BURNED AREA REHABILITATION PLAN

LIONSHEAD FIRE

PROJECT ASSESSMENT

Prepared by:
Lionshead Burned Area Emergency Response Team

TABLE OF CONTENTS

CHAPTER 1.0 - Purpose of and Need for Action

A. BRIEF DESCRIPTION OF PROPOSED ACTION

Lightning sparked the Lionshead Fire, which began August 16, 2020, in Whitewater Canyon on the Warm Springs Reservation approximately 14 miles west of the Warm Springs community. Several fires were reported that evening on trust land on the reservation including the P515 Fire and the Lionshead Fire. The P515 and Lionshead Fires grew larger and eventually merged together. They have been assessed together in this plan under the Lionshead Fire name. An historic windstorm arrived in the area on Monday, September 7, rapidly spreading the fire west onto the Willamette, Deschutes and Mt. Hood National Forests. The Lionshead Fire has heavily impacted several communities in the Santiam drainage and Breitenbush area, including the loss of 264 homes in Detroit. Highly valued tribal natural and cultural resources were affected. The fire burned 204,469 acres of which 96,266 acres are on the Warm Springs Reservation.

A Burned Area Emergency Response (BAER) Team was activated by the Superintendent and Tribal Branch of Natural Resource Manager on September 1, 2020 to assess impacts of the Lionshead Fire on the reservation. Most individual team members were provided by the local Tribe/Agency staff. See Chapter 2.0 for a detailed description of the Proposed Action (specifications) for the Lionshead Fire Rehabilitation Plan (Rehab Plan). The following treatments are proposed:

- Planting – 26,971 acres
- Seedling Procurement – 26,971 acres
- Stocking Surveys – 26,971 acres
- Site Preparation – 16,182 acres
- Pest Management – 20,541 acres
- Aerial Photography – Post-fire assessment
- CFI Plot Reestablishment – 383 plots

All projects proposed in the Lionshead Burned Area Emergency Response (BAER) Plan that are prescribed, funded, or implemented by federal agencies on the Warm Springs Reservation are subject to compliance with the *National Environmental Policy Act* (NEPA) in accordance with the guidelines provided by the *Council on Environmental Quality (CEQ) Regulations (40 CFR 1500-1508)*. This Appendix documents the BAER Team considerations of NEPA compliance requirements for prescribed emergency stabilization, rehabilitation and monitoring actions described in this plan for tribal trust acres affected by the Lionshead Fire on the Warm Springs Reservation. For any proposed activities not addressed in this plan, the BIA must complete separate NEPA analyses and compliance documentation.

B. PURPOSE AND NEED FOR ACTION

1. The Confederated Tribes of the Warm Springs Reservation of Oregon, a federally recognized Indian tribe, (Tribe) is a federally-recognized Tribe and is organized pursuant to the Indian Reorganization Act of 1934, 48 Stat. 984, as amended by the Act of June 15, 1935, 49 Stat. 378. The Tribe is legal successor in interest to the Indian signatories of the Treaty with the Tribes of Middle Oregon of June 25, 1855, 12 Stat. 963 (1855 Treaty). The Tribe possesses inherent sovereignty, which includes the right to self-government and self-determination. The Tribe also has a trust relationship with the United States that is defined by the United States Constitution, the 1855 Treaty, federal statutes, Executive Orders and court decisions.

2. Pursuant to the 1855 Treaty, the Tribe reserved approximately 644,000 acres for a permanent homeland in north central Oregon. The Warm Springs Reservation contains substantial forested areas that contain many resources, including, without limitation, water and riparian, fish and aquatic, wildlife, cultural, and timber.

3. Pursuant to Title IV of the Indian Self-Determination and Education Assistance Act, Pub. L. 93-638, the Tribe and the United States Department of the Interior (Interior) have entered into a compact of Self-Governance (Compact). Pursuant to the Compact, the Tribe has assumed responsibility for the implementation of, among other things, Interior's forestry program (Forestry Program), which was previously administered by the Bureau of Indian Affairs (BIA). In the Compact, the United States expressly reaffirms its trust responsibility to protect and conserve the trust resources of the Tribe and its members.

4. The Tribe has delegated the implementation of the Forestry Program to BNR Forestry. BNR Forestry undertakes forest land management activities pursuant to the Compact and the National Indian Forest Resources Management Act, 25 U.S.C. §§ 3101 *et seq*., (NIFRMA) and its implementing regulations, 25 C.F.R. Part 163.

