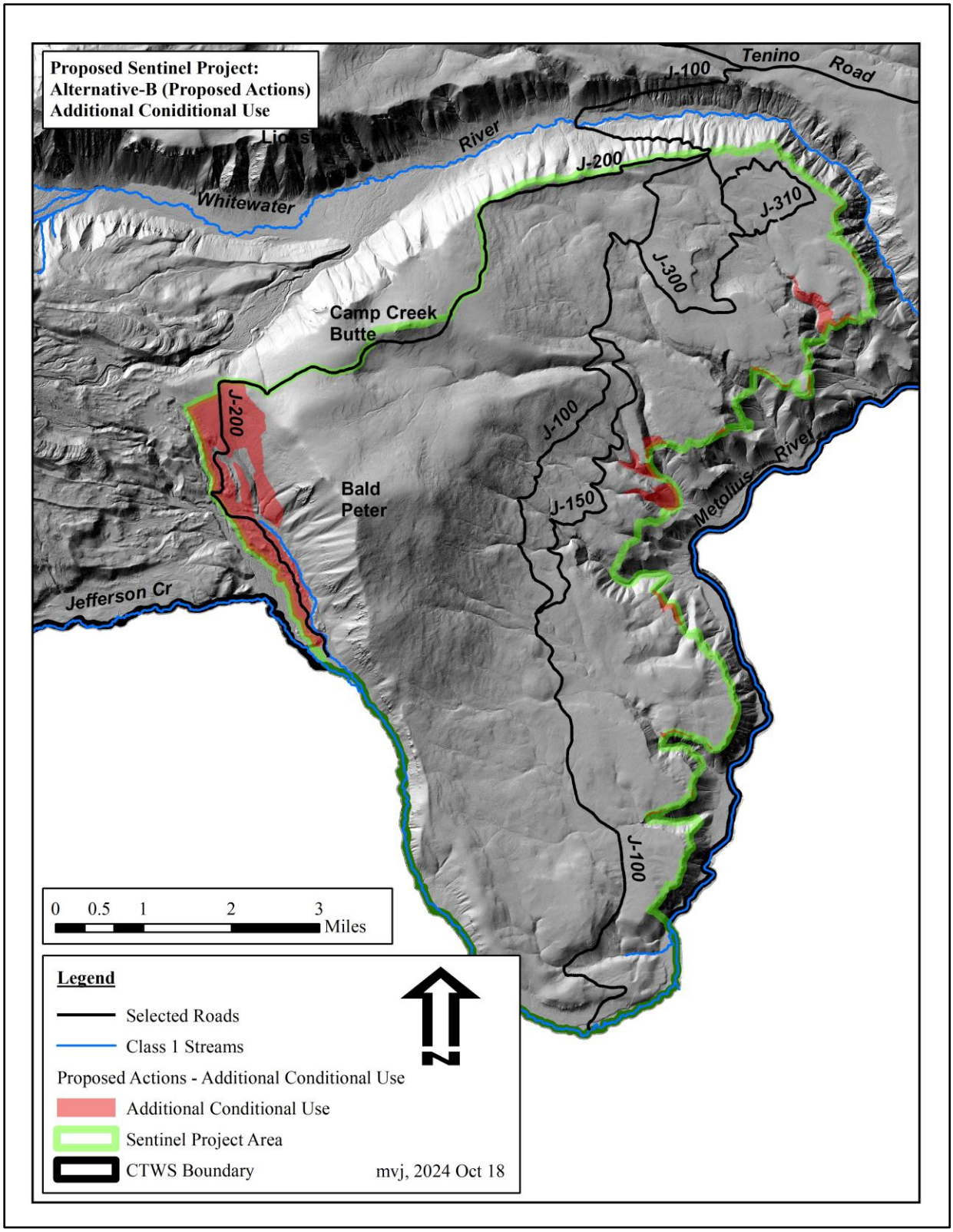


Figure-3b: Alternative-B, Proposed Actions - Additions to Conditional Use

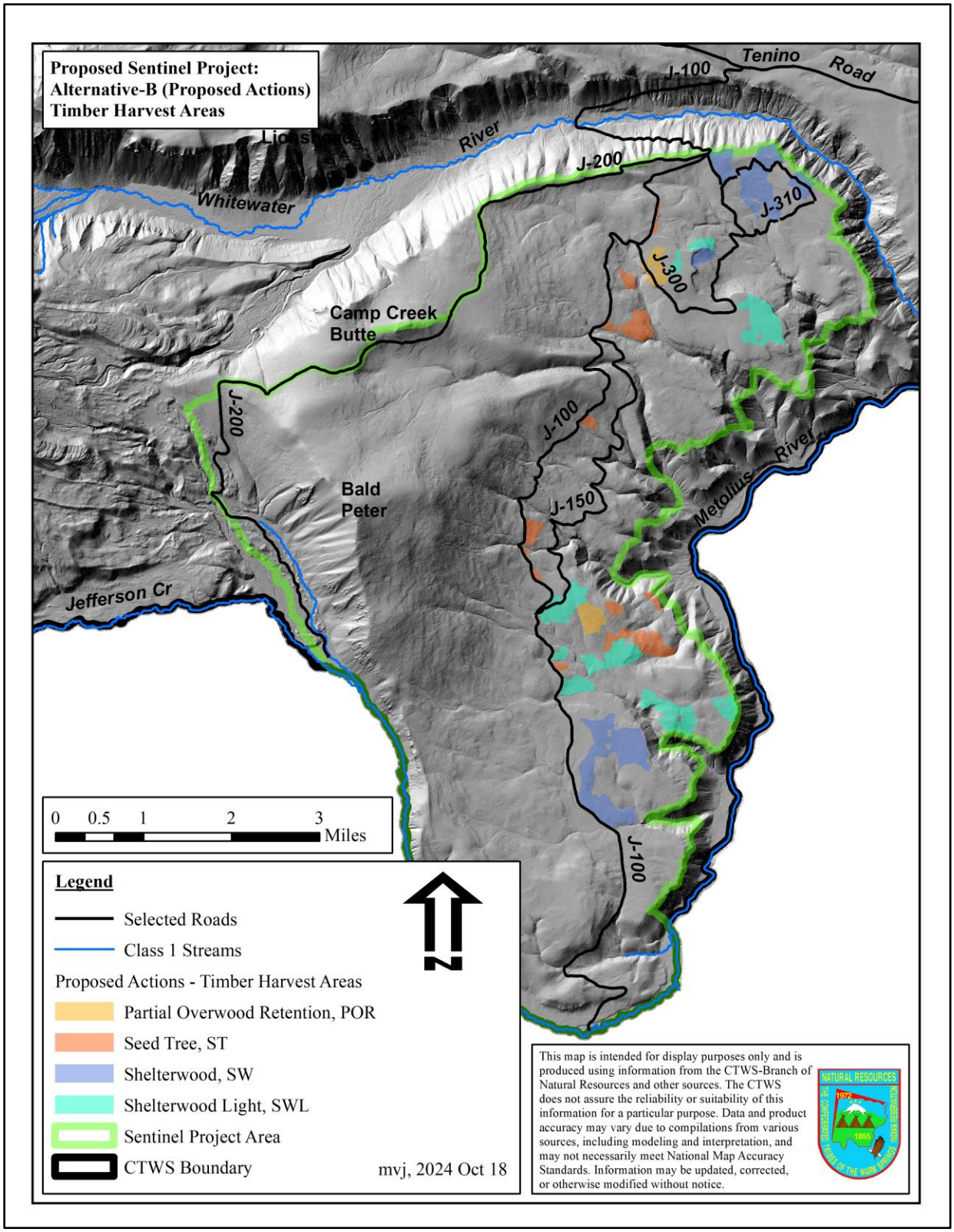


Figure-3c: Alternative-B, Proposed Actions - Timber Harvest Areas

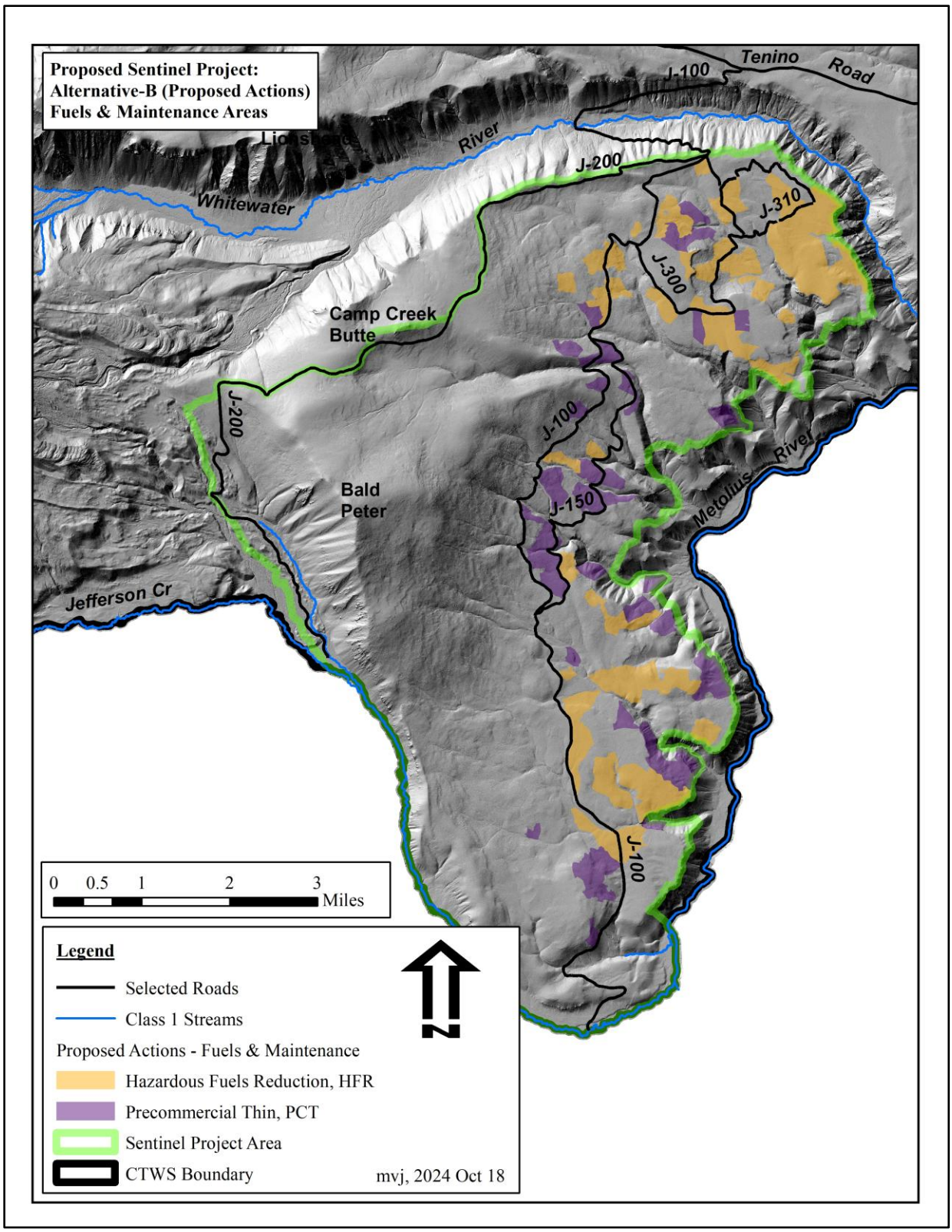


Figure-3d: Alternative-B, Proposed Actions - Fuels and Maintenance Areas

Comparison of Alternatives

Table-3 summarizes estimated amounts associated with the proposed actions, presenting timber harvest, fuels and maintenance treatment, and additions to Conditional Use between Alternative-A and Alternative-B.

Table-4 compares the considered resource values of the alternatives considered, using effects-indicators (or measures) for each resource. Indicators communicate anticipated differences between alternatives or proposed actions. Tabular comparisons begin with Water and conclude with Economics and Employment. There are no submissions for Cultural Resources or Fire.

Table-3: Proposed Actions Summary

Actions	Alternative-A	Alternative-B
Timber Harvest Volume (net million board feet)	As Approved	20.58
Total Treatment Area (net acres)	As Approved	5,130
Forest Vegetation Treatment Area by Type (net acres)		
Hazardous Fuels Reduction, HFR	0	2,330
Partial Overwood Retention, POR	0	105
Precommercial Thin, PCT	As Approved	1,325
Seed Tree, ST	0	270
Shelterwood, SW	0	580
Shelterwood Light, SWL	0	520
Timber Salvage, SAL	As Approved	As Approved
Additions to Conditional Use (net acres)	0	1,055

Table-4: Effects by Resource Indicator

WATER Indicators	Alternative-A	Alternative-B
Leaf Area	1	1.79
Canopy Storage	1	1.65
Runoff Lag Time	1	1.57
Total Runoff	1	1.37
***** Values reflect relative changes to each indicator as a result of proposed treatments averaged across the whole proposed Project Area. Each indicator was ranked on a 1-5 scale based on characteristics and proposed treatments of each sub-watershed (see Cumulative Effects section for complete description of relative index scores).		

FISHERIES Indicators	Alternative-A	Alternative-B
Erosion and Sediment Loads	No Change	Could Increase
Water Temperature	No Change	Could Increase
In-Stream Habitat (for example, large woody debris)	No Change	Could Reduce

WILDLIFE Indicators	Alternative-A	Alternative-B
Jefferson Creek WMZ[9] (1,927 acres)		
Cover to Forage Ratio (proportion) *IRMP Standard: 40 to 60 percent*	60:40	55:45
Hiding Cover (percent of project area)	40	38
Thermal Cover (percent of project area)	20	17
Open Roads Density (miles per section) *IRMP Standard: Less than 2.0 miles per section*	3.84	2.58
Racing Creek WMZ (3,156 acres)		
Cover to Forage Ratio (proportion) *IRMP Standard: 40 to 60 percent*	61:39	50:50
Hiding Cover (percent of project area)	41	33
Thermal Cover (percent of project area)	20	17
Open Roads Density (miles per section) *IRMP Standard: Less than 2.0 miles per section*	3.20	1.99
Sheep Creek WMZ (4,478 acres)		
Cover to Forage Ratio (proportion) *IRMP Standard: 40 to 60 percent*	52:48	39:61
Hiding Cover (percent of project area)	32	23
Thermal Cover (percent of project area)	20	16
Open Roads Density (miles per section) *IRMP Standard: Less than 2.0 miles per section*	2.23	1.60

SOIL Indicators[10]	Alternative-A	Alternative-B
Treatment Area (acres) **on Sites Rated High or Severe Potential for:**		
Erosion Hazard	0	1,080
Equipment Operability	0	3,745
Soil Compaction	0	0
Soil Displacement	0	495
Windthrow	0	0

[9] WMZ (Wildlife Management Zone, IRMP).

[10] United States Department of Agriculture, Natural Resources Conservation Service. 1998. Soil Survey of Warm Springs Indian Reservation, Oregon.

United States Department of Agriculture, Natural Resources Conservation Service. 2024. Online Soil Survey Data. URL - https://websoilsurvey.nrcs.usda.gov.

TIMBER Indicators	Alternative-A	Alternative-B
Area Treated by Relative Priority (acres)		
Low Priority	0	0
Low to Moderate Priority	0	135
Moderate Priority	0	815
Moderate to High Priority	0	1,995
High Priority	0	2,180
Age Class Proportion for the Entire Project Area (acres)		
0 to 39 years old	15,325	16,750
40 to 79 years old	725	725
80 to 119 years old	6,420	5,305
120 to 149 years old	1,865	1,605
150+ years old	450	400
Non-Forested (examples - meadows, rock)	180	180

RANGE Indicators	Alternative-A	Alternative-B
Additional Animal Unit Months, AUM's	No Change	16,062
Noxious Weed Infestation Potential (Relative Rate)	No Change	Moderate

TRANSPORTATION Indicators[11]	Alternative-A	Alternative-B
New Roads Constructed (miles)	0.00	0.00
Roads Reconstructed (miles)	0.00	4.05
Roads Maintained (miles)	0.00	67.10
Roads Closed (miles)	0.00	15.60
Roads Eradicated (miles)	0.00	0.70
Road Density for the Entire Project Area (miles/section)	3.90	3.40
Open Roads Density by Wildlife Management Zone (miles/section)		
Jefferson Creek	3.84	3.20
Racing Creek	3.20	2.30
Sheep Creek	2.23	2.23

[11] Access to proposed treatment areas would be limited to existing open roads and reconstruction of existing closed roads. Any new road construction would be limited to temporary stub roads only, deemed necessary for accessing treatment areas and facilitating product transport to existing open-road networks. All reconstructions and stubs require blocking and/or decommissioning following execution of proposed actions, including post-harvest activities (such as site-preparation and reforestation). See the Project Design Features section for more transportation system information.

ECONOMICS AND EMPLOYMENT Indicators	Alternative-A	Alternative-B[12]
Timber Harvest (net million board feet)	0.00	20.58
Employment (number of jobs)	0.00	86
Net Revenue (million dollars)	0.00	1.52

Features Common to Alternatives

Previously approved projects, but not yet implemented, are primarily limited to ongoing reforestation efforts. There are currently no program timber harvests approved for the project area. However, timber salvage operations could be accomplished under each alternative. Generally, salvaging would harvest commercially viable timber adversely affected by agents such as climate, fire, and/or insects/diseases, primarily located in and around existing treatment areas and/or along associated access routes. Timber salvaging is initiated following mortality-inducing events and is thus variable with its inherent unpredictability. Current activities such as cultural food gathering, subsistence hunting, livestock grazing, dispersed recreation, fire management and suppression, firewood cutting, and scheduled road maintenance would continue.

Recommended Alternative

In order to meet CTWS management direction for the generation of timber revenue, it is recommended implementing Alternative-B, including associated Project Design Features (PDF). A guiding principle in implementing land management actions is conserving and protecting the Tribe's important natural and cultural resources. To this end, PDFs comprise additionally prescribed elements aimed at protecting water, fisheries and wildlife habitat, and incorporating measures addressing cultural resources, soil, and noxious weeds.

Per IRMP direction, implementing Alternative-B strives for a balanced approach between resource protection and economic need. Trade-offs in terms of resource protection and economic benefit include anticipated continued trends for forest vegetation and organisms. The Cumulative Effects section presents more trends.

Monitoring

Monitoring is the collection of selected information over time, generally on a sample basis, measuring perceived change in an indicator or variable, determining the effects of resource management treatments (Society of American Foresters 2008). Objectives for project implementation and effectiveness monitoring are determining whether the project is:

- Implemented as planned and/or designed;
- Executed in accordance with the IRMP and other established policies and directives; and,
- Accomplished meeting planned goals and objectives.