5. Forest land management activities undertaken by BNR Forestry are designed to achieve multiple objectives including, but not limited to, the maintenance and improvement of timber productivity, grazing, wildlife, fisheries, recreation, aesthetic, cultural and other traditional values. BNR Forestry's forest land management activities are also designed to achieve the development of the Tribe's forest lands and associated value-added industries by the Tribe to promote self-sufficiency and so that the Tribe may receive from its forest land not only stumpage value but also the benefit of all labor and profit that such forest land is capable of yielding.

The purpose of the proposed Rehab Plan is to determine the need for, and to prescribe and implement, treatments (specifications) to minimize threats to life or property or to stabilize and prevent further unacceptable degradation to natural and cultural resources resulting from the effects of fire. If rehabilitation does not occur resource damage would continue uncontrolled and without mitigation.

C. PROJECT AREA DESCRIPTION

The Lionshead Fire grew to 204,469 acres of which 96,266 acres fall within the Warm Springs Reservation boundary. The fire spread across the southwestern portion of the reservation's forests with terrain varying from gentle benches to steeply sloped canyons. Several drainages including Parker Creek, Whitewater River, Shitike Creek, Boulder Creek, Mill Creek, Cedar Creek and Boulder Creek fall within the fire boundary on the reservation.

D. CONFORMANCE WITH APPLICABLE LAND USE PLANS

The Lionshead Fire BAER Plan was reviewed for consistency with relevant plans and policies related to Warm Springs trust lands impacted by the fire. Below are brief descriptions of plans referenced in the development of the Lionshead Fire BAER Plan.

Confederated Tribes of Warm Springs Reservation of Oregon, Integrated Resources Management Plan for the Forested Area and Rangelands, 2012 (Warm Springs IRMP)

Confederated Tribes of Warm Springs Reservation of Oregon, Forest Management Implementation Plan, 2012 (Warm Springs FMIP)

Tribal Vegetation Management Noxious Weed Control Plan and Assessment, 2014

The Warm Springs IRMP was reviewed by the BAER Team prior to the development of the BAER Plan to ensure that proposals developed for the Plan would be consistent with the Tribe's policies related to resource management. The IRMP conforms in scope to 25 CFR Part 163 which outlines the objectives for forest management planning on tribal lands.

E. APPLICABLE LAWS AND EXECUTIVE ORDERS

This section documents consideration given to the requirements of specific environmental laws in the development of the Lionshead Fire BAER Plan. Specific consultations initiated or completed during development and implementation of this plan are also documented. The following executive orders and legislative acts have been reviewed as they apply to the Lionshead Fire BAER Plan.

National Historic Preservation Act (NHPA). Certain BAER treatments may have the potential to affect significant cultural resources and thereby require the federal agency to comply with NHPA and as promulgated under 36 CFR Part 800. To assist the Warm Springs Agency in meeting NHPA compliance, the Tribal Historic Preservation Officer was consulted and informed that a BAER team was preparing a plan to address issues that were identified concerning potential post-fire risks to human life, property and important cultural and natural resources from the Lionshead Fire. A cultural resource assessment was conducted and it was determined that there were no proposed BAER Rehabilitation treatments that would impact significant cultural resources, thus negating the need for formal consultation under Section 106 of the NHPA.

Executive Order 11988, Floodplain Management. No proposed treatments would occupy or modify floodplains and all proposed treatments are in compliance with this order.

Executive Order 11990, Protection of Wetlands. No proposed treatments would result in long-term impacts to or loss of wetlands and all proposed treatments are in compliance with this order.

Executive Order 12372, Intergovernmental Review. Coordination and consultation is ongoing with affected Tribe, Federal, and local agencies.

Executive Order 12892, Federal actions to address Environmental Justice in Minority and Low-Income Populations. Federal actions must address and identify, as appropriate, disproportionately high and adverse human health or low-income populations, and Indian Tribes in the United States, The BAER Team has determined that the actions proposed in this plan will result in no adverse human health or environmental effects for minority or low-income populations and Indian Tribes.

Endangered Species Act. The BAER Team has consulted with US Fish and Wildlife Service and National Oceanic and Atmospheric Administration Biologists regarding actions proposed in this plan and potential effects on federally listed species and has determined that there is No Effect on threatened and endangered species.

Clean Water Act. All proposed treatments are in compliance with this Act. Rehabilitation measures proposed are necessary to maintain clean water within the burn and adjacent areas. Long-term impacts are considered beneficial to water quality.

Clean Air Act. Federal Ambient Air Quality Primary and Secondary Standards are provided by the National Ambient Air Quality Standards, as established by the U.S. Environmental Protection agency (EPA) (Clean Air Act, 42 U.S.C. 7470, et seq., as amended). The BAER Team has determined that treatments prescribed in the Lionshead Fire Plan will have short-term minor impacts to air quality due to equipment emissions and/or increase in particulates during ground-based activities, but they that would not differ significantly from routine land use practices for the area. As such, all proposed treatments are in compliance with this Act.

F. ISSUES CONSIDERED

During the initial agency briefing meeting with the BAER Team on September 1, 2020, the Confederated Tribes of Warm Springs (CTWS) identified many biological, cultural, and other environmental resources

issues potentially affected by the fire and/or suppression activities:

- ***Impacts to timber resources and reforestation of commercial forest lands***
- ***Watershed stability***
- ***Sedimentation and loss of soil productivity***
- ***Potential impacts to Threatened and Endangered Species***
- ***Impacts from fire suppression activities***
- ***Fire and fire suppression impacts to archaeological and cultural resources***

Some of these concerns were addressed under the Lionshead Emergency Stabilization Plan whereas others are covered under the Lionshead Rehabilitation Plan.

CHAPTER 2.0 – Alternatives including the Proposed Action

A. ALTERNATIVE I – NO ACTION

Under the NEPA required alternative of No Action, the CTWS would choose not to implement the proposed treatments in the Rehabilitation Plan. All natural resources would be left to the process of natural rehabilitation.

B. ALTERNATIVE II – IMPLEMENTATION OF TREATMENT SPECIFICATIONS (PROPOSED ACTION)

This alternative would allow the CTWS to proceed with implementation of specifications to mitigate the effects of the Lionshead Fire. Each treatment is discussed in detail in the Rehabilitation Plan. The proposed treatment specifications include:

Planting
A specification has been prepared to reforest high mortality acres identified by ground reconnaissance. All sites that have been identified for this treatment are void of adequate seed sources to regenerate the acres identified. Total area identified for reforestation is 26,971 acres. Planting would occur in spring. This specification meets the objectives as stated in the Delegation of Authority from the BIA Superintendent. Treatment effectiveness would be monitored (see specification 3). A mix of native conifers prescribed in the Warm Springs FMIP for each plant association will be planted with a majority of Douglas- fir and ponderosa pine. Trees on all units will be planted at a spacing of 8’ by 8’ resulting due to harsh sites to ensure adequate stocking at their rotation age. The purposes of the treatment are to maintain the ecological integrity of the areas by re-stocking the operational areas of the fire and to provide future forests, habitat and income to the Tribes.

Seeding Procurement
A specification has been prepared for seed/seedling procurement for reforestation acres identified during ground reconnaissance. All sites that have been identified for this treatment are void of adequate seed sources to regenerate the acres identified. Fire affected areas will be planted with majority Douglas-fir and ponderosa pine. Trees on all units will be planted at a spacing of 8’ x 8’. Seedlings will be procured from the following regional nurseries based upon stock type and species: Kintigh Mountain Home Ranch, Springfield, OR, Seven Oaks Native Nursery, Albany, OR, IFA Nurseries, Inc. Wilsonville, OR, Lava Nursery, Inc., Parkdale, OR, Silvaseed Company Inc., Roy, WA, Green Diamond Resource Company, Seattle, WA and USDA Forest Service J. Herbert Stone Nursery, Rogue River NF, Central Point, OR. The purpose of the treatment is to maintain the ecological integrity of the area by re-stocking the operational areas the fire affected. To provide future forests, habitat and income to the tribes.

Stocking Surveys
A specification has been prepared to perform stocking surveys. Stocking surveys are done in the fall of each year on reforestation plantations to ensure target stocking levels have been met on all units. This

monitoring process is the basis for re-treatment prescriptions if required. All areas and existing units that have been designated for reforestation within the burned area perimeter will have stocking surveys. Stocking survey design is a grid sample on a frequency of 1 plot per acre. Seedling survival, number of live trees, species, competition, and seedling damage are recorded for this region of the reservation. Natural regeneration is also recorded on these plots; however, little or no seed source remains on these areas on this fire. The purpose is to ensure that target numbers of seedlings specified in the Warm Springs FMIP are present on all commercial acres.

Site Preparation
A specification has been prepared for site preparation. The area to be reforested needs site preparation to ensure successful seedling establishment. Reducing competition for newly planting seedlings is essential for survival and growth on these moisture-limited sites. The first year of planting will be done without site preparation. After that time the brush will outcompete the planted trees without site preparation. Site preparation will be required in the areas with the most brush competition, management groups 1, 2, 3 and 4. Site preparation will not be required in the first year after the burn. Site preparation locations are all identified on the map titled Treatments. Competing vegetation will be site-prep sprayed with herbicides in the area where seedlings will be planted. The purpose of site preparation is to ensure survival and growth of newly planted seedlings. Controlling competing vegetation is a significant factor in successful establishment of plantations on these sites due to limited moisture availability.