[12] For planning purposes, estimated timber revenues were derived using an approximate average stumpage rate of $74.00 per thousand board feet harvested, based on current market projections. Actual stumpage would depend on market conditions, as well as administration and production costs at the time of proposed project implementation. For estimating employment, a factor of 4.2 jobs per million board feet (Warren 2006) of harvested timber is applied in approximating the number of jobs that would be supported from implementing Alternative-B.

For monitoring, the PIDT members would normally select ten percent of the treatment areas for on-the-ground assessments by the applicable resource specialist(s). Monitoring would be conducted within two years of completing proposed actions. Once completed, findings would become available; findings could potentially modify future actions (adaptive management process).

AFFECTED ENVIRONMENT

The Affected Environment consists of ten subsections presenting resource specialist assessments presented under the headings: Water, Fisheries, Wildlife, Cultural Resources, Soil, Fire, Timber, Range, Transportation, and Economics and Employment. Assessments provide a general overview of current conditions within the proposed project area and present baseline information aiding in the assessment of the two considered alternatives, along with potential effects. This section considers the attributes of Alternative-B as listed in Table-3 and Table-4 using effects indicators.

Effects indicators aid in assessing the anticipated consequences of implementing proposed actions within the bounds of a given place and time. Assessments begin by establishing both spatial (place) and temporal (time) bounds. Spatial bounds for the Sentinel Project are generally CTWS lands within the Metolius Forest Planning Unit (FPU), as the schedule of proposed actions would occur on these lands. Temporal bounds consider the immediate short-term effects occurring roughly five to fifteen years post-treatment; timeframes over fifteen years are more speculative. Professional judgment suggests that many forest activity-related effects become less evident within fifteen years post-treatment.

Water

The water resource analysis area (analysis area) is located almost entirely within the Upper Metolius River HUC-12 watershed[13] (HUC 170703011002) and drains into the Metolius River through a large network of ditches and natural channels. The very northern edge of the analysis area falls within the Whitewater River HUC-12 watershed (HUC 170703011001) and drains as overland flow or through many small rivulets down the steep canyons of the Whitewater River Basin.

The analysis area ranges in elevation from 2,200 ft along the rivers to 6,500 feet at the top of Bald Peter. The area receives 20-70 inches of precipitation annually, with higher elevation areas receiving more precipitation (PRISM Climate Group 2022).

Sub-Watershed Delineation and Treatment Areas

Hydrologists from CwM-H2O, LLC (hereafter "CwM"), used QSWAT+ (the Soil and Water Assessment Tool in QGIS) to delineate thirteen sub-watersheds within the analysis area, twelve of which discharge into the Upper Metolius River, and one of which discharges into the Whitewater River (Figure-4). These thirteen watersheds encompass all of the proposed forestry treatment areas, including precommercial thinning (PCT), hazardous fuels reduction (HFR), partial overwood retention (POR), seed tree (ST), shelterwood (SW), and shelterwood light

[13] Each HUC-12 watershed has a unique 12-digit Hydrologic Unit Code (HUC), of which the first eight digits match those of the larger, 8-digit HUC (HUC-8) basin it is part of. HUC-8 basins contain multiple HUC-12 watersheds.

(SWL). Additionally, there are areas of specified No-Action, classified as Habitat Clumps (HC), Riparian Zones (RZ), and Wildlife Screens (SCN).

Table-5 summarizes the total area of each sub-watershed, as well as the percentage of each watershed slated for each forestry treatment. Overall, approximately 22.3% of the total watershed area is proposed for some treatment action, with HFR and PCT being the most significant treatments by area.

Table-5: Identified Sub-Watersheds of the Upper Metolius River

Watershed	Area (acres)	Percent of Sub-Watershed Area (%)						
		No Treatment	PCT	HFR	POR	ST	SW	SWL
Rainy Creek (1)	2,679	61.2	4.4	24.3	0.0	0.4	4.2	5.4
Racing Creek (2)	3,639	82.3	4.2	9.5	1.4	2.3	0.0	0.3
Camp Creek (3)	4,260	92.7	5.7	1.2	0.0	0.3	0.0	0.0
***Unnamed* (4)**	427	86.1	13.9	0.0	0.0	0.0	0.0	0.0
Code Creek (5)	2,111	75.7	11.9	5.5	1.3	4.6	0.0	1.0
***Unnamed* (6)**	534	72.7	4.8	9.0	0.0	8.2	0.0	5.3
***Unnamed* (7)**	323	60.7	2.5	23.2	0.0	0.0	0.0	13.5
Sheep Creek (8)	2,969	74.4	6.4	7.0	0.8	0.7	2.4	8.2
***Unnamed* (9)**	477	90.0	2.6	7.3	0.0	0.0	0.0	0.0
Walker Creek (10)	3,129	79.3	1.0	12.3	0.0	0.0	7.4	0.0
Mariel Creek (11)	1,383	85.8	10.5	3.7	0.0	0.0	0.0	0.0
Whitewater River (12)	644	18.7	0.0	55.7	0.0	0.0	25.6	0.0
Unnamed (13)	381	71.6	21.1	0.9	0.0	0.0	0.0	6.4
Total (acres)	22,957	17,834.9	1,321.8	2,331.0	103.1	268.4	578.5	519.2
Percentage of Total	100%	77.7%	5.8%	10.2%	0.4%	1.2%	2.5%	2.3%

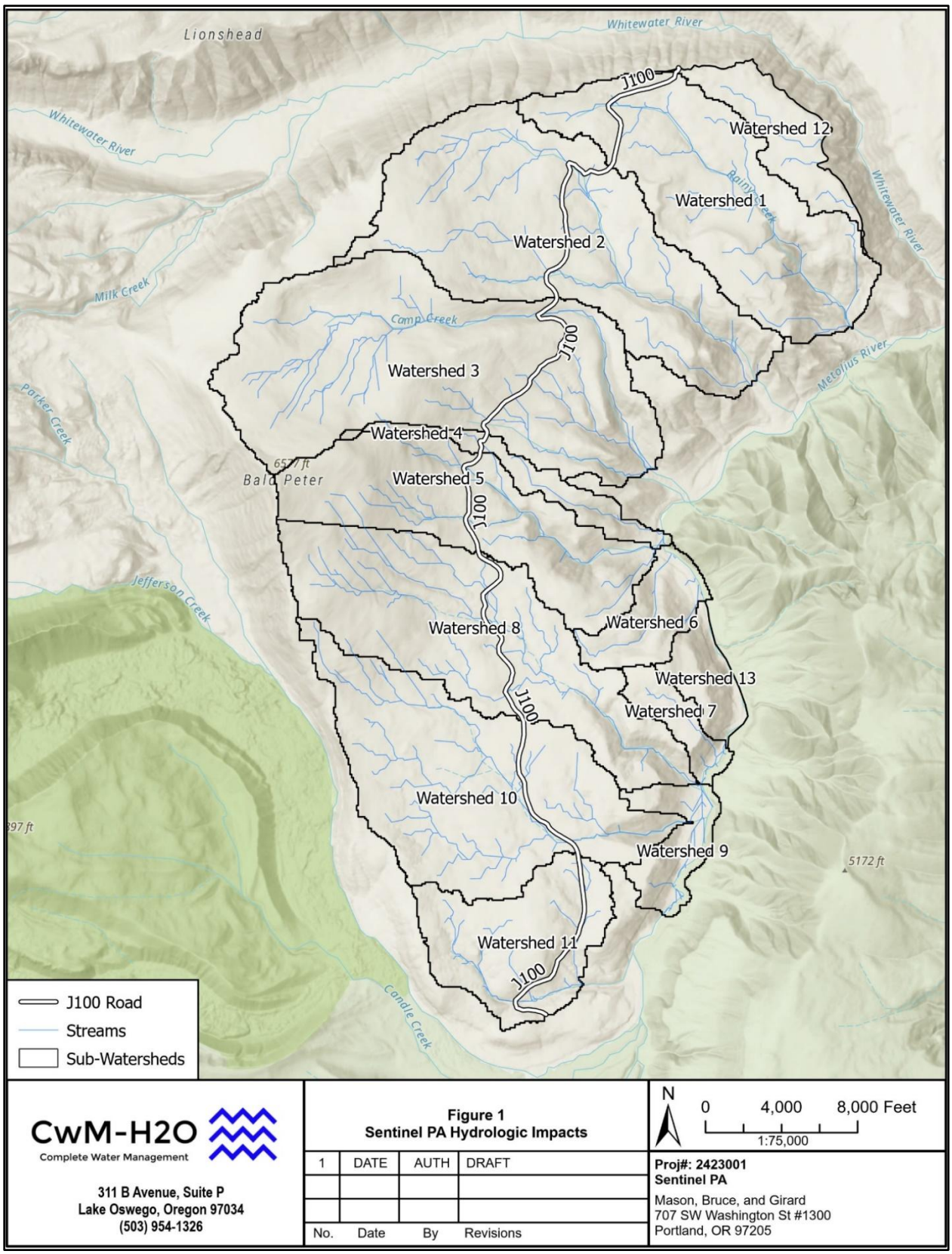


Figure-4: Sentinel Water Resource Analysis Area Sub-Watersheds

Current Conditions - Runoff and Sediment Transport

The analysis area includes seven moderately-sized, named channels that each drain between approximately 1,400 and 4,300 acres to the Upper Metolius River: Rainy, Racing, Camp, Code, Sheep, Walker, and Mariel creeks. Five other smaller watersheds that each drain approximately 325-535 acres were identified as unnamed drainages to the Upper Metolius River, and Watershed 12 drains approximately 645 acres to the Whitewater River (Figure-4). CwM conducted a site survey on September 23 and 24, 2024, which focused on observing and characterizing surface drainages that intersect with the J-100 Road and major offshoot roads that run across the project area. At the time of the visit, only Racing Creek, Code Creek, Camp Creek, and two unnamed tributaries of Camp Creek had surface water. All other creeks were dry, and few had any visible indicators of recent flow (moist soil, water marks on stems, oriented debris, etc.). Given the dry climate conditions prior to the site visit, the baseline flow in Camp, Code, and Racing Creeks are likely entirely groundwater contributions.

The sub-watershed delineation process also identified total runoff potential for each drainage due to precipitation events (not considering groundwater inputs). Capture area and average slope were the major determinants of runoff potential, with a greater capture area and higher average slope resulting in a higher runoff potential. Camp Creek's watershed was determined to have the highest runoff potential, with Racing Creek, Sheep Creek, Code Creek, and Walker Creek also ranking highly. Mariel Creek and the four unnamed channels all scored moderately, and the portion of the site draining to the Whitewater River ranked lowest (Table-5).

Initial QSWAT+ modeling identified Racing and Camp Creeks as the largest sediment-producing watersheds within the analysis area. These watersheds have significant portions of their drainage area covered by soils identified as "severe" erosion hazards (USDA 2022). These soils exist throughout the analysis area but especially at higher elevations. In addition, the Racing and Camp Creek watersheds have average slopes greater than 8°, suggesting that areas with steeper slopes should be monitored for increased runoff and erosion.

Alternative-A (No Action)

Alternative-A would see the Sentinel Project Area left as it is now. Under these conditions, the hydrologic regime would not change from current conditions.

Alternative-B (Proposed Action)

Alternative-B would see approximately 5,120 acres of the 24,950-acre Sentinel Project Area allocated for various forestry treatments. Reductions in leaf area, removal of canopy water storage, exposure of soils, and shortening of runoff response times are all expected results of the proposed treatments. Each of the proposed treatments will affect the existing hydrologic regime differently, depending on the degree of canopy and understory alteration. The six proposed treatments range in degree of alteration from relatively minor (PCT, leaving 70-194 trees per acre and retaining some understory) to relatively extensive (POR and ST, leaving 3-9 trees per acre but promoting understory development).

Overall, the outcome of any treatment that removes canopy cover and leaf area will be an increase in surface runoff and erosion, and a shift towards more flashy stream responses to precipitation events.

To minimize the adverse effects of these processes, five streams with water present during a late-summer field survey are recommended to be upgraded from "Class 3" to "Class 2", with the

corresponding increase in vegetated buffer size. Because most of these streams are unnamed, they are identified here by their OBJECT_ID values from their Geographic Information Systems (GIS)[14] shapefile attribute table: 8, 252, 311, 326, and 371. Additionally, culverts in poor condition should be refurbished or replaced, and should be regularly monitored and maintained under a periodic maintenance plan. During seasonal high-flow conditions, existing 18-inch culverts should be monitored to determine if any are sufficiently large to accommodate high-discharge conditions. Roadways crossing streams identified as "Class 2" should be bolstered with rock to make them more resilient to surface runoff. These actions will help to create a more resilient forest environment should the proposed treatments be implemented.

Fisheries

The project area overlaps portions of four HUC-12 watersheds within the Upper Deschutes River Basin (HUC 17070301): Jefferson Creek, Whitewater River, Headwaters Metolius River, and the Upper Metolius River. Fish species distribution records for these watersheds are summarized in Table-6 below (StreamNet 2024).

Table-6: Fish Species Documented in HUC-12 Watersheds That Overlap the Project Area

HUC Name (HUC #)	Common Name	Scientific Name	Data Source(s)	ESA Status*
Jefferson Creek (170703010910)	bull trout	*Salvelinus confluentus*	USFS 2016; StreamNet 2023	Threatened
	redband trout	*Oncorhynchus mykiss subsp.*	ODFW 2010	Not listed
Headwaters Metolius River (170703010911)	bull trout	*Salvelinus confluentus*	USFS 2016; StreamNet 2023	Threatened
	Chinook salmon	*Oncorhynchus tshawytscha*	ODFW & CTWS 2008	Not listed
	sockeye salmon	*Oncorhynchus nerka*	ODFW 2016	Not listed
	Pacific lamprey	*Entosphenus tridentatus*	USFWS 2017	Not listed
	redband trout	*Oncorhynchus mykiss subsp.*	ODFW 2010	Not listed
Whitewater River (170703011001)	bull trout	*Salvelinus confluentus*	StreamNet 2023	Threatened
	redband trout	*Oncorhynchus mykiss subsp.*	ODFW 2010; USFS 2016	Not listed
Upper Metolius River (170703011002)	bull trout	*Salvelinus confluentus*	USFS 2016; StreamNet 2023	Threatened
	Chinook salmon	*Oncorhynchus tshawytscha*	ODFW & CTWS 2008	Not listed
	sockeye salmon	*Oncorhynchus nerka*	ODFW 2016	Not listed
	Pacific lamprey	*Entosphenus tridentatus*	USFWS 2017	Not listed
	redband trout	*Oncorhynchus mykiss subsp.*	ODFW 2010	Not listed

* ESA = Federal Endangered Species Act.

[14] **Geographic Information Systems (GIS):** A technology that is used to create, manage, analyze, and map various types of data. GIS connects data to a map, integrating location data (where things are) with descriptive information (what things are like there). This provides a foundation for mapping and analysis that is used in science and almost every industry. GIS helps users understand patterns, relationships, and geographic context. The benefits include improved communication, efficiency, management, and decision-making. (URL - https://www.esri.com/en-us/what-is-gis/overview 2024).

All HUC-12 watersheds that intersect the Project Area (Table-6) drain to Lake Billy Chinook, a reservoir on the Upper Deschutes River whose water level is controlled by the Pelton-Round Butte Dam. The dam has no volitional fish passage, so fish are guided to collection facilities and trucked around the dam (Kock and others 2021). As such, populations of Chinook and sockeye salmon are not listed in the Deschutes River Basin, and steelhead above the Pelton-Round Butte Dam are considered an experimental population and are not listed as threatened or endangered under the Federal Endangered Species Act (ESA)[15] (NOAA 2024; Colleen Fagan, NOAA, personal communication, November 8, 2024). Bull trout are the only ESA-listed salmonid[16] in the Upper Deschutes River Basin. The Whitewater River, Metolius River, and Jefferson Creek contain reaches that are designated as critical habitat for bull trout (USFWS 2005, 70 FR 56212; USFWS 2010, 75 FR 63898).

There are no aquatic species data for any of the stream reaches within the interior of the Project Area, but there are StreamNet records of bull trout presence in the Whitewater River, Metolius River, Mariel Creek (tributary of the Metolius River), and Jefferson Creek (StreamNet 2024). Therefore, it is reasonable to assume that bull trout occupy all perennial tributaries of these waters. Biologists and Hydrologists visually inspected all waterways in the Project Area in September 2024 and found them to be dry (that is, intermittent or ephemeral) except for Racing Creek and one of its unnamed tributaries, Camp Creek and two of its unnamed tributaries, Code Creek, and Jefferson Creek (Figure-5). Field-verified perennial waters make up 18.6 percent of the total mapped stream miles in the Project Area. Table-7 shows a breakdown of all mapped streams within the Project Area by stream class.

Streams are classified per the IRMP as follows:

Class I - Perennial or intermittent streams, stream segments and lakes that have one or more of the following characteristics: 1. a direct source of domestic water; 2. supports a recreational fishery; 3. is used by anadromous fish or a moderate number of resident fish for spawning, rearing or migration; 4. supports a unique or threatened aquatic species; 5. has a high recreational, religious or aesthetic value; 6. contributes 20 percent of the total inflow to an irrigation or recreational reservoir; and, 7. flows enough water to have a major influence on a Class I stream.

Class II - Perennial or intermittent streams, stream segments and lakes that have one or more of the following characteristics: 1. is used by resident fish for spawning, rearing or migration; 2. contributes 10 to 20 percent of the total inflow to an irrigation or recreational reservoir; 3. contributes 10 to 20 percent of the volume to a receiving Class I stream during the period of greatest influence; 4. contributes more than 20 percent of the volume to a receiving Class II stream during the period of greatest influence; and, 5. has moderate recreational, religious or aesthetic value.

Class III - Perennial or intermittent streams, and stream segments that do not meet criteria for Class I or Class II waters.

[15] The steelhead population above the Pelton-Round Butte Dam will lose their experimental designation in early 2025 and become listed as Threatened (Colleen Fagan, NOAA, personal communication, November 8, 2024).

[16] Bull trout in the contiguous United States were listed as Threatened under the ESA on November 1, 1999 (USFWS 1999, 64 FR 58910).