Pest Management
A specification has been prepared for pest management. Based on historic results of stocking surveys gopher trapping will be required to facilitate and maximize seeding survival. All areas that have been identified as high risk for gophers that will be reforested within the burned area perimeter will be treated. These are areas that are within management groups 3 and 4. Traps will be placed at optimal locations within plantations to meet trapping objectives. The purpose of the treatment is to insure that target numbers of seedlings are surviving to meet reforestation goals specified in the forest management implementation plan.

Aerial Imagery and Orthophotography
A specification has been prepared for aerial photography acquisition. The treatment will provide an aerial photography flight to provide multispectral (4-band) orthoimagery at 0.25 meter resolution. The flight would cover the forested area of the Lionshead Fire. Acquisition of aerial photography will cover the extent of the Lionshead Fire located on the Warm Springs Reservation, approximately 125,000 acres. Orthophotography will be collected during peak sun angles for the day, under clear conditions with minimal cloud cover. The collected digital photographs go through multiple processing steps to create the final product. Adjusted images will be orthorectified to the Tribes lidar-derived ground model and airborne global positioning system (AGPS). Photo identified landmarks will serve as supplemental control points for geo-spatial correction and evaluation of accuracy. The resulting spatial accuracies (RMSE) are routinely < 12 pixels. A digital file of project will be included in the deliverable package projected in NAD 83, UTM Zone 10N. The purpose of the specification is to add to baseline data that will be used as a tool for documenting fire mortality, quantifying forest change, monitoring of fire effects, and post fire management planning activities.

CFI Plot Reestablishment
A specification has been prepared for aerial photography acquisition. The treatment will locate and reestablish 383 Continuous Forest Inventory (CFI) plots on the Warm Springs Reservation that were damaged by the fire. Plots are all located within the burned area perimeter identified on the map in Appendix III titled Treatments. The treatment will locate plots on the ground based on CFI data sheets location descriptions and assess damage to bearing trees and tree tags on each plot within the burn. In addition, the treatment will establish new bearing trees if necessary, locate plot centers, and mark/retag all trees within the plot. The purpose is to reestablish all CFI plot locations to maintain inventory growth records for the area.

CHAPTER 3.0 - Affected Environment

This chapter describes environmental and cultural components potentially affected by the implementation of the Rehabilitation Plan. More in depth and detailed information on these components can be found in the Resource Assessments (Appendix I) of the Rehabilitation Plan.

The following critical elements of the human environment are not present or are not affected by the Proposed Action or alternative and are not addressed in this Project Assessment:

- Public safety
- Operations

The following critical elements and resources brought forward for analysis of effects from proposed management actions:

A. WATER

The Lionshead Fire burned notable acres in nine different watersheds within the boundaries of the reservation; Jefferson Creek, the Upper Metolius, Whitewater, Upper Shitike, Middle Shitike, Lower Mill, Upper Mill, Middle Warm Springs, and Badger Creek. A total of 106 miles of Class 1, 373 miles of Class 2, and 435 miles of Class 3 streams occur within the fire perimeter. The major creeks included in this count are Parker Creek, the Whitewater River, Shitike Creek, Boulder Creek, Mill Creek, and Cedar Creek. Elevations within the fire area range from 8,000 feet on the slopes of Mt Jefferson down to 2,850 feet near Sawmill Butte. Average annual precipitation within the fire area ranged from nearly 100 inches per year on Mt Jefferson to less than 20 inches on the eastern edge of the fire. Most precipitation falls during the winter as snow accumulates as snowpack and melts during the spring and early summer. Rain-on-snow events are common in the Cascade Range, and usually produce the greatest floods in this area.

B. SOILS

Soils within the perimeter of the Lionshead Fire have mostly been created from eroded andesite and basalt, with a strong component of ash. This makes much of the area extremely porous and results in very little runoff. The exception to this is found along the valley bottoms, which contains primarily fluvially deposited soil, which tend to be finer grained and much less porous. Within the fire area, 13,800 acres of ground are both rated as highly erodible and suffered from a moderate to high burn severity. Most of these areas are found along the canyon walls of Whitewater, upper Shitike, Boulder, and Mill Creeks.