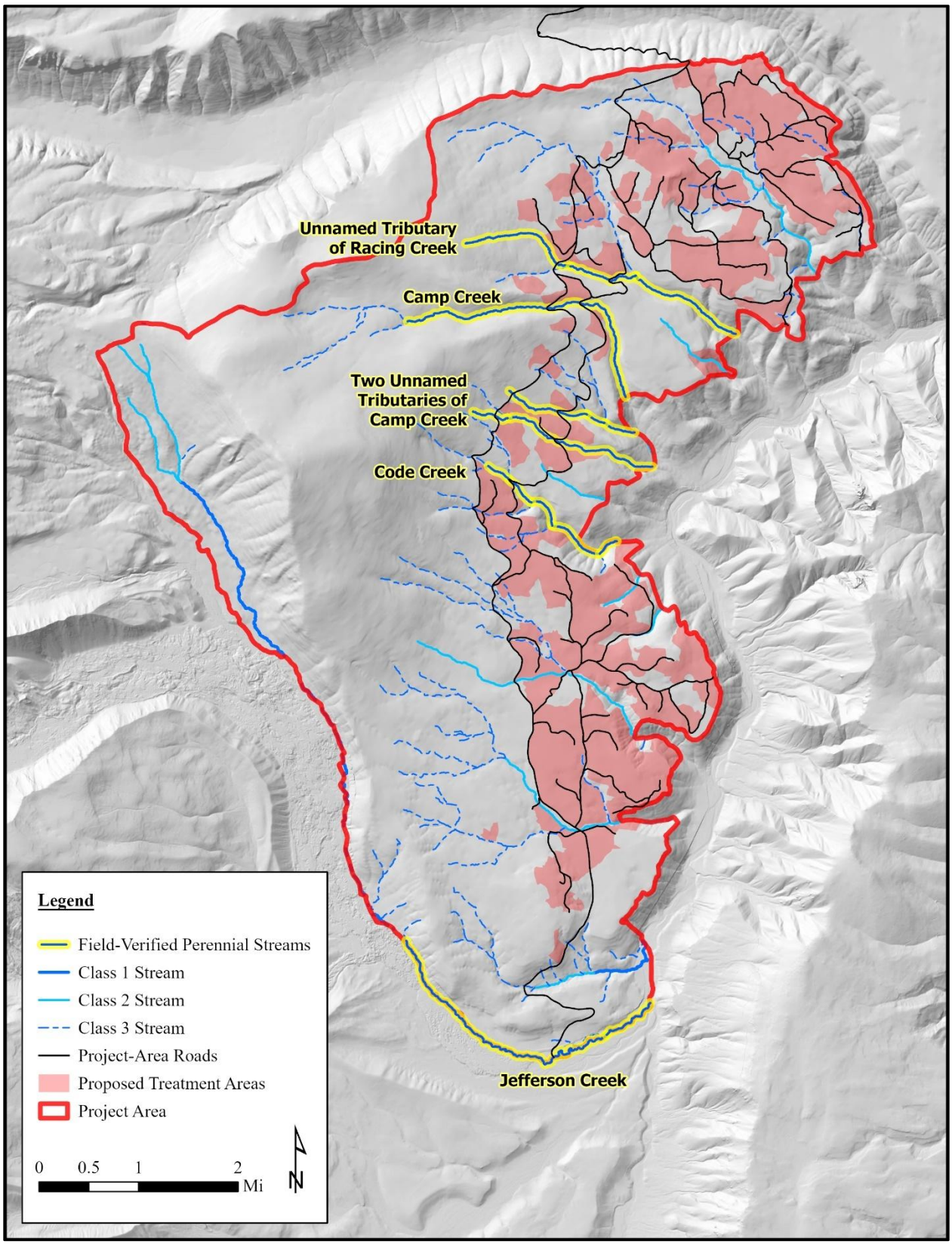


Figure-5: Field-Verified Perennial Streams in the Project Area.

Table-7: Total Mapped Stream Miles in Project Area by Stream Class.

STREAM NAME	STREAM MILES			
	Class 1	Class 2	Class 3	Total
Unnamed	4.1	9.5	52.3	65.9
Camp Creek	0.0	0.2	3.2	3.4
Code Creek	0.0	1.3	0.0	1.3
Jefferson Creek	2.1	0.0	0.0	2.1
Mariel Creek	0.8	0.7	0.0	1.5
Metolius River	0.0	0.0	0.0	0.0
Racing Creek	0.0	1.3	3.2	4.4
Rainy Creek	0.0	2.1	0.0	2.1
Sheep Creek	0.0	1.1	0.9	2.1
Walker Creek	0.0	1.9	0.0	1.9
Total Miles	7.1	17.9	59.6	84.6
Percent of Total	8%	21%	70%	100%

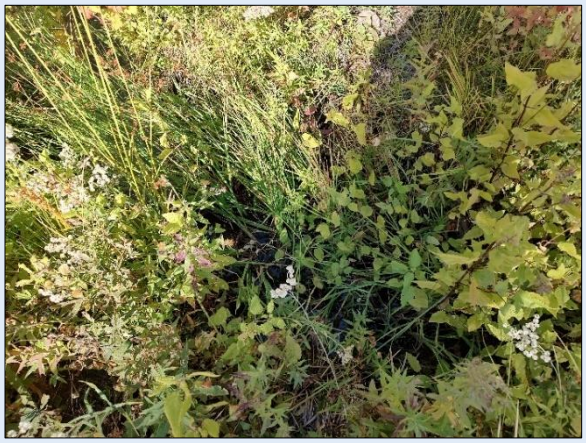
Many of the mapped streams in the interior of the Project Area were partially vegetated and did not show any evidence of recent flow (Figure-6). They appeared to be topographical draws that only collect snowmelt, but some may provide seasonal surface-water flows to receiving waters. Although these draws do not directly provide habitat for bull trout or other fish species, they may, nonetheless, support habitat conditions by metering out cool water from snowmelt runoff as seasonal surface-water inputs or as hyporheic flow to intermittent and perennial waterways lower in the watershed.

In summary, there are 84.6 total stream miles within the Project Area, of which 15.7 stream miles (≈19% of total) were field verified as perennial. StreamNet has one record of bull trout in Mariel Creek near its confluence with the Metolius River. There are no other data of fish species presence/absence or habitat quantity/quality for waters within the Project Area. A September 2024 field assessment of fish habitat in project-area streams near crossings of roads J-100 and J-150 found conditions in most streams to be unsuitable for any life stage of bull trout. However, some streams could seasonally support juvenile bull trout (Figure-5), and others may support habitat conditions in intermittent and perennial streams lower in the watershed by metering out cold water from snowmelt runoff.

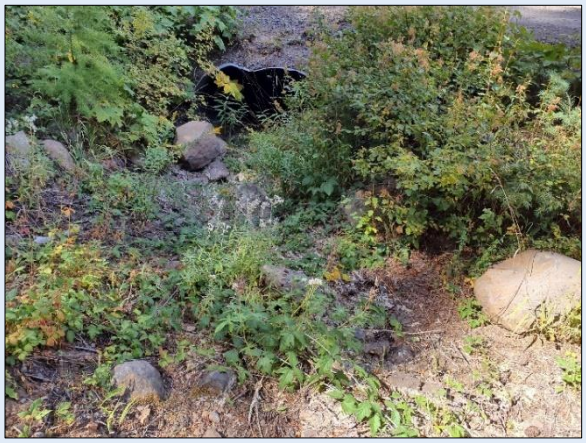
No new roads are proposed for this project, and riparian buffers will minimize impacts to aquatic species and habitat per the IRMP (discussed in detail in the Project Design Features section of this document). However, the Project Area has a history of habitat stressors from past logging activity and the recent 2020 Lionshead wildfire, and proposed actions may compound them.

Streambed of Walker Creek east of J-100 shows no signs of recent flow.

Streambed of Walker Creek west of J-100 shows no signs of recent flow.



Streambed of unnamed tributary of Camp Creek. This stream has some surface water, but it is overgrown with established vegetation and functions more as a wetland than a waterway.



Streambed of Racing Creek's upper reaches are partially vegetated and show no signs of recent flow.

Figure-6: Representative Photos of Streambed Conditions in Much of the Project Area

Alternative-A (No Action)

Alternative-A would have no immediate effect on existing terrestrial or aquatic habitat conditions and, therefore, would not affect species within those habitats. Over time, however, unmanaged commercial forest stands may increase the risk of wildfire (Starrs and others 2018).

Alternative-B (Proposed Action)

Alternative-B could potentially affect aquatic habitat and species by increasing the amount of erosion and subsequent sediment transfer in areas compacted by machinery, roads, and skid trails. The Project Area has a history of habitat stressors from past logging activity and the recent 2020 Lionshead wildfire, and proposed actions may compound them.

Wildlife

Big-game species like mule deer, black-tailed deer, Rocky Mountain elk, and Roosevelt's elk are important subsistence foods for tribal members within the Metolius Forest Planning Unit (FPU). At Warm Springs, habitat is the strongest limiting factor for mule deer population size and distribution. When habitat conditions decline or become eliminated, mule deer populations follow a synonymous trajectory. Wildlife mitigations for the Sentinel project area have been developed with a working knowledge of this detail. IRMP Standards and Best Management Practices have been adhered to throughout the course of project development and minimum requirements for optimal thermal cover, hiding cover, and forage habitat components have been met. Grey wolves, spotted-owl, monarch butterfly, black bear, mountain lion, bobcat, grouse, and many other non-game species also inhabit the proposed project area and have received similar considerations.

Thermal cover for deer and elk is defined as a stand of coniferous trees at least 40 feet tall with an average canopy closure of 70 percent or more. Optimal cover is found mainly in multi-storied mature or old-growth stands. When the original IRMP was written, wildlife specialists considered thermal cover to be critical to deer and elk survival and reproduction. More current research has signified that cover is not as essential as was once assumed, and that forage abundance and quality has as a higher priority. Areas with dense canopy cover, that is thermal cover, have lower densities of the shrubs, forbs, and bunchgrasses that mule deer depend on as food sources. For this reason, reducing thermal cover, while increasing summer and winter forage quality through forest openings, is critical to deer population growth, reproduction, and survival. Thermal requirements within the yet to be approved IRMP revision (2024) state that ten percent of a project area should be retained for thermal cover, but that these stands should not exceed 40 percent, when combined with hiding and fawning cover.

Hiding cover is defined as vegetation that would hide 90 percent of a standing deer at 200 feet or less. The Sentinel Project Area was heavily affected by the 2020 Lionshead Fire, making hiding cover scarce over much of the western half of the project area. For this reason, the CTWS Wildlife Department prescribed road buffers to many treatment blocks along the J-100 Road, mostly adjacent to burned areas. This would limit the ability of poachers and hunters to easily see deer and elk from the road for significant distances. Buffers are 75 feet wide and run parallel with the roadside.

Prescribed seasonal restrictions limit logging activities upon identified big-game ranges located within established IRMP Wildlife Management Zones (WMZs) and sensitive areas. Within the Sentinel Project Area, 38 percent of the total acres lie within one of three. These areas constitute some of the most productive winter range on the CTWS. For this reason, mastication will be avoided in areas with healthy bitterbrush densities, a shrub species critical for the nutrition of mule deer throughout the winter. A hazard fuel reduction block deemed critical for mule deer winter forage has been identified and would be manually thinned, bucked, and piled by the Wildlife Department over a two-year period. Piles would be latter burned.

Wet meadows identified as birthing and nurturing areas for deer or elk are natural openings with a high density of ground cover used extensively for foraging, hiding, and fawning/calving. Within the project area, there are nearly twenty acres of wetlands, all of which would be avoided during the conduct of project activities.

Roads are a significant factor in habitat fragmentation and have many detrimental effects on wildlife populations. Increased timber harvest in forested areas, beginning in the 1960s, steered to a proliferation of road networks in forested ecosystems inhabited by deer and elk. These road densities have been viewed as a significant factor influencing distributions of both species across the landscape. Researcher Rowland (2005) summarized the direct impacts of roads and associated traffic on elk, in addition to outright mortality from vehicular collisions as follows:

- Elk avoid areas near open roads, but varies in response to traffic rates;
- Elk vulnerability to mortality from hunter harvest, both legal and illegal, increases as open road density increases; and,
- Elk exhibit higher levels of stress and increased movement in areas of higher open road density.

Rowland (2005) also noted that elk-use increased proportionally to farther distances between open roads. Rowland recommended thoughtful closing of specific road segments (particularly road spurs) whereas providing enough access for management activities, can preserve or generate clumps of habitat that function as sanctuary areas for elk and other game species. For this reason, the Wildlife Department has requested nearly 30 miles of open roads be decommissioned within the Wildlife Management Zones of the Sentinel Project Area.

Current Conditions: The Sentinel Project Area consists of a diversity of forested stands that have been influenced by a diverse combination of factors over time. The western part of the area was heavily affected by the 2020 Lionshead Fire, creating a large-scale disturbance that would be slow to recover. This area hosts large open areas proliferated by ceanothus and red stemmed manzanita. Historically, this area would have consisted of wet and moist mixed conifer stands that transition east to dry mixed conifers in the lower elevations. Due to stand crowding on the east side of the project area, the condition on this side of the J-100 Road has generated a denser canopy cover of trees, effectively reducing forage availability and edge habitat use.

The Sentinel Project Area is primarily located in deer and elk winter range. The main goal for wildlife habitat in this area is to maintain and enhance the populations, habitats, and species diversity that could sustain the cultural, subsistence, and recreational needs of Tribal members into perpetuity. These actions will simultaneously enhance the environmental and ecological components that ensure wildlife species viability and genetic vigor. The proposed project area contains critical winter range, summer habitats, and holds vital ground for big-game transition or migration routes identified in the 2014 Reservation Mule Deer Resource Selection Modeling. The transition period in which mule deer and elk move between their summer and winter habitats represents the times in which they are most vulnerable to predation, legal/illegal hunting, and calving/fawning periods.

Road Densities: The Sentinel Project Area open road density, in general is less than 1.5 miles per section. Per IRMP standards, the average open road densities in IRMP Wildlife Management Zones (WMZ) shall not exceed 2.0 miles per section. At present approximate open road densities within WMZ's of the Sentinel Project Area are:

- Jefferson Creek ≈ 3.84 miles per section;
- Racing Creek ≈ 3.2 miles per section; and,
- Sheep Creek ≈ 2.23 miles per section.

The open road densities have rendered it only 29 percent effective for big-game. Open road densities in all WMZ's in the planning area exceed this standard.

Thermal Cover: The Metolius FPU contains approximately 2,277 acres (13%) of optimal thermal cover, 1,545 acres (9%) of near-optimal thermal cover, 3,169 acres (18%) of marginal cover, and 2,559 acres (15%) of hiding cover.

Alternative-A (No Action)

The "No Action" Alternative would allow for forests to move through a natural trajectory, with the increased risk of stand-replacing wildfires. A spring burn would have the potential to allow tree densities and understory overstock to be reduced to levels similar to the state that would have been seen before extensive fire exclusion. This would create the forest gaps conducive to an increase in available forage without the need of a timber sale. However, a summer fire in these dense stands would lead to a "sterilization" of the forest, similar to that evidenced by the west side of the project area.

Deer and elk would become dependent on wildfire and other disturbances for the creation of new openings in the forest that provide forage in the summer and winter range areas. These events could have large-scale consequences, that without proper response, would lead to a transition to an ecosystem dominated by invasive weeds. This long-term degradation of the habitat would ultimately result in stands unsuitable for wildlife use.

No roads would be closed or decommissioned. Because of the high density of roads currently located within the Wildlife Management Units of the Sentinel Project Area, deer and elk use of habitats adjacent to these roads would continue to be minimal.

Without harvest, stands would continue to mature, decreasing the amount of edge habitat. A more mosaic of forest openings created by wildfire would dominate the landscape, thus increasing biodiversity. Depending on the management and vegetative responses to these disturbances, IRMP Standards, and other functioning wildlife habitat ecosystems can change (positively and negatively) over-time.

Alternative-B (Proposed Action)

Conducting the project under the current proposed actions would alleviate some of the denser forest canopies, allowing for a greater proliferation of forage for elk and mule deer. If only forest management actions were to occur, thermal cover would be reduced in favor of hiding cover and fawning and calving habitat. However, because of the high prescriptions for hazard fuel reductions (HFR), this hiding cover and fawning and calving habitat will also be reduced in the short term. Hiding cover in many of the areas proposed for treatment is integral for the survival of big-game species in the project area. Vast reductions in hiding cover became prominent in 2020 when the Lionhead Fire eliminated thousands of acres of habitat. Mule deer and elk traveling along the west side of the project area are now greatly exposed to road hunters and poachers. The Wildlife Department prescribes a road buffer 75 feet in width be implemented along the J-100 Road on identified treatment blocks mostly adjacent to the Lionhead Fire scar, intending to provide some hiding cover when moving in the vicinity of the J-100 Road.

Further, hazard fuel reductions have shown negative effects on shrub species vital for mule deer survival over winter, namely bitterbrush stands (Johnston and Anderson, 2023). Because of this, the Wildlife Department prescribes the manual thinning of HFR Block 238 (Walker Creek Rehab

#1) located in critical winter range. Work, including bucking and piling of slash would be performed by the Wildlife Department over a two-year period. Piles would be latter burned.

Extensive hazardous fuel reductions also have the potential to negatively affect other species. For instance, spotted owls inhabit old-growth forests with a complex understory. Hazardous fuels reductions in these stands limit the travel corridors between spotted owl nest cores and reduce the ability of owls to forage for small rodents in the understory. Numerous other species such as amphibians, mesopredators,[17] song birds, and bears would be similarly negatively affected. For this reason, the Wildlife Department identified specific HFR Blocks, or portions of blocks, in stands determined to be suitable spotted owl habitat be omitted from the original portfolio of proposed actions. Identified areas are no longer a part of the assessed proposed actions.

Timber sale activities including hauling and noise during project operation seasons could cause some displacement resulting in a temporary decrease in the use of the area. Project design criteria would require no noise-generating activities such as harvest, road construction/reconstruction, or fuels treatment during the fawning, calving, and rearing season (April 16 to July 31) within established IRMP WMZ's.

Throughout the implementation of this project, new temporary road construction and old existing temporary roads would be reopened and reconstructed to access several of the units. These roads would not be open to the public and would be closed again following the implementation of this project. Furthermore, proposed new road segments totaling approximately 0.94 mile would be closed. The temporary increase in open road density during project operations would likely result in some deer and elk displacement. However, the proposed decommissioning of an additional 30 miles of open roads within the project area would result in a net benefit for ungulate populations after the project has been completed.

This alternative would alter the structural diversity of around 3,500 acres of wildlife habitat. This proposal would allow for natural conifer regeneration to occur in some areas and program conifer planting elsewhere. Open shrub-dominated and early seral habitat conditions are expected to persist for conceivably 30 years before a closed canopy conifer-dominated stand condition becomes reestablished. With the consideration of the above mitigations, it is the belief of the Wildlife Department that this proposed action provides the most significant benefit to wildlife species associated with early-seral habitats.

Cultural Resources

A cultural resource desktop assessment was conducted for this project. As a part of the assessment and approval process, as wells as due to the high sensitivity of the project area and known cultural resources, the project area would be surveyed for cultural resources by GeoVisions.

None of the proposed treatment areas contain the cultural plants of huckleberries, roots, western red cedar, or bear grass. This project excludes all meadow-like and riparian habitats; such areas would not be entered by treatment proposals.

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[17] **Mesopredator**: A predator that occupies a mid-ranking position in a food web. There is no standard definition of a mesopredator, but mesopredators are usually medium-sized carnivorous or omnivorous animals, such as raccoons, foxes, or coyotes. They are often defined by contrast from apex predators or prey in a particular food web. Mesopredators typically prey on smaller animals. (URL - https://en.wikipedia.org/wiki/Mesopredator 2024).

Soil

Soil characteristics and definitions are obtained from Natural Resource Conservation Service Soil Survey data (NRCS 1998, 2024). Within the Sentinel Project Area, the scale of analysis for effects on the soil resource is by the "treatment block", evaluated within the context of the project area. That is, the stand polygon or activity area proposed for silvicultural treatment is considered by soil type and risk assessment. Proposed treatment blocks were assessed using NRCS soil data and Geographic Information Systems (GIS) for dominant characteristics pertaining to critical features such as potential soil erosion, equipment operability, soil displacement, soil compaction, and windthrow hazard.

Within the proposed project blocks, dominant soil series are Smiling-Simnasho-Pipp (75%) and Howash-Mackatie (25%); cool wet volcanic soil associated with mountainous terrain. Soil series are described as follows (NRCS 1998):

- Smiling - considered a sandy[18] loam[19] and is a deep (40 to 60 inches), well-drained soil formed in residuum[20] and colluvium,[21] derived dominantly from andesite[22] with a mantle of volcanic ash in the upper part, slopes are 0 to 12 percent.
- Simnasho - considered a very stony[23] sandy loam and is a moderately deep (20 to 40 inches), well-drained soil formed in residuum and colluvium, derived dominantly from andesite with a mantle of volcanic ash in the upper part, slopes are 0 to 40 percent.
- Pipp - considered a very stony sandy loam and is a deep (40 to 60 inches), somewhat excessively drained soil formed in residuum and colluvium, derived dominantly from andesite and volcanic ash, slopes are 12 to 65 percent.
- Howash - considered a very gravelly[24] sandy loam and is a very deep (greater than 60 inches), somewhat excessively drained soil formed in residuum and colluvium, derived

[18] **Sand:** As a soil separate, individual rock or mineral fragments from 0.05 to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay (NRCS 1998).

[19] **Loam:** Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles (NRCS 1998).

[20] **Residuum (residual soil material):** Unconsolidated, weathered and partly weathered mineral material that accumulated as consolidated rock disintegrated in place (NRCS 1998).

[21] **Colluvium:** Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes (NRCS 1998).

[22] **Andesite:** Gray to black volcanic rock with between about 52 and 63 weight percent silica. Andesites contain crystals composed primarily of plagioclase feldspar and one or more of the mineral pyroxenes (clinopyroxene and orthopyroxene) and lesser amounts of hornblende. At the lower end of the silica range, andesite lava may also contain olivine. Andesite magma commonly erupts from stratovolcanoes as thick lava flows, some reaching several kilometers in length. Andesite magma can also generate strong explosive eruptions to form pyroclastic flows and surges and enormous eruption columns. Andesites erupt at temperatures between 900 and 1,100 ° C (1,652 to 2,012° Fahrenheit). URL - https://volcanoes.usgs.gov/vsc/glossary/andesite.html.

[23] **Stony (soil material):** Material that is 15 to 35 percent, by volume, rounded or partially rounded fragments 10 to 24 inches in diameter. Very stony material is 35 to 60 percent of these rock fragments, and extremely stony material is more than 60 percent (NRCS 1998).

[24] **Gravelly (soil material):** Material that is 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches in diameter. Very gravelly soil material is 35 to 60 percent of these rock fragments, and extremely gravelly material is more than 60 percent (NRCS 1998).

dominantly from andesite with a mantle of volcanic ash in the upper part, slopes are 12 to 65 percent.

- Mackatie - considered a sandy loam and is a deep (40 to 60 inches), well-drained soil formed in residuum and colluvium, derived dominantly from andesite with a mantle of volcanic ash in the upper part, slopes are 0 to 30 percent.

The features of concern and subsequent recommendations are primarily for potential soil erosion, equipment operability, and soil displacement. Potential for compaction and windthrow are considered moderate and slight.

Alternative-A (No Action)

Under Alternative-A, there will be no alterations to existing soil conditions from proposed actions or harvest activities. Soil resources would continue in their current state of development and character. However, without tree density and hazardous fuels treatments to help bring the landscape back into a more balanced wildfire regime, fuel loads would remain high and likely lead to high severity wildfires, which could reduce soil fertility and/or promote soil erosion. Such is the case as noted for areas affected by the 2020 Lionshead Fire.

Alternative-B (Proposed Action)

Potential soil impacts derive from the use of heavy equipment and the removal of overstory and surface vegetation that keep soil in place. Soil displacement and compaction also occurs from skidding logs, along with slash piling and burning. The largest project impacts are related to potential soil erosion and equipment operability. Adverse impacts would be lessened as proposed treatments on steeper slopes have been minimized. Also, by adhering to prescribed project design features, adverse effects would be reduced. In addition, road systems in the project area are less developed compared to other portions of the forest; therefore, ground impacts from machinery would be further limited once the area closes due to winter accessibility.

Fire

Analysis of the Sentinel Project Area utilizes the Interagency Fuels Treatment Decision Support System (IFTDSS) to analyze and compute the project landscape. IFTDSS incorporates many fire and fuels software programs that analyzes and computes many landscape and atmospheric elements to model fire behavior at the 97th percentile conditions within a specified area. Due to the bulk of the project units designated as HFR, the analysis primarily focused on these areas and describes the analyzed elements in each category numerically and produces percentages across the project area. It is important to note that the landscape attributes that exist across the project area vary spatially in continuity and are not always concentrated in a central area.

Landscape Baseline Elements

The Sentinel Project Area is within a mid-high elevation timber type ranging from approximately 3,000 to 5,500 feet. Forested stands are predominantly in Management Groups[25] 3, 4, 5, 6, and 8 with some areas containing lodgepole pine and varying amounts of associated species such as ponderosa pine, Douglas-fir, mountain and western hemlock, and grand fir. The project area is

[25] Management Groups: Plant associations that are grouped according to site potential productivity (CTWS Forest Management Implementation Plan Warm Springs Reservation 2012-2021, 2013). Refer to the Glossary for more detailed information.

mainly within Fire Regime Group III. Nearby surrounding stands are represented by Fire Regime Groups IV and V. See Table-8 for descriptions of Regime Groups.

Table-8: Natural Fire Regime Groups

Fire Regime Group	Fire Return Frequency (Years)	Fire Intensity/Severity
I	0 to 35	Low to mix severity (surface fire most common with less than 75% of the overstory vegetation replaced)
II	0 to 35	High severity (stand replacement with greater than 75% of the dominant overstory replaced)
III	35 to 100+	Mixed severity (less than 75% of the overstory vegetation replaced)
IV	35 to 100+	High severity (stand replacement with greater than 75% of the dominant overstory replaced)
VI	Over 200	High severity (stand replacement with greater than 75% of the dominant overstory replaced)

Topographic and Fuels Condition

Approximately 69 percent of the project area has slopes exhibiting a range of between zero and five degrees with a small proportion of units up to twenty degrees. Aspects are primarily flat or east to southeast. The main fuel models are identified as GS2 - Low load dry climate grass, TU5 - Very high load dry climate timber shrub, and TL4 - Dwarf conifer with understory. Canopy cover across the project area ranges from 30-70 percent with 35 percent of the project area exhibiting 40-50 percent canopy cover. Tree-stand heights average between 40 and 90 feet across 61 percent of the project area. The canopy base height average is one to three feet tall for 61 percent of the project area.

Fire Behavior

Fire modeling is based on the 97th percentile conditions, which generally means “worst case scenario” related primarily to fuel moistures, live and dead as a result of the climactic and landscape conditions analyzed together. Local remote automated weather stations (RAWS) compile weather data and compute daily data to generate elemental averages while identifying the time and duration of the elements that contribute to the energy release that predicts wildfire likelihood and intensity. The elements accounted to describe the 97th percentile conditions in the project area are as follows:

Wind Type - Gridded
Wind Speed - 14 mph
Wind Direction - 225°
Crown Fire Method - S&B
Foliar Moisture - 100%
1-Hour Moisture - 3%
10-Hour Fuel Moisture - 4%
100-Hour Fuel Moisture - 6%
Herb Fuel Moisture - 99%
Woody Fuel Moisture - 120%

Alternative-A (No Action)

Alternative-A would not alter the fuels structures, composition, arrangement and/or continuity and the likelihood of moderate fire behavior would pose a challenge to contain with hand crews

and heavy equipment. Additionally, the passive crown fire event could degrade a substantial amount of merchantable timber spatially.

Alternative-B (Proposed Action)

Alternative-B would alter the fuels structures, composition, arrangement and/or continuity reducing fire spread, intensity, and passive crown fire allowing fire suppression efforts to be more effective in the event. By creating more interspace between conifers, leaving fire resilient conifer species, mulching surface fuels and increasing canopy base heights, fire is less likely to burn at intensities that are challenging to contain and damaging to the health and vigor of the area. Through the use of prescribed burning within the project area, further reduction in fuels will likely allow for effective suppression efforts, safe suppression activities, reduced damaged to desired species and a resilient area to fire.

Timber

Two dynamics primarily influence a forest's form and function; competition and disturbance. Vegetation competes for limited on-site resources, also known as growing space (water, sunlight, and nutrients). In addition, forest systems are active and subject to regular disturbance events from agents such as climate, wildfire, and insects/disease. Although competition and disturbance are regular parts of the forest system, there are implications to land management goals and objectives. Management complexities are also influenced by the presence of infrastructure and by the needs of commodity values. It is a complex and challenging endeavor when seeking to balance desired environmental and economic outcomes, coupled with prescribing and implementing management plans and actions.

The Sentinel Project Area contains a diversity of tree species and forest-stand types, also influenced by climate and precipitation, along with disturbance (human and natural). Beginning in the east of the project area (lower to middle elevations), timber-types classify as dry mixed-conifer comprised of Douglas-fir, grand fir, incense cedar, ponderosa pine, sugar pine, and western larch. Proceeding west, stands transition to moister mixed conifer types containing more lodgepole pine, Pacific silver fir, western hemlock and western white pine. The upper reaches of Bald Peter have subalpine fir and whitebark pine. Whitebark pine was listed as a "threatened" species in 2022. Limited areas were recently planted with whitebark pine in 2024.

It is speculated that forest plant communities have retreated further from described historic (or reference) conditions that existed around the mid to late 1800's, prior to intensive industrialized land management activities, including aggressive fire suppression and concerted logging. Mature Douglas-fir and ponderosa pine are now not as dominant in forest composition and structure as once described. Healthy tree-individuals and groups are declining in areas, largely due to climatic extremes, fire exclusion, and stand crowding. Fire exclusion has also generated a competitive advantage for some tree species like Douglas-fir, grand fir, and incense cedar as well as increased amounts of their smaller younger components. Vegetative shifts generating deviations of forest composition and structure also contribute to adversely altering wildfire character as well as affecting ecological functions. For example, increased amounts of smaller younger tree components forming ladder fuels and contributing to more damaging wildfire events.

Generally, stands are now denser or more crowded, resulting in increased intertree competition and contributing to reduced tree health and viability. Disturbances, human and natural have also

shaped current stand characters into a mix of plantations, overcrowded stands, and fragmented landscape-level structures. Additionally, reductions occurred to the older large-tree component on the landscape, generally resulting from commodity-based timber harvests. This combined with fire suppression have generated conditions promoting the growth of young dense stands capable of outcompeting older larger trees. The late-old structure (LOS) within such stands is declining in areas; remaining LOS stands typically have overcrowded understories and species-compositions developing an increased risk for adverse impacts from insects, diseases, and/or wildfires. Prescribed or controlled burning efforts could also experience more difficulty successfully directing fire intensity and spread, along with localized unfavorable effects.

Therefore, proposed actions aim at generating a more resilient and sustainable forest landscape by employing targeted management actions. Desired conditions include forest vegetation that is more resilient to future disturbance events with conditions more representative of reported historic levels and types. This generally entails reducing current stand densities and ladder fuels along with favoring the more resilient timber species, as well as conserving the healthy larger mature components already present on the landscape. Douglas-fir, ponderosa pine, sugar pine, and western larch would be present on the landscape at more sustainable levels. Stands would be healthier and more resistant to large-scale disturbances. Older stands would retain some remnant large tree attributes at the local scale promoting its ecological functions.

Proposed actions thus present a portfolio of treatments addressing varied forest health and resiliency goals and objectives, along with promoting economic viability. Treatments would typically favor the more resilient timber species, reduce intertree competition and ladder fuels, and redistribute limited growing space onto to the healthier and more desirable tree-individuals and groups. Objectives would also promote the longevity of existing healthy dominant Douglas-fir, ponderosa pine, and sugar pine encouraging current and future LOS. Another favored resilient tree species includes western larch. Proposed forest vegetation treatments include hazardous fuels reduction, partial overwood retention, precommercial thin, seed tree, shelterwood, and shelterwood-light proposals. Refer to Appendix-A Glossary for descriptions of forest vegetation treatment proposals.

Alternative-A (No Action)

Alternative-A continues current actions and management within the proposed project area and serves as a baseline for evaluating the proposed actions (Alternative-B). Alternative-A does not propose any new ground disturbing activities and therefore, program fuels management or timber treatments would not likely occur. This alternative would not proactively address timber health issues or generate monetary receipts as relating to program timber sales.

Alternative-A would not address current stand densities, other than any approved precommercial thinnings. As stands densities become overcrowded and intertree competition for limited growing space continues, it typically requires more time for tree individuals to mature and display larger diameters. As intertree competition increases, trees would continue growing in height, but diameter growth would be considerably slowed; where trees become more dependent on neighboring trees for structural support. Trees developing in this manner are more susceptible to windthrow. If stands were left untreated, mortality from self-thinning would continue, along with reduced diameter growth and healthy crown development. The opportunity for optimizing timber volume over time would decline. Generating conditions for large-tree development

would decline, as well as increasing risk for insect infestation (for example, bark beetles) and losses to wildfire.

Maintaining tree health and viability through targeted treatments increases the likelihood of maintaining a healthier condition through the life of the stand and thus, a healthier more resilient landscape. By not acting, overcrowded conditions persist, resulting in stands with increased small tree crowding, reduced viability, increased mortality, and increased susceptibility to stressors such as insects, diseases, and climate. Overcrowded stands have lessened defense against agents such as insects and diseases. Lessened vitality is a direct result of increased stress and overall reduced health related to limited growing space. Factors such as limited sap production could also promote conditions for the successful entry and colonization of pest insects; decreased vitality decreases the tree's ability to combat damaging or limiting stressors.

Per the IRMP (2012) Issue 6, Goal 1 - "Manage timber to optimize its growth and sustain the production of quality wood products in a manner consistent with IRMP guidelines and economic efficiency". As such, stands in the project area would trend towards being less viable and towards having slowed volume accretions. Such stands can typically display volume reductions from defect, stem decay, and individual or group mortality. If left untreated, timber growth and volume projections would diminish over time. In addition, thriftier plantations optimally producing timber volume and value over time would experience delayed growth to commercial size, further affecting future revenue to the CTWS.

Largely due to fire exclusion and varied timber treatments, stands commonly have multilayered canopies and structures; structural types conducive to the spread of diseases like dwarf mistletoe. Mistletoe reduces tree health and growth over time and spreads from the larger overstory to the younger midstory and understory, a condition that eventually contributes to mortality and reduced monetary value. If left untreated, conditions perpetuate themselves, also infecting the new regeneration of timber. Similar effects are anticipated regarding uncharacteristic wildfire impacts. Forest health and value would continue declining under Alternative-A.

Alternative-B (Proposed Action)

As reported by Agee and Skinner (2005), wildfire impacts continue across America's western forests, prompting land managers to actively address fuels management at a considerably larger scale (for example, at the watershed scale). The importance of scale becomes apparent, as treated edges adjacent to untreated areas are more likely to sustain tree mortality, even when applying surface fuel treatments such as prescribed fire to the treated stand. In addition, fires on treated lands that omit surface fuel follow-ups (for example, piling and burning of slash) can be more intense than those areas of untreated land, often leading to crown torching and spread. Therefore, large-scale treatments (Alternative-B, Proposed Action) strive for mediating potential negative effects across a broader scale.

Primarily due to fire exclusion, grand firs and incense cedars, along with increasing amounts of younger Douglas-fir and ponderosa pine have gained a competitive edge, consequently expanding its presence and structure outside of reported historic conditions. Excluding fire as a stocking control contributes to tree crowding where intertree competition could predispose trees to insects, diseases, and density-induced mortality. Also, hardwood components (such as black cottonwood) are declining in and around watered habitats. Implementing proposed actions anticipates reductions in tree crowding, individual tree hazards, and the likelihood of damaging crown fires. A reduction in ladder fuels and an increase in live crown heights would reduce the

risk of wildfire impacts, including the risk of losing mature Douglas-fir, ponderosa pine, and sugar pine to wildfire. Divergent conditions would continue by pursuing a no action approach.

An objective of this proposal emphasizes forest resiliency and future LOS, particularly for Douglas-fir, ponderosa pine, and sugar pine; as well as for western larch to a lesser degree. Planned efforts would be a step toward increasing stand resiliency and sustainability. Proposed actions aid in maintaining desired timber species and stocking, as well as promoting fire as a reoccurring less destructive disturbance. The project area is a suitable candidate for landscape level fire reintroduction, due to its relative removal from immediate wildland-urban interface centers. For example, the area has less at-risk community infrastructure and less smoke management issues.