Wildfire can have a number of different effects on soil, including water repellency (hydrophobicity), changes in vegetative ground cover, soil structure, and susceptibility to water erosion. Hydrophobic soils are formed when organic material found within the soil volatilizes and then forms a waxy surface on the soil surface. This can dramatically increase storm-generated runoff as precipitation is prevented from infiltrating into the soil profile. The loss of soil structure results in powdery soil that is very easily erodible.

C. CULTURAL RESOURCES

Previous cultural resource survey and inventory efforts within the area burned by the Lionshead Fire (about 28 percent of the Project APE has been surveyed) indicate that the Project APE has a Low probability for the presence of significant archaeological resources. For this reason, and in consideration of the specific methods of planting (very minor disturbance) the THPO and Cultural Resource Department

recommends that the proposed planting activities will have *No Adverse Effect* on such properties. Any areas proposed for planting that are within areas deemed by the THPO to have a Moderate to High potential for such resources will be subject to survey and inventory efforts in advance of Project implementation. In addition, previously recorded sites will be flagged for avoidance, and crews will be instructed on how to report any suspected archaeological resources so that they can be documented and added to the THPO sites database.

With regard to cultural plants, it appears that a portion of the Project APE is within huckleberry areas. Consultation between concerned stakeholders (including but not limited to the Forestry Department, Forestry Committee, Culture & Heritage Committee, and the Cultural Resources Department) will lead to recommendations about best practices to enhance huckleberry growth and regeneration.

D. WILDLIFE

Mule deer, Rocky Mountain goats, Rocky Mountain elk, and Roosevelt elk are common within the project area. Deer and elk populations have been steadily meeting the tribe's IRMP management goal of maintaining standard buck-to-doe and bull-to-cow ratios over the past few years. Northern spotted owl, wild turkey, black bear, mountain lion, bobcat, ruffed and blue grouse, and many other wildlife species also inhabit the area. Tribal members are dependent on deer and elk for subsistence and the preservation of their hunting culture. Intact and functioning ecological systems that produce wildlife for traditional subsistence use have intrinsic and instrumental value. Wildlife species that are utilized for subsistence are invaluable by tribal members.

Previous land management activities such as timber harvest, fire suppression, and grazing have had landscape-level effects in the proposed treatment area. Much of the area consisted of a mix of habitat connectivity that provided large amounts of escapement cover, resulting in highly productive use by big game and other wildlife species and birds. The Lionshead Fire has removed this escapement cover across much of the burned area, and it will take decades to return. The current state of the treatment area is heavily burned land with very little vegetation interspersed with isolated patches of habitat. Whether or not the area is treated, we will see changed species interactions and population numbers, elevated rates of predation, and increased edge effects. The land has been reset to an early successional habitat, and how long it remains that way will be dependent upon whether or not the area is treated. With treatment, the habitat will return to a forested area much quicker, providing essential habitat for forest species and escapement cover that is critical for the success of big game populations.

The Lionshead Fire converted 57% of the remaining suitable Northern Spotted Owl (NSO) habitat on the reservation to unsuitable habitat. In the last decades, the reservation has seen a stark decline in the numbers of NSO pairs nesting on the reservation. This is in part due to the encroachment of Barred Owls into the western United States. Their already dwindling population combined with the impact of the Lionshead Fire to their remaining habitat does not bode well for their future success. Simply replanting the fire area does not solve this problem, as they require old growth forests for nesting. It will be centuries before the treatment area reaches this successional stage. And the surrounding forest stands that could reach an old growth stage sooner are already occupied by Barred Owls. We will have to survey the reservation’s historical owl activity centers in the coming years to determine the fire’s long-term impact to the NSO population.

E. FISH

Reforestation treatments are distributed throughout the southwest portion of the Warm Springs Reservation of Oregon (Reservation/CTWSRO) that was burned in the 2020 Lionshead Fire (Fire). The Fire burned an area of approximately 96,226 acres. The reforestation treatments cover 26,971 acres spread across the burned area. Treatment areas are distributed among the Lower Deschutes, Upper Deschutes, Middle Willamette, North Umpqua, and Lower Crooked subbasins. Treatment locations can

be divided further among nine subwatersheds: Badger Creek, Mill Creek Canal, Upper Mill Creek, Boulder Creek, Lower Mill Creek, Upper Shitike Creek, Whitewater River, Metolius Bench-1 (Upper Metolius River), and Jefferson Creek. These subwatersheds contain streams with documented populations of two fish species listed under the Endangered Species Act (ESA), mid-Columbia River summer steelhead (steelhead) (*Oncorhynchus mykiss*) and bull trout (*Salvelinus confluentus*) (Figure 3). Some of these streams also contain other culturally important salmonid species including Chinook salmon (*Oncorhynchus tshawytscha*) and resident redband trout (*Oncorhynchus mykiss*), as well as culturally important Pacific lamprey (*Entosphenus tridentatus*). Streams within this area that contain ESA-listed and/or other culturally significant species (listed in order of north to south) include (Table 1):

- Mill Creek: Mill Creek provides critical spawning and rearing habitat for steelhead and possibly supports a population of bull trout; however, information regarding bull trout in Mill Creek is limited to anecdotal accounts. Mill Creek also provides critical spawning and rearing habitat for spring Chinook salmon, resident redband trout, and Pacific lamprey.
- Boulder Creek: While Boulder Creek is ephemeral, annual redd surveys and fish counts conducted by CTWSRO fisheries staff have shown that it provided spawning and rearing habitat for steelhead. Boulder Creek also provides habitat for resident redband trout.
- Shitike Creek: Shitike Creek produces the greatest number of both steelhead and bull trout of any single stream on the Reservation. The Creek supports a robust population of migratory (fluvial) bull trout, which is particularly important, as this life history pattern has experienced steep declines among bull trout populations in other Reservation streams, e.g., the Warm Springs River. Additionally, Shitike Creek provides critical spawning and rearing habitat for spring Chinook salmon, resident redband trout, and Pacific lamprey.
- Whitewater River: The Whitewater River provides critical spawning and rearing habitat for bull trout. Bull trout spawning activity has been documented in the Whitewater River by both CTWSRO and Oregon Department of Fish and Wildlife (ODFW) surveys.
- Milk Creek: Bull trout have been documented in Milk Creek.
- Parker Creek: Bull trout have been documented in Parker Creek by CTWSRO surveys.
- Jefferson Creek: Jefferson Creek provides critical spawning and rearing habitat for bull trout. According to one report, the Creek is a “major spawning ground for adfluvial bull trout,”, and spawning activity has been documented in multiple surveys conducted by CTWSRO Fisheries Department staff.

Among these streams, Mill Creek, Shitike Creek, and Jefferson Creek are particularly important, as each supports robust populations of one or both ESA-listed species, along with other culturally important salmonids. The importance of these creeks is shown in annual redd counts that are conducted by the CTWSRO Fisheries Department to monitor salmonid populations in Reservation streams. Redd counts are one of the principal metrics used for monitoring Columbia River Basin salmonid populations, as the method gives a good indication of spawning success, and the temporal and spatial distribution of spawning activity. Annual redd counts have been conducted in Mill Creek, Shitike Creek, and Jefferson Creek for mid-Columbia River summer steelhead, bull trout, and Chinook salmon, and serve to provide a metric of these fish populations over time:

- Mill Creek: Since steelhead redd counts began in Mill Creek in 1982, the Creek has produced an average of 11 steelhead redds per year, with a maximum of 37 redds in 2016. Spring Chinook salmon redd surveys have been conducted in Mill Creek since 1980, with an average of 21 redds per year and a maximum of 120 redds in 2001. This makes Mill Creek a significant producer of both species.
- Shitike Creek: Bull trout redd surveys began in Shitike Creek in 1998, and since then, the Creek has produced an average of 92 bull trout redds per year, with a maximum of 204 redds in 2002. Shitike Creek has produced an average of 52 steelhead redds per year since surveys began in 1982, with a maximum of 138 redds in 2015. This makes Shitike Creek the largest producer of both bull trout and steelhead of any single stream on the Reservation. Shitike Creek is also a significant producer of spring Chinook salmon, with an average of 32 redds per year since surveys began in 1998, and a maximum of 109 redds in 2004.

- Jefferson Creek: Jefferson Creek is a significant bull trout producing stream and has produced an average of 54 redds per year since surveys began in 1986 and a maximum of 182 redds counted in 2003.

The Whitewater River is also a fairly significant bull trout producing stream; however, no reforestation treatments are planned in its immediate vicinity. Bull trout have also been documented in Parker Creek, a tributary of Jefferson Creek, and in Milk Creek; however, there are fewer data regarding bull trout in these streams, and they likely support smaller bull trout populations. Additionally, while steelhead redds have been documented in Boulder Creek, redd counts have always been low, with over half of annual redd surveys finding no steelhead redds in the Creek. Also, Boulder Creek is ephemeral, and for these reasons, is not considered to be as significant of a concern as the other two steelhead-bearing streams (Mill Creek and Shitike Creek) within the fire area.