Continued resiliency efforts would begin shifting the forest composition and structure towards a more single and double-strata ponderosa pine and Douglas-fir dominate system, ultimately leading to a more resilient and sustainable forest. Resilient tree species would show an increase in vitality and thus height and diameter growth. Encroaching conifers, like grand firs and incense cedars would be reduced in stands allowing for other light-tolerant species like ponderosa pine, sugar pine, and western larch to grow into the midstory and overstory.

Insect and disease populations would maintain at more endemic[26] levels due to decreased intertree competition and the resulting fragmentation of damaging insect habitat (limiting its continuous spread). For example, although grand fir is not a host-species for the mountain pine beetle, reducing intertree competition would encourage healthier, more viable growing conditions for pine, which is susceptible.

Additionally, by reducing the proportion of grand fir and incense cedar in overcrowded areas, the more preferred resilient species of Douglas-fir, ponderosa pine, sugar pine, and western larch would likely dominate post-treatment sites. Residual trees would then have reduced intertree competition and thus improved individual tree health and vitality. Favoring the more resilient species further reduces intertree competition and meets management plan objectives for a healthy sustainable forest, as well as being resistant or resilient to adverse wildfire.

As for dwarf mistletoe, proposed actions aimed at producing more single or double-layer structures would aid in limiting currently expanding mistletoe occurrences. Like ladder fuels with wildfire, multi-layer structure accelerates mistletoe spread. Proposed actions would also target the removal of mistletoe-infected tree-individuals and groups and regenerate more sustainable conditions by planting non-susceptible conifer species where prescribed.

Generally, in response to insects and disease, the more effective management strategies include maintaining stand vitality, maintaining resilient tree species, limiting wounding of residual trees, and fragmenting high-risk habitats. A combination of proposed actions (reducing tree crowding favoring resilient species and conditions) and burning are effective strategies. Proposed actions emphasize forested-stand resiliency. Prescribed burning, coupled with tree thinning, and slash removal can be effective techniques (Grenier and others 2010). Treating and removing activity fuels does not anticipate reducing long-term site-productivity. Removal of activity residues (slash) does not adversely affect site productivity. Studies conclude no appreciable difference in vegetation growth, structure, or diversity between studied treatments (Busse and others 2009).

[26] **Endemic:** Belonging exclusively or confined to a particular place, as opposed to *epidemic* which is extremely prevalent or widespread. (URL - https://www.dictionary.com/browse/endemic or epidemic 2024).

With reported climatic fluctuations increasing the risk of impacts from large-scale disturbances, the purpose and need for proposed actions becomes increasingly important. Barring implementation of proposed actions, anticipations are that following a large wildfire, consumption of many trees would result due to existing ladder fuels and stand densities. Water stress also contributes to limiting the growth and vitality of trees, especially in a drier forest context. With projections of warming temperatures and altered precipitation patterns (increase in more temporal rain over more persistent snowpack), trees would have more difficulty proliferating following the effects of insects, disease, and wildfire.

Implementing proposed actions could initially reduce carbon storage levels because of decreased stand densities. However, long-term storage would recover as storage transitions to the larger, longer-lived remnant trees. Projections also expect that climatic conditions could increase the size, severity, and intensity of wildfires (Franklin and Johnson 2009). Reductions in future smoke emissions from wildfires could result from implementing proposed fuel activities. Some related perceived effects of thinning include:

- Temporary reduction of smaller trees not storing large amounts of carbon;
- Promotion of large diameter trees storing a larger proportion of carbon;
- Proliferation of forest resiliency, promoting viable trees better equipped to withstand natural disturbances (climate, wildfire, insects/disease); and,
- Reduction of smoke emissions from wildfire due to fuel reduction activities.

Collectively, Alternative-B proposes actively managing the project area for improving timber resiliency and reducing hazardous fuel loads while providing economic returns to the CTWS.

Range

Plant communities contained within the Sentinel Project Area have been impacted by management activities over time. Past wildfires, logging, road building, grazing, wind, and other environmental effects have altered the make-up and ecological condition of native plant communities. The establishment of non-native invasive species such as annual grasses, knapweed complex, houndstongue, and tansy ragwort has also influenced this area. Small infestations of scotch broom have been found and treated are introduced from the west side of the Cascades. These species are easily spread through wind, water, animals, heavy equipment, and small vehicles, and establish easily on disturbed lands. They also provide direct competition to native species for water, nutrients, and space within the plant community.

The proposed Sentinel Project is situated within the Metolius Grazing District. Domestic livestock typically do not utilize this area due to the lack of fencing and water developments, and because of the area's remote location in relation to District livestock operations. Synergy Resources conducted a rangeland inventory in 2014. The grazeable forest production is approximately 786 pounds per acre in the Metolius Grazing District. The forage base is considered important for wildlife and livestock. In the short term, when treated, forage gains, would last for approximately fifteen years then drop-off as tree reproduction begins to shade-out grass and forb species.

Plant communities in the proposed project area are diverse with mostly dry ponderosa pine, Douglas-fir, and grand fir at lower elevations to lodgepole pine, silver fir, and hemlock at the

higher elevations. Moist meadows and wetland systems are also found. Shrubs at the lower elevations are mainly ceanothus and chinkapin with some bitterbrush; higher elevations also contain a bear grass and huckleberry component. Proposed treatment areas are located within the lower elevation plant communities. Ground disturbing activities and open canopies created through harvest activities lead to shrub dominated plant communities. In the higher elevation plant communities, shrub competition may slow forest regeneration. Beargrass is a culturally significant species that occurs in the hemlock and true fir communities. Beargrass may be initially impacted by skidding and harvest activities but readily reproduces following disturbance. It is anticipated that forbs, herbs, beargrass, ceanothus, snowberry and some huckleberry will increase in open canopy situations following harvest. They easily spread into disturbed lands via logging equipment, wind, water, and animals. Disturbance through logging and roading activities has been the primary vector for spread of these species in the northwestern portion of the Reservation. None of the proposed treatment areas contain silver fir, hemlock, huckleberry, snowberry, or beargrass. Tansy and houndstongue are primarily found in seed tree and old clear-cut units within the project area while spotted and diffuse knapweed can be found along most major roads.

Alternative-A (No Action)

Alternative-A would not change the current condition of forage resources nor increase the potential of noxious weed spread into existing plant communities.

Alternative-B (Proposed Action)

Implementation of Alternative-B would increase the available forage base by approximately 16,062 animal unit months (AUM) from its current status. The noxious weed potential would be moderate and greater in comparison to the no action alternative due to number of acres disturbed and miles of roads utilized during harvest operations.

Mastication followed by fire would increase native plant diversity. The down side of this treatment could also increase non-native species also. Total AUMs for timber harvest area entry would be about 16,062 AUMs.

Transportation

The average open-road density within the Sentinel Project area is approximately 3.90 miles per section - road densities range from 0.01 to 7.40 miles per section on associated commercial forest lands. Road conditions vary from very good to poor, with poor conditions more prevalent when road surfaces are wet. The J-100 and J-300 roads provide primary access into the project area. Relatively small portions of the J-100 are gravel-surfaced in good to very good condition. Roads are designed for lower speeds and routine maintenance is required for ensuring safe travel. There are sufficient water sources that can be used for dust abatement within or adjoining the project area. Crushed aggregate or pit run from the J-300 quarry would be used to form a surface that would minimize erosion at stream crossings and tanker-fill sites. The objective of both alternatives would be to improve and maintain a safe and economical transportation system while reducing the number of open roads needed for management purposes within the commercial forest.

Alternative-A (No Action)

Alternative-A continues current management within the proposed project area, preforming routine or emergency roadwork only. For example, providing for improved surface conditions on those roads deemed necessary for hauling timber salvage material.

Alternative-B (Proposed Action)

Alternative-B would include an objective to upgrade the primary forest access routes while protecting other resources. There would be no new road construction proposed under this alternative. Miles of reconstruction to access treatment blocks equals approximately 4.05 miles. Maintenance activities would be performed on 67.10 miles. Estimated miles of road include access to all proposed commercial harvest, precommercial harvest, hazardous fuel reductions.

Seven roads will be reconstructed under this alternative for a total of 4.05 miles. Roads reconstructed for accessing harvest blocks would be decommissioned immediately following harvest activities. Blocked roads opened for access to harvest, precommercial thinning, and hazardous fuels reductions would be re-blocked immediately following each activity.

Two roads equaling 0.70 miles would be decommissioned under this alternative. 15.60 of existing open road would be blocked under this alternative. Twenty-one, Class II and class III stream crossings are proposed to be surfaced under this alternative. In addition, two overgrown roads would be brushed open equaling about 0.84 miles, allowing access to harvest units. Refer to Figure-6 for a map of planned road work.

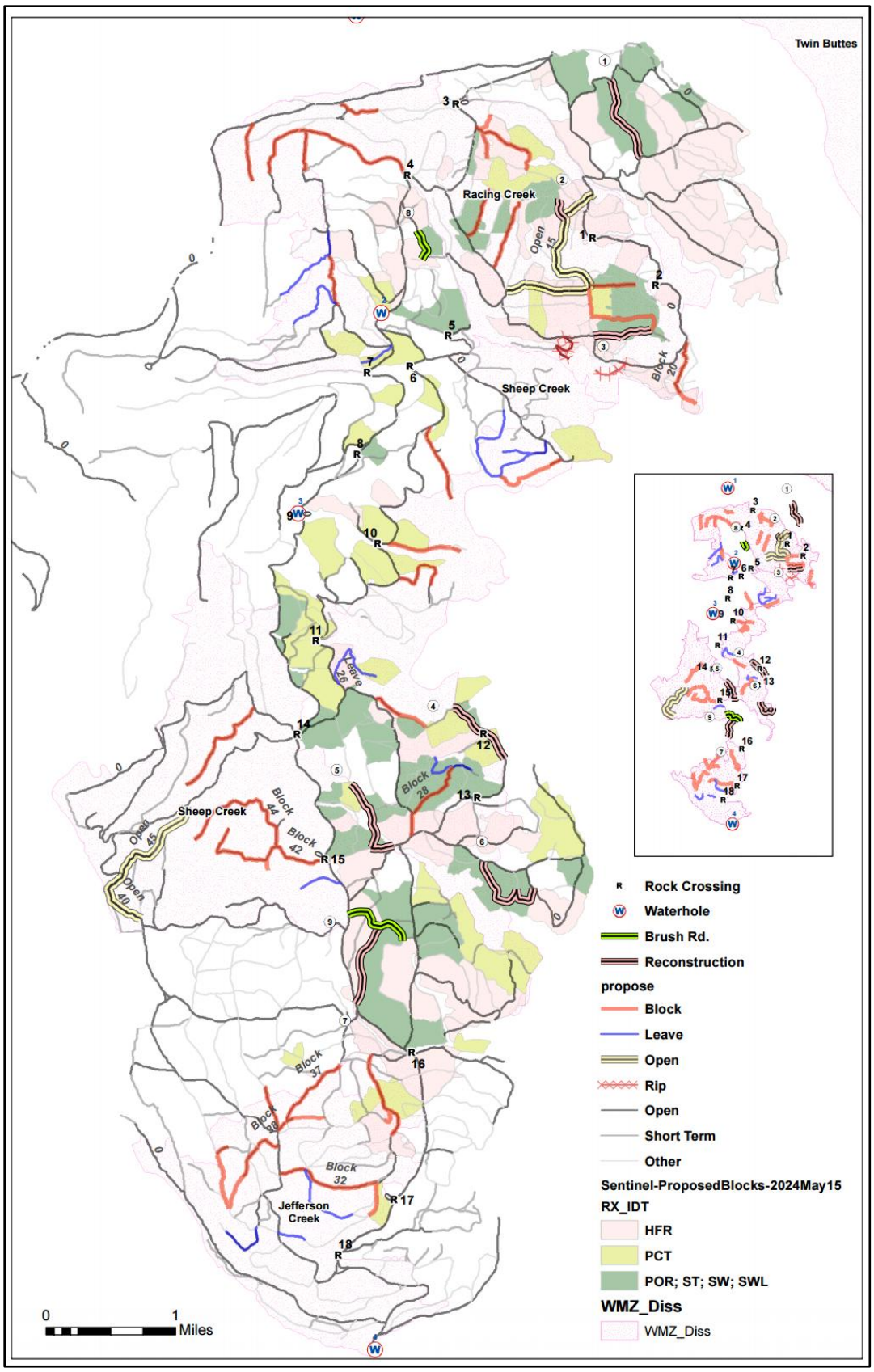


Figure-6: Roads Plan

Economics and Employment

Although the CTWS no longer supports a local forest products mill (the former Warm Springs Forest Products Industries, WSFPI), timber resources continue as an important source for local employment and economic benefit, as well as promoting other secondary economies (for example, food and fuel); collectively important to CTWS interests. Revenue from timber harvest remains a primary money source for the Tribes. Harvesting timber involves a committed financial investment by applicable parties. The economic efficiency of this investment is an important issue in determining management options. Log prices in the Pacific Northwest have been extremely variable over time; realizing an economic return from timber largely depends on the strategic marketing of wood products to available markets when prices are high. Log and lumber markets have declined in the last two years, with anticipated downward trends. Logging and administrative costs also have marked impacts on realized returns to the Tribes. Therefore, because of log price volatility and cost efficiency, predicting potential timber revenues over a year in advance is inherently speculative.

Alternative-A (No Action)

Non-economic forest attributes include cultural, subsistence, recreation, and aesthetic values; and would continue. Under Alternative-A, opportunity for additional employment and revenue would not be generated through the program harvest of timber, mainly affecting the CTWS and timber-dependent entities.

Alternative-B (Proposed Action)

Primary species anticipated for harvest are Douglas-fir, grand fir, and ponderosa pine; secondary species include lodgepole pine and western larch. Ponderosa pine would be a large component of the harvested material; current pine markets are extremally low. For planning purposes, estimated timber revenues are derived using an approximate average stumpage rate of $74.00 per thousand board feet harvested, based current market projections. Actual stumpage would depend on market conditions, as well as administration and production costs at the time of proposed project implementation. For estimating employment, a factor of 4.2 jobs per million board feet (Warren 2006) of harvested timber is applied in approximating the number of jobs that would be supported from implementing Alternative-B. With a proposed net timber harvest of approximately 20.58 million board feet and applying economic conversions, the Sentinel Project would generate approximately $1.52 million in net revenues and support 86 jobs.

CUMULATIVE EFFECTS

Cumulative effects consider the incremental effects, or influences upon affected resources from implementing proposed actions, when combined with other past, present, and reasonably foreseeable future actions. An effects assessment begins with defining both the spatial and temporal bounds of the assessment. The spatial bound for this proposal is generally the Metolius Forest Planning Unit, also known as the “South-End.” Spatial bounds are considered reasonable as effects from past, present, and reasonably foreseeable future actions within this area have the most likelihood of contributing cumulative effects, when linked to the proposed actions. Temporal bounds consider activities within this same area over the course of the reasonably foreseeable future (approximately 30 years maximum), as anticipated effects to forest resources are not anticipated exceeding this period and become speculative. Cumulative effects analyses are presented for assessed resources beginning with Water and concluding with Range;

Cumulative Effects are not submitted for Cultural Resources, Fire, Transportation, or Economics and Employment.

Water

Hydrologic Shifts Due to Proposed Treatments

CwM created a qualitative assessment ranking to evaluate the relative hydrologic impacts of the proposed treatment actions in each sub-watershed. The goal of this qualitative assessment is to identify where best management practices (such as vegetated buffers and erosion control measures) would be most effectively employed and where reduced action levels may be justified. Six factors were considered for the No-Action and Proposed Action scenarios, two constants and four which are changed by the proposed treatments: watershed capture area (constant), average slope (constant), leaf area index (LAI), canopy storage (CANMX), runoff lag time (SURLAG), and runoff curve number (CN2). These factors are explained in greater detail in the following sections.

Each factor was ranked on a scale of 1 to 5 relative to the range of values found across the analysis area. Factors changed by the proposed forestry treatments were assigned a value of 1 for the current conditions, with degree of change scaled across treatments. The factors were weighted differently based on their relative impact to overall runoff. The result is a runoff potential risk score which can be used to compare sub-watersheds. The factors are summarized in Table-9.

Table-9: Hydrology Analysis Factors and Definitions

Factor	Weight	Description
Slope	20%	Average slope of the sub-watershed.
Area	30%	Area of the sub-watershed.
Leaf Area Index (LAI)	10%	LAI is calculated by dividing the green leaf area by the total land area.
Canopy Storage (CANMX)	10%	CANMX is the maximum amount of water that can be stored in the canopy when the canopy is fully developed (in mm H_2O).
Runoff Lag Time (SURLAG)	15%	SURLAG is the fraction of the total available water that will be allowed to enter the reach on any one day.
Runoff Curve Number (CN2)	15%	CN2 is a parameter that represents a soil's permeability, land use, and antecedent soil water conditions.

Leaf Area Index and Canopy Storage

LAI and canopy storage are closely related factors that impact how much precipitation falls directly through vegetation and onto the land surface. In densely vegetated ecosystems with broad-leafed plant species, leaf area index and canopy cover can result in most precipitation being intercepted before it reaches the ground. Plant species with higher LAI have greater potential to store water, resulting in a higher canopy storage coefficient. Higher LAI and CANMX result in lower levels and longer temporal distribution of runoff. Table-11 summarizes LAI and CANMX scores assigned to each proposed treatment.

Table-10: Leaf Area Index and Canopy Cover Impacts by Treatment

Treatment	Target Trees per Acre / Understory Condition	Leaf Area Index Score	Canopy Storage Score
No Action	*Current Conditions*	1	1
PCT	70-194 / thinned	3	3
HFR	50-110 / reduced	4	3
POR	~4 / promoted	5	5
ST	3-9 / promoted	5	5
SW	15-25 / reduced	4	4
SWL	10-15 / reduced	4	4

Runoff Lag Time and Curve Numbers

Runoff lag time and runoff curve number are both related to the time it takes for water to travel through the watershed and into the drainage channel. This is affected by basin size, land use, and soil properties, but is also linked to vegetation density and composition. Table-12 summarizes how each proposed treatment may affect these two variables and assigns them scores accordingly.

Table-11: Runoff Lag Time and Runoff Curve Number Impacts by Treatment

Treatment	Lag Time Score	Curve Number Score
No Action	1	1
PCT	2	2
HFR	3	2
POR	4	4
ST	4	4
SW	4	3
SWL	4	3

Qualitative Watershed Impact Assessment

CwM examined how each of the four factors (LAI, CANMX, SURLAG, and CN2) may change based on each of the proposed treatments within the Sentinel Project Area. These are summarized in Table-11 and Table-12. The analysis was completed for pre- and post-treatment scenarios, with both total scores and the change from pre- to post-treatment being considered in the analysis. The minimum score for a watershed with the lowest susceptibility to surface runoff and erosion is 1, while the highest is 5. Overall, no watershed scored higher than 2.85 in the pre- and post-treatment analyses, suggesting that runoff and erosion risk is moderate.

Current Conditions, Alternative A (No-Action)

The qualitative watershed impact analysis was completed for each watershed based on existing conditions. Note that all watersheds were assigned the same value (1.0) for all vegetation and runoff variables, meaning current conditions were compared solely based on area and slope. The results are shown in Table-1. Watersheds with lower scores are understood to be less susceptible to surface runoff and erosion than watersheds with higher scores. Below, Racing, Camp, Code

and Sheep Creeks are identified as the most susceptible to surface runoff and erosion under current conditions.

Table-12: Pre-Treatment Values of Hydrology Analysis Factors

Watershed	Ave. Slope	Area	LAI	CANMX	SURLAG	CN2	Total
Rainy Creek (1)	3.0	3.0	1.00	1.00	1.00	1.00	2.00
Racing Creek (2)	3.0	5.0	1.00	1.00	1.00	1.00	2.60
Camp Creek (3)	4.0	5.0	1.00	1.00	1.00	1.00	2.80
***Unnamed* (4)**	4.0	1.0	1.00	1.00	1.00	1.00	1.60
Code Creek (5)	5.0	3.0	1.00	1.00	1.00	1.00	2.40
***Unnamed* (6)**	5.0	1.0	1.00	1.00	1.00	1.00	1.80
***Unnamed* (7)**	4.0	1.0	1.00	1.00	1.00	1.00	1.60
Sheep Creek (8)	4.0	4.0	1.00	1.00	1.00	1.00	2.50
***Unnamed* (9)**	5.0	1.0	1.00	1.00	1.00	1.00	1.80
Walker Creek (10)	3.0	4.0	1.00	1.00	1.00	1.00	2.30
Mariel Creek (11)	3.0	2.0	1.00	1.00	1.00	1.00	1.70
Whitewater River (12)	1.0	1.0	1.00	1.00	1.00	1.00	1.00
***Unnamed* (13)**	5.0	1.0	1.00	1.00	1.00	1.00	1.80

Projected Conditions, Alternative B (Proposed Action)

The qualitative watershed impact analysis was completed for each watershed based on the proportion of the watershed dedicated to each proposed action. Watersheds where a smaller proportion of the total area have proposed actions will experience a smaller change than areas with a greater proportion of their land proposed for action. Table-14 summarizes the results of these analyses. Overall, surface runoff and erosion are projected to increase in each of the twelve watersheds as a result of the proposed treatments, though not every watershed experiences the same degree of change.

The watersheds that are most susceptible to surface runoff and erosion under post-treatment conditions are still Racing, Camp, Code, and Sheep Creeks. Table-15 summarizes the magnitude of change in qualitative score experienced by each sub-watershed as a result of the proposed treatments. Higher numbers indicate more significant increases in runoff and erosion.

Table-13: Post-Treatment Values of Hydrology Analysis Factors

Watershed	Ave. Slope	Area	LAI	CANMX	SURLAG	CN2	Total
Rainy Creek (1)	3.0	3.0	2.25	1.97	1.92	1.54	2.44
Racing Creek (2)	3.0	5.0	1.50	1.42	1.34	1.25	2.78
Camp Creek (3)	4.0	5.0	1.17	1.15	1.09	1.08	2.86
***Unnamed* (4)**	4.0	1.0	1.28	1.28	1.14	1.14	1.70
Code Creek (5)	5.0	3.0	1.69	1.64	1.45	1.39	2.66
***Unnamed* (6)**	5.0	1.0	1.86	1.76	1.64	1.49	2.13
***Unnamed* (7)**	4.0	1.0	2.34	2.06	2.03	1.60	2.08
Sheep Creek (8)	4.0	4.0	1.74	1.67	1.59	1.41	2.79
***Unnamed* (9)**	5.0	1.0	1.27	1.20	1.17	1.10	1.89
Walker Creek (10)	3.0	4.0	1.65	1.52	1.51	1.30	2.54
Mariel Creek (11)	3.0	2.0	1.37	1.28	1.23	1.14	1.82
Whitewater River (12)	1.0	1.0	3.44	2.89	2.89	2.07	1.88
***Unnamed* (13)**	5.0	1.0	1.65	1.64	1.43	1.35	2.04

Table-14: Magnitude of Change in Each Sub-Watershed as a Result of Proposed Treatments

Watershed	Change
Rainy Creek (1)	0.44
Racing Creek (2)	0.18
Camp Creek (3)	0.06
***Unnamed* (4)**	0.10
Code Creek (5)	0.26
***Unnamed* (6)**	0.33
***Unnamed* (7)**	0.48
Sheep Creek (8)	0.29
***Unnamed* (9)**	0.09
Walker Creek (10)	0.24
Mariel Creek (11)	0.12
Whitewater River (12)	0.88
Unnamed (13)	0.24

Fisheries

The Project Area has a history of habitat stressors from past logging activity and the recent 2020 Lionshead Wildfire, and proposed actions may compound them. There are many ways that silviculture could affect aquatic habitat and species:

- Erosion and sediment loads may increase from changes to vegetative ground cover, soil compaction, road runoff, and the loss of soil cohesion from the decay of roots (McEachran and others 2021);
- Water temperature could increase by removing shade trees from riparian areas (Adamus 2014, Liquori and others 2008);
- The amount of in-stream habitat suitable to salmonids' life-history needs and habitat elements (for example, large woody debris) have been reduced by past land-use practices and could be further reduced by logging in riparian areas (Dominguez & Cederholm 2020); and,
- The risk of wildfire - for better or worse - could be affected by silviculture (Levine and others 2022).

However, these effects pathways will be mitigated because: 1. proposed actions do not include construction of any new roads; 2. the project will establish no-work riparian buffers; 3. the majority of mapped streams within the project area were field-verified to be ephemeral (few are perennial or intermittent); and, 4. the position of proposed actions on the landscape (that is, on a relatively flat terrace) minimizes the amount of erosion and the possibility of overland sediment transport to adjacent waterways that could result from tree removal. Furthermore, proposed actions include several Project Design Features (described in this document) that will avoid or minimize any effects to aquatic habitat and species.

Wildlife

The effects of the proposed action would resonate outside of the immediate bounds of the project footprint, affecting adjacent Forest Service lands, private property, and the CTWS. Disturbance associated with heavy machinery and large-scale manipulation of the natural environment will cause wildlife species to leave the area, potentially moving onto private or Federal lands in the short-term. This migration out of the project area could last anywhere from a few months to a few decades, depending on the response rates of the vegetation to management. However, it is the hope of Wildlife Department that the short-term exodus would give way to more animals moving into the area in the long run.

The time frame used to include or exclude actions varies by the type of land management actions. Some impacts, such as past regeneration harvest would recover gradually over roughly 30 to 40 years. Some limited duration road closures and decommissioned roads are abrupt and immediately promote wildlife movement and activity.

This wildlife assessment relies on current and past ecological conditions as a representation for anticipated impacts. Existing conditions reflect the accumulated impacts of prior human related actions and natural events that have affected the ecosystem and would likely contribute to the cumulative effects. The forest pattern of vegetation in the project area has been affected by historical timber harvest, disease and insect mortality on forest stands, and most recently large-

scale wildfire. The aftermath is substantial impact to habitat cover and forage for big-game deer and elk, with thousands of acres of forage, hiding cover, and thermal cover lost to stand-replacing wildfire. Historical road maintenance, construction, and decommissioning have also added to the cumulative effect, further altering the ability of species to move across the landscape with adequate protection from hunting and poaching.

The identified future action within the project area is aimed at improving forage quality for big game species. Potential negative impacts, such as increased road densities, loss of hiding cover, and reductions in habitat for other non-game species have been addressed through mitigation. The Wildlife Department prescribed approximately 159 acres of hazardous fuels reduction (HFR) treatments in spotted owl habitat be omitted, one HFR treatment in critical mule deer winter range be manually treated by the Wildlife Department, road buffers 75 feet in width along the J-100 Road mostly adjacent to the Lionhead Fire scar be implemented, 30 miles of roads within Wildlife Management Units be removed, and the footprint of all burned slash piles be treated with herbicide and reseeded. All requested measures have been resolved with identified areas being amended or omitted from the final portfolio of assessed proposed actions.

Soil

Within the proposed project blocks and generally for the project area itself, dominant soil series are Smiling-Simnasho-Pipp (75%) and Howash-Mackatie (25%); cool wet volcanic soil categories associated with mountainous terrain. Soil characters are moderately deep to very deep (greater than 40 to 60 inches), well-drained to somewhat excessively drained soil found on slopes of 0 to 65 percent (NRCS 1998).

Understanding the relationship between soil productivity and forest management is complex. Soil formation is the result of interconnected natural processes that are connected and dependent upon varied ecosystem facets occurring over millennium. Time, climate, topography, organisms, and parent material all contribute to a dynamic and unique role in soil formation and productivity (CTWS, Metolius Timber Sale Project Assessment 2013).

Timber harvest impacts include soil erosion and compaction, as well as changing the nutrient and microbial balance in forest soil, which can affect future forest productivity as well as its overall health. The combination of past timber harvests, wildfires, and other disturbance events have cumulative impacts. Soil takes time to develop and become productive (CTWS, Willow Summit Project Assessment 2020).

Generally, soil is part of the commercial timber base and can experience long-term negative impacts when IRMP Standards and Best Management Practices (BMPs) are not followed during operational activities. Most detrimental impacts result from the use of heavy, rubber-tired, ground-based machinery, or the removal of ground cover, or the loading and hauling of timber. Potential impacts include compacted subsoil, reduction in soil productivity, reduced ability to capture and store water, and erosion of fine sediment into streams and rivers. By changing, altering, or shifting the overall function of forest soil, it is conceivable to change over time, the natural sequence of ecosystem inputs and outputs, jeopardizing general timber productivity in a given area. Road and skid trail densities should be reduced for limiting the deterioration of water quality. In addition, compaction should be minimized for promoting both vegetation growth and water capture and storage. Soil management includes alleviating long-term affects by adhering to IRMP Standards and BMPs, and by implementing additional mitigation measures to reduce

the long-term effects of timber harvest and treatments on soil resources (CTWS, Metolius Timber Sale Project Assessment 2013).

Timber

The Sentinel Project area contains approximately 24,770-forested acres and approximately 180 non-forested acres such as rock and natural openings. Approximately 7,920 acres or 32 percent of the project area is excluded from intensive land management activities per management direction. Excluded areas include water-related safeguards, identified wildlife habitat, and management plan exclusions like Conditional Use. Refer to Figure-2a for excluded areas, also known as avoidance areas.

Most all accessible ground within the project area was selection logged, going back to the 1960's. More recently, according to Geographic Information Systems (GIS), nearly 67 percent of the project area has had some sort of previous timber harvest documented from 1980 through 2021 - approximately 16,600 harvest acres out of 24,950 project area acres (See Figure-2a: Alternative-A, No Action) with about 15,320 acres in stands less than 40 years old, particularly within the areas affected by the 2020 Lionshead Fire (see Figure-2b: 2020 Lionshead Fire Footprint). Previous treatments, targeting economic and stand heath objectives, range from intermediate thinnings to regeneration harvests. Harvests also encompass timber salvaging in response to wildfire-induced mortality, as well as insect and windstorm events.

Varied levels of timber harvest directly influence current stand character, like tree species composition, age, and structure. A cumulative impact of intensive timber harvests, both scheduled and salvaged, is that mature timber stands are diminished in quantity. Some of the harvest blocks in the proposed action encompass areas left untreated from past projects situated in between previous treatment areas. About 63 percent of the proposed action blocks, both commercial and noncommercial treatments encompass reentries into previously harvested blocks - approximately 3,235 acres out of 5,115 total treatment acres. In addition, most of the established plantations are not currently at an age or size-class conducive to a commercial timber entry. These stands require more time to grow into commercial size and as such, are now proposed for precommercial thinning or hazardous fuels reduction as funding and opportunities arise. In addition, the 2020 Lionshead Fire consumed maturing plantations, resetting stand ages back to zero.

In general, remaining forested areas are overcrowded with younger smaller trees and have a greater proportion of grand fir and incense cedar. Grand fir in particular has expanded its range in both the middle and higher elevations. Historically, stands were once more dominated by ponderosa pine and Douglas-fir. Stands, especially in unmanaged areas, have shifted to containing lesser amounts of ponderosa pine and Douglas-fir and greater amounts of younger grand fir and incense cedar. Fire-excluded areas generally have decreased stand vitality with increased potential for insect and disease complications and increased potential risk for more intense wildfire.

Overall, cumulative effects from implementing proposed actions addressing resiliency and sustainability are positive, as subsequent stand trajectories would contribute to systems more in line with reported resilient conditions. That is, resilient species-dominated by single and double-strata stands. This entails limiting intertree competition, favoring more resilient timber species, reducing encroaching conifers, and reducing wildland fire fuels. However, identified exclusion

areas would remain at their current matrix, as areas are left untreated and would continue as such barring natural disturbance or management intervention. The Metolius Timber Sale in 2013 implemented examples of forest health and resiliency objectives, contributing to positive cumulative effects for the area. Examples of treated areas sustained relatively less adverse impacts from the 2020 Lionshead Fire.

Deferring management actions would perpetuate increased tree crowding, shading, and competition; affecting the more resilient timber species at the individual and stand level, eventually affecting landscape level sustainability. Declining timber health and vitality would also likely continue, along with increased susceptibility to insects and disease with less robust conditions. The cumulative effect of not implementing the proposed actions is a higher likelihood of more stand-replacing wildfire events. This could result in larger amounts of early seral and lesser amounts of late seral stand characters further divergent from historic resiliency. Being that resiliency efforts aim at promoting conditions more reflective of more robust conditions, then the proposed actions would facilitate this objective by generating stands better mimicking its reported resiliency, particularly for promoting the health and sustainability of future late-old structure (LOS).

It is expected that some on-going and foreseeable future projects or land uses would not appreciatively contribute to cumulative effects. For example, prohibition of off-road motorized travel and enforcement of road closures result in settings that would not appreciably manipulate forest vegetation. Continuance of these land management practices would not likely contribute toward undesirable cumulative effects upon forest vegetation within the project area.

Incorporation of public lands adjacent to the project area's east, west, and south boundary is a component of the cumulative effects as management on adjacent lands could influence conditions on the CTWS. The United States Forest Service (USFS) manages these public lands. Active timber management in these areas is minimal and thus stresses a greater urgency for proposed actions on the CTWS. By not implementing the proposed actions, overall cumulative effects could be negative, as forest vegetation would lack landscape-level management seeking desired conditions and become more susceptible to wildfire crossing over unto the CTWS. Adjacent public lands would not receive the benefits of reducing disturbance risks on CTWS lands as well, if proposed actions are not implemented.

Overall, beneficial cumulative effects to forest vegetation would occur by going forward with the Sentinel Project, stemming from the incremental effects of the proposed actions. While some land allocations like untreated avoidance areas would not immediately contribute positively to historic resiliency, this consideration would not outweigh the benefits expected from the on-going and foreseeable future, and proposed vegetation management upon CTWS lands. Proposed actions would provide beneficial cumulative benefits to forest vegetation across the landscape, moving stands toward more desired conditions, improving stand compositions, possibly allowing for the reintroduction of fire on the landscape and reducing susceptibility of stands to wildfire and insect/disease impacts. Therefore, the incremental cumulative effects of the proposed actions are expected to be beneficial and would improve forest vegetation conditions more than if the proposed actions were not implemented.

Range

Human management over the last 100 years has increased the establishment of nonnative invasive plant species such as annual grasses, tansy ragwort, hound's tongue, and knapweeds in the area. As climate is rapidly warming, nonnative annual invasive weeds would continue to increase. These species easily spread along roads on equipment, and vehicles.

Converting a closed canopy to an open-forage system would increase diversity. As result of logging activities, livestock and wildlife would benefit. Changes in the landscape on a large scale can have detrimental effects. Increased use by livestock, hunters, logging, and cultural plant opportunities could increase noxious weeds; open roads are vectors for weed spread.

PROJECT DESIGN FEATURES

Sentinel Project

Project Design Features (PDF), also known as "mitigation measures" stem from concerns and evaluations regarding the effects of implementing land management actions upon the Tribal forestland resource. A guiding principle in implementing actions is conserving and protecting the Tribe's important natural and cultural resources. To this end, PDFs comprise additionally prescribed elements aimed at protecting water, fish and wildlife habitat, and incorporating measures preventing soil erosion, the spread of noxious weeds, and conserving of cultural resources. The PDF intent is lessening or diminishing anticipated unfavorable impacts to recognized resources. Prescribed operating seasons (approved times of year when industrial activities are permissible) are also a part of the design features and are tabularly listed (by treatment block) in Appendix-A; seasons are graphically displayed in Appendix-B.

Project work would not typically proceed unless features are first met, modified, or waived by the applicable resource specialist. Should a PDF be waived, negotiations would then commence between parties and if deemed desirable or necessary, plan and implement any additional remedial action(s). If not posing a health or safety risk, or when not conflicting with other on-going and reasonably foreseeable future actions and authorized land uses, apply the following features, beginning with Water and concluding with Transportation:

Water

1. Protection of waters and riparian zones would be achieved through buffers comprised of two zones, Zones "A" and "B" (IRMP 2012). For this project, both zones are combined as one contiguous buffer and are prescribed as no-entry exclusion areas. Designated areas are excluded from proposed treatment activities. Entry by mechanized equipment is also excluded.
    - **a.** Zone-A is the area immediately adjacent to the high-water mark of a water body or outer edge of a wet area.
    - **b.** The minimum A-Zone riparian buffer will be 100 feet on each side of a Class I stream, 60 feet on each side of a Class II stream, and 30 feet on each side of a Class III stream. Buffer zones will be measured horizontally from both banks of a stream channel or wetted area and include the riparian area and floodplain.
    - **c.** Zone-B is the area immediately upslope of Zone-A with a buffer width equal to that of the corresponding A-Zone.
    - **d.** The Tribal Hydrologist and Fisheries Biologist would conduct a field review to approve deviations from specific buffer zones for every water body within a project area, before the project is implemented. Field review will include drainages to determine stream classification and wet areas to determine status.
    - **e.** An increase in the minimum buffer width will be imposed when circumstances put the watershed, stream channel stability, or aquatic resources at risk.
    - **f.** Wetlands, springs, seeps, bogs, spring headwalls and any other designated wet area will be given the same protection as a Class I stream.

g. No new log decks or landings will be placed within any riparian buffer.