Mill Creek and Shitike Creek also provide habitat for Pacific lamprey. While Pacific lamprey is listed as a "species of concern" by ODFW, it is not as vulnerable as salmonids to certain risk factors (increased fine sediment transport into streams) associated with the Fire. Pacific lamprey is therefore not considered as great of a concern regarding the Fire and proposed treatment as are salmonids.

The reforestation treatments described in the present assessment are expected to pose minimal, if any risk to fish populations or critical fish habitat, and therefore no negative effects are expected. Conversely, the actions may have a positive effect, as the planting and seeding treatments will promote soil stabilization in areas that have undergone heavy losses of vegetation. This will help mitigate transport of fine sediments into streams within the Lionshead Fire burn area. Installation of protective fencing may further benefit fish populations, as it will help keep livestock and wild horses out of sensitive and fire damaged areas, thus reducing additional ground disturbance and sediment transport.

Care should be taken to ensure that herbicides are not introduced into streams or riparian areas, either directly or through soil leaching. Adherence to proper standard operating procedures (see below), as well as the standards set in the Tribes' *Integrated Resource Management Plan*, should be strictly followed to minimize these risks. Additional care should be taken to minimize the use of roads when implementing the treatments. Forrest roads are a primary contributor of fine sediments into streams. Minimizing road use as much as possible will help mitigate sediment inputs into streams due to increased traffic associated with the reforestation treatments.

F. TIMBER

The Lionshead and P-515 fires occurred on the east slope of the Cascade Range in conifer forests at elevations ranging from 2,980 to 5,320 feet. In the higher elevations the overstories are composed of mountain hemlock, subalpine fir, noble fir, lodgepole pine, Douglas fir, western larch, western white pine, and ponderosa pine. In the lower elevations Douglas fir, ponderosa pine, and grand fir dominate the stands. Understory vegetation is composed of shrubs, sedges, grasses and forbs. The primary shrub species are Oregon boxwood, chinkapin, snowbrush/ceanothus, manzanita and grouse whortleberry. These fires were initiated following lightning storm events.

The Lionshead started near the summit of Lionshead Butte. The fire was somewhat small until a front moved in from the east and pushed the fire from Lionshead Butte around Mt. Jefferson and Olallie Butte to the town of Detroit, Oregon around September 9th, 2020. About a week later the fire made another push driven by winds from the southwest, northeast towards Sawmill Butte and the B-140 mainline road. Fire crews were able to hold the fire in these approximate locations. During this time the Lionshead Fire also merged with the P-515 fire near North Butte on the P-600 road system.

This area consists of about one third of the Tribes commercial timber base. Reforestation of these areas

of the commercial forest is critical to the long term economic base and an important source of jobs for the Tribe. Revenue from timber has provided a significant portion of tribal income for many decades.

G. NOXIOUS WEEDS

The spread of noxious weeds into previously undisturbed sites is of concern to CTWS Range and Agricultural Department as infestations can have lasting and sometimes irreversible repercussions to ecosystem structure and stability. Most noxious weeds are early successional opportunistic species that produce many seeds and establish quickly, thereby out-competing native species for space, water, sunlight and nutrients.

While there are natural processes that contribute to noxious weed dispersal like wind, seasonal flooding and animal movements, human and mechanical disturbances are the primary mechanisms for establishment and spread of noxious weeds. Newly disturbed areas are most vulnerable to noxious weed introduction and roads are common avenues of invasion, as seeds are carried from occupied areas into newly disturbed unoccupied areas.

Fire management activities, motor vehicle traffic and logging operations present key dispersal opportunities for noxious weed seeds as the seeds attach to tires/tracks and various other logging-related substrates. How and when seed detachment occurs is a random event and could take place within feet or miles from the seed source.

Weed species that have been identified around the Lionshead Fire Complex include diffuse knapweed (*Centaurea diffusa*), spotted knapweed (*Centaurea maculosa),* mediterranean sage *(Salvia aethiopis*), scotch thistle (*Onopordum acanthium)* and tansy ragwort *(Senecio jacobaea*). The local occurrences of these species raise concern that noxious weeds occupying nearby sites will be transported and then ultimately spread vicinity wide. Infestations of the species listed above have been located along major roads and secondary roads en route to the sale area. Incident levels have been classified as mild to moderate with knapweed species being most prominently detected along the roadways. The primary transport mechanism for knapweed into newly disturbed areas is via motorized vehicles.

Of special mention will be the need to adhere to vehicle washing guidelines.