2. Various treatment blocks contain ephemeral draws or drainages that do not meet requirements for a Class III stream. While these draws do not require buffering, any skid trail crossings must be first designated and then be no closer than 300 feet apart. Crossings must be perpendicular to the draw; heavy machinery operation up and down draws is prohibited.

Fisheries

3. Protection of fisheries would be achieved adhering to the following standards (IRMP 2012):

a. No timber harvest or salvage operation will occur in a riparian A-Zone, unless approved through the appropriate process. These trees will be left to provide adequate sources of woody debris recruitment for riparian areas and instream habitat.

b. Large woody debris will not be removed from streams unless approved through the appropriate process.

c. Culverts, bridges, and stream crossings on fish-bearing streams will be designed for passage of adult and juvenile fish of the appropriate species.

d. Fine sediments (<6.4mm) in substrates will be less than or equal to 20 percent in fish bearing streams. In the event streams or stream reaches exceed the standard as a result of management activities, mitigating measures will be implemented to maintain or improve current levels.

e. Stream bank stability will average no less than 90 percent in all streams. In the event streams or stream reaches violate the standard as a result of management activities, mitigating measures will be implemented to maintain or improve current levels.

4. Heavy machinery exclusion zones are established for both the "A" and "B" zone buffers, only hand-thinning operations are permitted within the buffered zones. Wood generated from hand-thinning activities would be deposited into stream channels where possible for contributing to system complexity.

5. As part of the project design when selecting potential treatment blocks, steep slope areas, particularly adjacent to stream channels and wetted areas were avoided where possible. In addition, construction and reconstruction of roads was kept to a minimum.

Wildlife

6. Within established IRMP Wildlife Management Zones (WMZ), noise generating activities such as timber harvesting, precommercial thinning, masticating, and road constructing/reconstructing would not occur April 16 through July 31 (calving, fawning, rearing season). The prescribed four-month operating season is August 1 through November 30. This feature applies to:

a. Harvest Blocks 5, 6, 7, 8, 9, 10, 11, 18, 20, 21, 22, 23, 24, 26, 27, and 28;

b. Hazardous Fuels Reduction (HFR) Blocks 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 140, 142, 143, 144, 146, and 153;

c. Precommercial Thinning (PCT) Blocks 201, 202, 203, 204, 208, 209, 210, 218, 221, 224, 225, 226, 227, 233, 236, 237, 238, 239, and 240.

7. Wildlife trees/snags - where possible maintain at least four quality hard snags per acre within the treatment blocks. Snags should be at least ten inches diameter at breast and ten feet tall. Worker health and safety risks take precedence, including fire management activities.

8. Should a previously unknown raptor nest be located, it shall be protected January 1 through August 31. No disturbing activities would be conducted within ¼-mile of the active nest site. Report occurrences to the BNR Wildlife Department. Prescribed measure may be extended to 1-mile when loud decibel disturbance occurs, as determined by the Wildlife Biologist.

9. For selected treatment blocks along the J-100 Road, observe prescribed 75-foot-wide wildlife screens. Areas are prescribed as no-entry exclusions. This feature applies to:

a. Harvest Blocks 15, 17, 26, 27, 28, and 29;

b. HFR Blocks 133, 136, 146, 147, and 148;

c. PCT Blocks 205, 209, 212, 213, 214, and 217.

For harvest blocks, areas are designated with blue flagging and two-bar yellow paint. For HFR blocks with no other access road, exception to total exclusion is recognized for mastication equipment only, to access treatment areas beyond the buffer. Buffered areas would not be masticated but minimal impact is permitted allowing for limited access only.

10. PCT Block 238, located within critical mule deer winter range would be manually thinned, bucked, and piled over a two-year period by the BNR Wildlife Department. Piles would be latter burned.

11. As identified between the BNR Wildlife Department and the Forestry Department (Road Engineering Section), close/decommission 30 miles of roads located within applicable Wildlife Management Zones (WMZ).

12. Following completion of harvest operations, herbicide would be applied to all log landings for reducing the spread of weeds. "Plateau" herbicide will be applied to landings immediately following the burning of slash piles, at a rate of approximately seven ounces per acre. In addition, reseeding of all landings would occur, using a mix of Idaho fescue (*Festuca idahoensis*), bluebunch wheatgrass (*Pseudoroegneria spicata*), and bottlebrush squirreltail (*Elymus elymoides*) at a rate of about eight pounds per acre. Reseeding would occur either in the fall or the spring, following the burning of slash piles.

Soil

13. Harvesting methods shall minimize cumulative impacts upon the soil resource by means including:

- **a.** Establishing skid trails at an angle to the slope (not straight up and down), as water could flow back onto the skid trails (even with waterbarring).
- **b.** On slopes 35 percent or greater - Covering skid trails with slash prior to heavy equipment operation, using low ground pressure equipment, and minimizing the number of equipment passes.
- **c.** Limit the use of equipment to periods when the soil is dry or frozen.

14. Waterbar requirements:

- **a.** On slopes 5 to 15 percent, waterbars would be no more than 300 feet apart;
- **b.** On slopes 15 to 35 percent, waterbars would be no more than 200 feet apart; and,
- **c.** On slopes greater than 35 percent, waterbars would be 50 feet apart and reinforced on the downhill side with brush, slash, and/or woody debris

15. Skid trails should be minimized on slopes greater than 35 percent and erosion control measures would be implemented as stated in PDF 15 (reinforced waterbars).

16. To mitigate for the addition of new skid trails and the use of existing skid trails in blocks where the ten percent standard is exceeded, trails would need to be ripped prior to project completion, bringing the skid trail area percentage down to the ten percent standard for those blocks.

17. When constructing spur stubs or reconstructing former roads for timber hauling, erosion control measures would be included in harvest planning and implementation, especially in minimizing impacts to the soil resource during wet weather conditions and/or heavy rains. For example, measures would include rocking roads at culvert crossings (where runoff is anticipated).

Timber

18. Retain and protect from damage, occurrences of live and healthy select-trees, serving as identified as genetic seed-source trees. Trees are typically designated with a numbered metal tag and orange paint-band near or at four and one-half feet above ground level and often highlighted with a numbered stake near the road edge.

19. Leave standing and protect from damage, areas of healthy natural and planted tree regeneration - typically, Douglas-fir, ponderosa pine, sugar pine, and western larch. Avoid damaging areas during harvest and slash reduction operations; directionally fell trees away from concentrated areas. However, efficient/effective landing and skid trail locations (both new and established) take precedence.

20. Retain and protect from damage all healthy occurrences of midstory and overstory sugar pine and western larch.

Range

21. The CTWS-BNR would identify noxious weed areas and measures would be taken to avoid the spread of weeds to other sections of the project area.

Transportation

22. The Purchaser would immediately after hauling, block roads that have been opened to access harvest blocks. Roads needed to access blocks for post-harvest activities would be reopened for those activities and blocked upon completion.

23. The Purchaser would immediately after hauling, decommission all new spur stubs as instructed.

24. All reconstructed roads opened for accessing harvest areas would be re-decommissioned, by the Purchaser; timing to be determined based upon post-harvest activity needs.

25. All reconstructed roads would be blocked; timing to be determined based upon post-harvest activity needs. Blockage placement would ensure access by tree planting contractors (that is, placed within the harvest block with room to turn around).

26. The Purchaser would block overgrown roads that have been brushed opened for accessing harvest areas; timing to be determined based upon post-harvest activity needs.

APPENDIX-A, Part I Seasonal Restrictions - Harvest Blocks[27]

Block ID	Rx	Seasonal Restrictions by Calendar Month and Resource Emphasis											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	SW												
2	SW												
3	SW												
4	SW												
5	ST	W	W	W	W	W	W	W					W
6	POR	W	W	W	W	W	W	W					W
7	POR	W	W	W	W	W	W	W					W
8	SWL	W	W	W	W	W	W	W					W
9	SWL	W	W	W	W	W	W	W					W
10	SW	W	W	W	W	W	W	W					W
11	SWL	W	W	W	W	W	W	W					W
12	ST												
13	ST												
14	ST												
15	ST												
16	ST												
17	SWL												
18	ST	W	W	W	W	W	W	W					W
19	POR												
20	ST	W	W	W	W	W	W	W					W
21	SWL	W	W	W	W	W	W	W					W
22	ST	W	W	W	W	W	W	W					W
23	ST	W	W	W	W	W	W	W					W
24	SWL	W	W	W	W	W	W	W					W
25	SWL												
26	SWL	W	W	W	W	W	W	W					W
27	ST	W	W	W	W	W	W	W					W
28	SWL	W	W	W	W	W	W	W					W
29	SW												
30	SW												

[27] Empty cells do not have prescribed seasonal restrictions and are therefore, "open" to industrial operations.

Wildlife (W): Within established IRMP Wildlife Management Zones (WMZ), noise generating activities such as timber harvesting, precommercial thinning, masticating, and road constructing/reconstructing would not occur April 16 through July 31 (calving, fawning, rearing season). The prescribed four-month operating season is August 1 through November 30. This feature applies to:

Harvest Blocks 5, 6, 7, 8, 9, 10, 11, 18, 20, 21, 22, 23, 24, 26, 27, and 28.

APPENDIX-A, Part II Seasonal Restrictions - Hazardous Fuels Reductions, HFR[28]

Block ID	Treat Priority	Seasonal Restrictions by Calendar Month and Resource Emphasis											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
101	High												
102	High												
103	Mod												
104	Mod-High												
105	High												
106	Mod-High												
107	Mod-High												
108	High												
109	High												
110	High												
111	Mod-High												
112	Mod-High												
113	High												
114	High	W	W	W	W	W	W	W					W
115	High	W	W	W	W	W	W	W					W
116	Mod-High	W	W	W	W	W	W	W					W
117	Mod	W	W	W	W	W	W	W					W
118	Mod-High	W	W	W	W	W	W	W					W
119	High	W	W	W	W	W	W	W					W
120	Mod-High	W	W	W	W	W	W	W					W
121	Mod-High	W	W	W	W	W	W	W					W
122	Mod-High	W	W	W	W	W	W	W					W
123	Mod	W	W	W	W	W	W	W					W
124	High	W	W	W	W	W	W	W					W
125	High	W	W	W	W	W	W	W					W
126	High	W	W	W	W	W	W	W					W
127	Mod-High	W	W	W	W	W	W	W					W
128	Mod-High	W	W	W	W	W	W	W					W
129	Mod	W	W	W	W	W	W	W					W
130	Mod-High	W	W	W	W	W	W	W					W
131	Mod-High	W	W	W	W	W	W	W					W
132	High												
133	High												
134	Mod-High												
135	High												
136	Mod-High												
137	Mod-High												
138	High												
139	High												
140	High	W	W	W	W	W	W	W					W

[28] Empty cells do not have prescribed seasonal restrictions and are therefore, "open" to industrial operations.

Wildlife (W): Within established IRMP Wildlife Management Zones (WMZ), noise generating activities such as timber harvesting, precommercial thinning, masticating, and road constructing/reconstructing would not occur April 16 through July 31 (calving, fawning, rearing season). The prescribed four-month operating season is August 1 through November 30. This feature applies to:

HFR Blocks 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 140, 142, 143, 144, 146, and 153.

Block ID	Treat Priority	Seasonal Restrictions by Calendar Month and Resource Emphasis											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
141	Mod-High												
142	Mod-High	W	W	W	W	W	W	W					W
143	Mod	W	W	W	W	W	W	W					W
144	Mod-High	W	W	W	W	W	W	W					W
145	Mod-High												
146	Mod	W	W	W	W	W	W	W					W
147	High												
148	Mod-High												
149	Mod-High												
150	Mod-High												
151	Mod-High												
152	Mod-High												
153	High	W	W	W	W	W	W	W					W
154	High												

APPENDIX-A, Part III Seasonal Restrictions - Precommercial Thinnings, PCT[29]

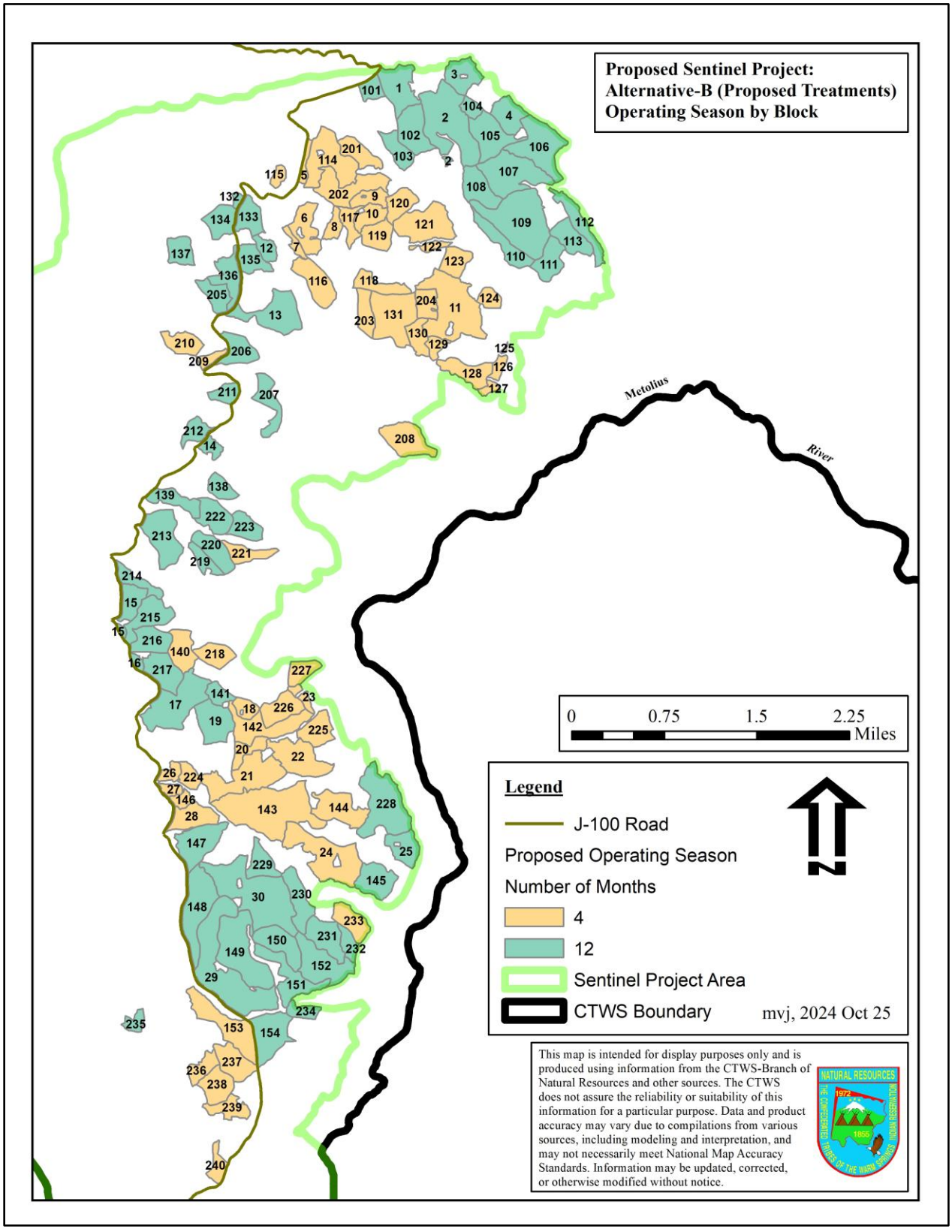
Block ID	Treat Priority	Seasonal Restrictions by Calendar Month and Resource Emphasis											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
201	Mod	W	W	W	W	W	W	W					W
202	Mod	W	W	W	W	W	W	W					W
203	Mod-High	W	W	W	W	W	W	W					W
204	High	W	W	W	W	W	W	W					W
205	Mod-High												
206	Mod												
207	Mod												
208	Mod	W	W	W	W	W	W	W					W
209	Mod	W	W	W	W	W	W	W					W
210	Mod	W	W	W	W	W	W	W					W
211	High												
212	High												
213	Low-Mod												
214	High												
215	High												
216	High												
217	Mod												
218	Mod-High	W	W	W	W	W	W	W					W
219	Mod												
220	High												
221	High	W	W	W	W	W	W	W					W
222	Mod												
223	High												
224	Mod-High	W	W	W	W	W	W	W					W
225	Mod	W	W	W	W	W	W	W					W
226	Mod-High	W	W	W	W	W	W	W					W
227	Mod-High	W	W	W	W	W	W	W					W
228	Mod												
229	Low-Mod												
230	Low-Mod												
231	Mod-High												
232	Mod												
233	Mod	W	W	W	W	W	W	W					W
234	Mod												
235	High												
236	High	W	W	W	W	W	W	W					W
237	Mod-High	W	W	W	W	W	W	W					W
238	Mod-High	W	W	W	W	W	W	W					W
239	Mod-High	W	W	W	W	W	W	W					W
240	High	W	W	W	W	W	W	W					W

[29] Empty cells do not have prescribed seasonal restrictions and are therefore, "open" to industrial operations.

Wildlife (W): Within established IRMP Wildlife Management Zones (WMZ), noise generating activities such as timber harvesting, precommercial thinning, masticating, and road constructing/reconstructing would not occur April 16 through July 31 (calving, fawning, rearing season). The prescribed four-month operating season is August 1 through November 30. This feature applies to:

PCT Blocks 201, 202, 203, 204, 208, 209, 210, 218, 221, 224, 225, 226, 227, 233, 236, 237, 238, 239, and 240.

APPENDIX-B, Operating Season by Block - Graphic Summary



APPENDIX-C, List of Contributors

The following Branch of Natural Resources staff participated on the Project Interdisciplinary Team (PIDT) for the Sentinel Project, contributing to the planning and/or writing of the project assessment. Technical assessments and write-ups were also submitted by Mason, Bruce, & Girard and CwM-H2O as contracted services on behalf of the BNR and PIDT.

- Camille Brooks, Wildlife Biologist
- Edward Heath, Forest Engineering Technician
- Matt V. Jimenez, Area Forester + Project Lead + Writer/Editor
- Rodney Kenyan, Fire Management
- Max Oakes, Wildlife Biologist
- Tim Outman, PIDT Leader
- Bill Reynolds, Rangeland Management Specialist
- Mason, Bruce, & Girard, Fisheries
- CwM-H2O, Hydrology

APPENDIX-D, Tribal Committees

The following Committees representing the Tribal Council of The Confederated Tribes of Warm Springs, Oregon participated with the PIDT for the Sentinel Project, providing input and guidance.

- Culture and Heritage
- Fish and Wildlife (On-Reservation)
- Land Use
- Timber

APPENDIX-E, Agencies and Individuals Consulted

The following Federal and private entities were consulted for technical expertise during the planning process for this project.

- Natural Resources Conservation Service (NRCS)
- United States Fish and Wildlife Service (USFWS)
- Sage Science

APPENDIX-F, Glossary

Allowable Cut (AC): The calculated net quantity (board feet measure) of timber harvested from the area of suitable land covered by the management plan for a time period specified by the plan.

Anadromous, fish: Born in fresh water, spends most of its life in the sea and returns to fresh water to spawn.

Andesite: Gray to black volcanic rock with between about 52 and 63 weight percent silica. Andesites contain crystals composed primarily of plagioclase feldspar and one or more of the mineral pyroxenes (clinopyroxene and orthopyroxene) and lesser amounts of hornblende. At the lower end of the silica range, andesite lava may also contain olivine. Andesite magma commonly erupts from stratovolcanoes as thick lava flows, some reaching several kilometers in length. Andesite magma can also generate strong explosive eruptions to form pyroclastic flows and surges and enormous eruption columns. Andesites erupt at temperatures between 900 and 1,100 ° C (1,652 to 2,012° Fahrenheit). (URL - https://volcanoes.usgs.gov/vsc/glossary/andesite.html).

Animal Unit Month (AUM): The amount of forage required to fee a 1,000-pound cow and her calf for one month, based on a forage allowance of approximately 800 pounds per month. A deer requires .20 AUMs per month, or 160 pounds of dry-weight forage. An elk requires .70 AUMs per month, or 560 pounds of dry-weight forage. A horse requires 1.5 AUMs per month or 1,200 pounds of dry-weight forage.

Best Management Practice (BMP): Prescribed methods to be followed routinely during the performance of a given management activity.

Burn, prescribed: To deliberately burn wildland fuels in either their natural or their modified state and under specified environmental conditions, which allows the fire to be confined to a predetermined area and produces the fireline intensity and rate of spread required to attain planned resource management objectives (Society of American Foresters 2008).

Colluvium: Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes (NRCS 1998).

Conifer: A cone-bearing tree.

Endemic: Belonging exclusively or confined to a particular place, as opposed to *epidemic* which is extremely prevalent or widespread. (URL - https://www.dictionary.com/browse/endemic or epidemic 2024).

Erosion, rill: Erosion that results in small, short-lived and well-defined streams. When rainfall does not soak into the soil, it can gather on the surface and runs downhill, forming small channels of water called rills.

Erosion, sheet: Erosion that occurs fairly evenly over an area. As raindrops loosen soil, the surface water runoff can transport topsoil in a uniform fashion, almost like a bed sheet sliding off of a bed. This can be so subtle that it might not even be noticed until much of the valuable, nutrient-rich topsoil has already been washed away.

Forest Planning Unit (FPU): A subdivision of the total forestland base on the reservation, generally based on the large watersheds. A separate Allowable Cut is calculated for each FPU.

Geographic Information Systems (GIS): A technology that is used to create, manage, analyze, and map various types of data. GIS connects data to a map, integrating location data (where things are) with descriptive information (what things are like there). This provides a foundation for mapping and analysis that is used in science and almost every industry. GIS helps users understand patterns, relationships, and geographic context. The benefits include improved communication, efficiency, management, and decision-making. (URL - https://www.esri.com/en-us/what-is-gis/overview 2024).

Gravelly, soil: Material that is 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches in diameter. Very gravelly soil material is 35 to 60 percent of these rock fragments, and extremely gravelly material is more than 60 percent (NRCS 1998).

Hazardous Fuels Reduction (HFR): A maintenance and restoration treatment, intermediate timber harvest, or partial cutting aimed at reducing the amount of flammable material in a fire-prone system. Management activities include mechanical mastication, manual thinning and piling, and prescribed burning. Residual stocking is commonly 70 to 110 trees per acre (tree spacing about 20-25 feet). Hazardous fuels reductions do not necessarily fire-proof a stand, but afford wildland firefighters with more response time in a less risky work environment, while increasing suppression success and reducing adverse fire impacts and costs. As hazardous fuels reductions typically manipulate younger smaller ladder fuels and thus generate limited timber receipts, treatments often necessitate subsidized or allocated funds for implementation.

Integrated Resources Management Plan (IRMP): The management plan that provides guidelines for the stewardship of all forest and rangeland resources, and serves as a basis for making management decisions on the Warm Springs Reservation.

Ladder Fuels, or fuel-ladders: Combustible material that provides vertical continuity between vegetation strata and allows fire to climb into the crowns of trees or shrubs. Ladder fuels contribute to the initiation and continuation of crown fires (Society of American Foresters 2008).

Landing, Log: a place where trees and logs are gathered and sorted in or near the forest during a logging operation for further processing and transport to a mill or log yard facility. (URL - https://www.lawinsider.com/dictionary/log-landing 2024).

Late-Old Structure (LOS): Refers generally to tree individuals or groups and/or forested stands displaying structural characteristics associated with an “old growth” or mature forest - for example, larger bole diameters and greater ages with more complex stand structures.

Light Detection and Ranging (LiDAR): A remote sensing method that uses light in the form of a pulsed laser to measure ranges (variable distances) to the Earth. These light pulses combined with other data recorded by the airborne system generate precise, three-dimensional information about the shape of the Earth and its surface characteristics. (URL - https://oceanservice.noaa.gov/facts/lidar.html 2024).

Loam: Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles (NRCS 1998).

Management Groups: Plant associations grouped by site potential productivity (CTWS Forest Management Implementation Plan Warm Springs Reservation 2012-2021, 2013). Groupings are:

- Management Group 1 (Ponderosa Pine Plant Associations) is comprised of four plant associations and is a low productivity area with an estimated managed stand production potential of 200 board feet per acre per year.
    - Ponderosa pine-meadow (PIPO/Meadow)
    - Ponderosa pine/prairie smoke avens-mule's ear (PIPO/GETR-WYAM)
    - Ponderosa pine/bitterbrush (PIPO/PUTR)
    - Ponderosa pine/bitterbrush-green leaf manzanita (PIPO/PUTR-ARPA)
- Management Group 2 (Ponderosa Pine - Douglas-fir Plant Associations) is comprised of two plant associations and is a moderately productive area with an estimated managed stand production potential of 360 board feet per acre per year.
    - Ponderosa pine-Douglas-fir/bitterbrush-ceanothus (PIPO-PSME/PUTR-CEVE)
    - Ponderosa pine-Douglas-fir/snowberry PIPO-PSME/SYMPH)
- Management Group 3 (Mixed Conifer Plant Associations) is comprised of three plant associations and is a moderately productive area with an estimated managed stand production potential of 427 board feet per acre per year.
    - Mixed conifer/snowberry (Mixed Conifer/SYMPH)
    - Mixed conifer/snowberry-elk sedge (Mixed Conifer/SYMPH-CAGE)
    - Mixed conifer/ceanothus (Mixed Conifer/CEVE)
- Management Group 4 (Grand Fir Plant Associations) is comprised of three plant associations and is a highly productive area with an estimated managed stand production potential of 613 board feet per acre per year.
    - Grand fir/Oregon boxwood (ABGR/PAMY)
    - Grand fir/snowberry (ABGR/ SYMPH)
    - Grand fir/vine maple (ABGR/ACCI)
- Management Group 5 (Hemlock/Beargrass Plant Associations) is comprised of four plant associations and is a moderately productive area with an estimated managed stand production potential of 493 board feet per acre per year.
    - Western hemlock/beargrass (TSHE/XETE)
    - Western hemlock/rhododendron (TSHE/RHMA)
    - Silver fir/beargrass (ABAM/XETE)
    - Mountain hemlock/beargrass (TSME/XETE)
- Management Group 6 (Mountain Hemlock - Lodgepole Pine Plant Associations) is comprised of four plant associations and is a moderately productive area with an estimated managed stand production potential of 461 board feet per acre per year.
    - Grand fir-lodgepole pine/Oregon boxwood/pine grass (ABGR-PICO/PAMY/CARU)
    - Mountain hemlock-lodgepole pine/pinemat manzanita (TSME-PICO/ARNE)
    - Mountain hemlock-lodgepole pine/grouse whortleberry (TSME-PICO/VASC)
    - Mountain hemlock-lodgepole pine/subalpine fir (TSME-PICO/ABLA 2)
- Management Group 7 (Ponderosa Pine - Douglas-Fir {Mutton Mountains} Plant Associations) is comprised of four plant associations and is a low productive area with an estimated managed stand production potential of 155 board feet per acre per year.

- Ponderosa pine-Douglas-fir/prairie smoke avens-mule's ear {Mutton Mountains} (PIPO-PSME/GETR-WYAM {Mutton Mountains})
- Ponderosa pine-Douglas-fir/bitterbrush {Mutton Mountains} (PIPO-PSME/PUTR {Mutton Mountains})
- Ponderosa pine-Douglas-fir/green leaf manzanita-ceanothus {Mutton Mountains} (PIPO-PSME/ARPA-CEVE {Mutton Mountains})
- Ponderosa pine-Douglas-fir/snowberry {Mutton Mountains} (PIPO-PSME/SYMPH {Mutton Mountains})

- Management Group 8 (Silver Fir Plant Associations) is comprised of three plant associations and is a highly productive area with an estimated managed stand production potential of 638 board feet per acre per year.
  - Grand fir/big-leaf huckleberry (ABGR/VAME)
  - Western hemlock/vine maple (TSHE/ACCI)
  - Silver fir/queencup beadlily (ABAM/CLUN)

Mesopredator: A predator that occupies a mid-ranking position in a food web. There is no standard definition of a mesopredator, but mesopredators are usually medium-sized carnivorous or omnivorous animals, such as raccoons, foxes, or coyotes. They are often defined by contrast from apex predators or prey in a particular food web. Mesopredators typically prey on smaller animals. (URL - https://en.wikipedia.org/wiki/Mesopredator 2024).

Monitoring: The collection of information over time, generally on a sample basis by measuring change in an indicator or variable, to determine the effects of resource management treatments in the long term (Society of American Foresters 2008).

Overstory: The uppermost layer of foliage that forms a forest canopy.

Partial Overwood Retention (POR): Typically applied as a final timber harvest retaining approximately four overstory trees per acre (overstory tree spacing about 104 feet). Treatment typically follows a previous shelterwood treatment implemented fifteen to twenty years earlier or may address an overstory in declining health while conserving a healthier understory. Objectives include redistributing available growing space unto a healthier understory while providing some overstory trees for structural diversity and resiliency. Future planned treatments include a precommercial thin.

Precommercial Thin (PCT): Typically, an even-aged intermediate thinning targeting the removal of younger and smaller trees, not for immediate financial return, but for reducing residual stocking by concentrating growth on the more preferred trees (Society of American Foresters 2016). Residual stocking is approximately 70 to 110 trees per acre (tree spacing about 20 to 25 feet). As precommercial thins manipulate smaller trees, thinnings are a noncommercial investment necessitating subsidized or allocated funds for implementation. Follow-up treatment includes a more commercial thinning.

Project Design Feature (PDF): Otherwise known as "mitigation measures", PDF's respond to tribal public concerns and project-related evaluations concerning the effects of implementing proposed actions. The PDF intent is lessening or eliminating anticipated undesirable impacts to identified resources. Measures must be in-place before proposed actions can proceed; for example, compliance with prescribed operating seasons.

Project Interdisciplinary Team (PIDT): A group of technical, professional resource experts, and Tribal committee representatives who provide specific input to project assessments.

Reach, river: A continuous extent of water.

Redd: A spawning nest that is built by salmon and steelhead in the gravel of streams.

Resource Management Interdisciplinary Team (RMIDT): A CTWS decision-making and advisory group comprising the General Manager, Branch of Natural Resources department managers, Tribal committee, and enterprise representatives, charged with reviewing environmental assessments.

Riparian: Relating to or living or located on the bank of a natural watercourse (as a river).

Residuum: Residual soil material - unconsolidated, weathered and partly weathered mineral material that accumulated as consolidated rock disintegrated in place (NRCS 1998).

Road, closed: These are generally local roads, temporarily closed with a gate or similar barrier. The road will be closed to the general public but may be open to all during commercial activities. The road may or may not be closed to administrative uses on a seasonal basis depending upon impacts to the resources. Drainage structures will be left in place.

Road, decommissioned: These closures will be based on resource protection needs identified in watershed analysis and the IRMP directives. 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 prepared to avoid future maintenance needs; the road will be left in an "erosion-resistant" condition by establishing cross drains. The road will be closed with a device similar to an earthen barrier (tank trap) or equivalent.

Salmonids: A fish of the salmon family including salmon, trout, char, and whitefish.

Sand: As a soil separate, individual rock or mineral fragments from 0.05 to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay (NRCS 1998).

Seed Tree (ST): Prescribed as a conventional even-aged regeneration treatment providing economic value and occasion for a subsequent healthy and robust future stand (plantation). Seed Trees typically retain three to nine trees per acre with a diameter at breast height (dbh) of at least fifteen inches (dominants, codominants, and intermediates; tree spacing about 70 to 120 feet) providing a variety of structural and legacy features for biodiversity and aesthetics. Retained trees are generally dispersed but aggregating trees is also common. As this is a "final harvest", the goal is not necessarily retaining trees that will respond in growth and vitality. Treated areas are planted with resilient conifer species; typically, a mix of Douglas-fir, ponderosa pine, sugar pine, western larch, and western white pine. Therefore, it is normal retaining individuals with genetic imperfections (in terms of timber quality). Trees with the potential for spread of disease (like dwarf mistletoe) are harvested or cut and left on-site. An objective includes retaining a variety of size and crown classes providing for the recruitment of future snags and down wood. Follow-up treatments include the planting of desirable conifer species, later followed by a precommercial thin.

Shelterwood (SW): Depending on the site and management objectives, a shelterwood could be either an even-aged intermediate or regeneration harvest. The primary goal is providing environmental protection for a developing understory, as well as for structural diversity and

visual quality. Objectives include retaining dispersed and aggregated trees, providing shade and general buffering from climatic fluctuations and not necessarily providing seed for the next generation of trees. Residual stocking is approximately 20 to 25 healthy trees per acre (dominants, codominants, and intermediates; tree spacing about 40 to 55 feet) displaying stout height-diameter ratios and live crown ratios greater than 30 percent. Generally, where regeneration of resilient seedlings is favorable, natural regeneration is prescribed. Otherwise, a SW would be planted with seedlings of resilient tree species; typically, a mix of Douglas-fir, ponderosa pine, sugar pine, western larch, and western white pine. In most cases, the shelterwood would remain standing through the next generation, called a "reserve" shelterwood. Where disease persists or economic necessities arise, the reserve trees could be harvested, providing that on-site regeneration and resources at-risk remain protected. Follow-up treatments include a precommercial thin, seed tree, or partial overwood retention.

Shelterwood Light (SWL): Treatment is like a conventional shelterwood, but retains fewer trees per acre, mostly due to dwarf mistletoe. In terms of residual stocking (approximately ten to fifteen tress per acre; tree spacing about 55 to 65 feet), a SWL is situated between a seed tree and a fully stocked shelterwood. Retained dispersed and aggregated trees (dominants, codominants, and intermediates) provide a variety of structural and legacy features for biodiversity and aesthetics, as well as some environmental protection for a developing understory. Generally, following harvest, areas would be planted with seedlings of resilient conifer species; typically, a mix of Douglas-fir, ponderosa pine, sugar pine, western larch, and western white pine. Follow-up treatment includes a precommercial thinning of the developing regeneration.

Skid Trail: A temporary, non-structural pathway over forest soil created by dragging or skidding felled trees or logs from a stump to a log deck. Skidders, fellers and other harvesting equipment use skid trails. Development does not require excavation with equipment (USDA-USFS 2015).

Slash: Coarse and fine woody debris generated during logging operations, *forest activities*, or through wind, snow or other natural forest disturbances (Society of American Foresters 2008).

Stand: 1. Ecology - a contiguous group of similar plants; 2. Silviculture - a contiguous group of trees sufficiently uniform in age-class distribution, composition, and structure, and growing on a site of sufficiently uniform quality to be a distinguishable and manageable; Note 1 - a mixed stand is composed of a mixture of species; Note 2 - a pure stand is composed of essentially a single species; Note 3 - in a stratified mixture stand different species occupy different canopy strata (Society of American Foresters 2015).

Standard: Rules that must be followed in managing natural resources on the Warm Springs Reservation.

Stony, soil: Material that is 15 to 35 percent, by volume, rounded or partially rounded fragments 10 to 24 inches in diameter. Very stony material is 35 to 60 percent of these rock fragments, and extremely stony material is more than 60 percent (NRCS 1998).

Sub-Forest Planning Unit (SFPU): A subdivision of the larger forest planning units. Sub-FPU boundaries represent planning subdivisions primarily associated with the transportation network.

Thermal Cover: A vegetative canopy and associated stem and branch structure which modifies the ambient air temperature for wildlife located in that cover patch.

Watershed: A region or area bounded peripherally by a divide and draining ultimately to a particular watercourse or body of water.

Wetland: A land area that is saturated with water, either permanently or seasonally, such that it takes on the characteristics of a distinct ecosystem.

Wildlife Management Zone (WMZ): Areas designated on the CTWS that would be managed to achieve specific objectives for the benefit of deer and elk populations.

Windthrow, or blowdown, windfall: Trees fallen or broken-off by the wind.

APPENDIX-G, Acronyms

AC: Allowable Cut.

AUM: Animal Unit Month.

BIA: Bureau of Indian Affairs.

BMP: Best Management Practice.

BNR: Branch of Natural Resources.

CTWS: Confederated Tribes of Warm Springs, Oregon.

DOI: Department of the Interior.

FONSI: Finding of No Significant Impact.

FPU: Forest Planning Unit.

HFR: Hazardous Fuels Reduction.

IRMP: Integrated Resources Management Plan.

LOS: Late-Old Structure.

PA: Project Assessment.

PCT: Precommercial Thin.

PDF: Project Design Feature.

PIDT: Project Interdisciplinary Team.

POR: Partial Overwood Retention.

RMIDT: Resource Management Interdisciplinary Team.

SPFU: Sub-Forest Planning Unit.

ST: Seed Tree.

SW: Shelterwood.

SWL: Shelterwood-Light.

USFS: United States Forest Service.

WMZ: Wildlife Management Zone.

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