Noxious weeds have not been detected within the sale area, although since noxious weed species do inhabit adjacent roadways and because off reservation equipment and machinery have unknown weed associations, reforestation treatments could inadvertently result in noxious weed establishment within treatments sites. The same can be true for the inadvertent spread of invasive annual grasses that occupy vast stretches of the reservation rangeland, although the spread of these species into the upper forested areas is controlled somewhat by forest composition and elevation change. Cheatgrass and medusahead are uncommon in mature forest stands but can establish when disturbance creates open exposed sites.

CHAPTER 4.0 – Environmental Consequences

The BAER Team has reviewed appropriate physical and biological resources in the proposed project areas. As part of the design process and environmental evaluation, the Team considered whether the impacts on physical and biological resources would have subsequent economic and social effects.

The following section addresses the issues raised and the potential impacts of implementing the proposed
rehabilitation treatments on 7 key resource disciplines: 1) Water, 2) Soils, 3) Cultural Resources, 4) Wildlife, 5) Fish, 6) Timber, and 7) Noxious Weeds.

A. WATER

Alternative I - No Action
Large openings in the forest canopy created by the fire will offer less interception of snow and rain than under pre-fire conditions. More snow pack may accumulate in these openings and either prolong duration of the snow pack during spring melt or be available for rapid melt during rain-on-snow storms. Remaining stems and tree boles in these openings offer minor wind resistance and have some modifying effects to wind-driven rain-on-snow events. Such effects will be temporary and deteriorate over the next decade as stems decay and fall. Little change in snow pack conditions and response to rain-on-snow events is expected between post-fire conditions and salvage harvesting of burnt timber.

High mortality of forest cover occurred in many regions of the fire, but were especially concentrated in the upper regions of Shitike Creek, Whitewater River, and throughout the Boulder Creek, Upper Mill, and Cedar Creek watersheds. Many of the streams that drain the eastern slopes of Bald Peter into the Metolius are ephemeral until they near the Metolius indicating that pre-fire conditions did not respond rapidly to runoff. Localized high runoff may occur within the burn area. Off site and downstream effects should be minimal because the naturally high infiltration rates which occur within this area will most likely lead to little increase in natural runoff.

Alternative II - Proposed Action

The replanting of the burned areas would speed the recovery of watershed vegetation and reduce erosion and surface production of sediment, thus improving water quality. The increase in ground cover what will be created by the planting of seedlings in the project area will increase the interception of precipitation and decrease the amount of exposed bare ground. This will drastically reduce the amount of splash erosion occurring over the project area. This occurs as a raindrop strikes the soil surface, oftentimes detaching that soil particle from the ground surface. This is one major component of erosion and sediment delivery that could occur within the fire perimeter.

The presence of seedlings throughout the landscape will also help to disrupt flow paths of runoff. Once runoff and erosion begin, the most direct route downslope allows that runoff to gain energy and thus, increase runoff as it flows. By forcing that runoff around trees, through needles, and over other ground vegetation will help to reduce he energy of that runoff and give the sediment a change to deposit prior to reaching a stream channel.

B. SOILS

Alternative I - No Action
A significant increase in erosion is expected to occur within the fire parameter. Severely burned hillslopes within the fire perimeter can expect erosion rates of up to 1.5 tons/acre for the first couple years following the fire. This is above the natural rate of near 0. The majority of the erosion is expected to occur on the eastern slopes of Bald Peter, and along the valley walls of Whitewater River, Shitike Creek, and Mill Creek.

The high burn severities combined with high rates of mortality lead to large amounts of unprotected soil with decreased soil structure overlaying hydrophobic conditions. This increases the amount of water held in the upper few inches of the soil profile, which also is most likely to have been structurally altered by the fire and has lost the majority of its cohesiveness. These soils are easily detached which can lead to large increases in erosion.
Alternative II - Proposed Alternative
Soil and watershed stabilization following wildland fire would be enhanced by successful reestablishment of plant communities dominated by native or desired plants. Implementing

seeding treatments and planting seedlings would promote faster vegetation recovery and surface stabilization where these treatments are proposed.

Some minor soil compaction may occur along fences as a result of vehicular traffic involved in the replanting effort. Following best management practices and timing use of heavy equipment and other vehicles when soils are dry or frozen will help minimize the risk of compaction. Site preparation treatments involving soil disturbances could also expose soils to short-term water/wind erosion prior to successful seedling establishment. However, these impacts are anticipated to be short-lived, while the benefits to soils from establishment of native or desired plant communities would be long-term.

C. CULTURAL RESOURCES

Alternative I - No Action
The No Action alternative has the potential to increase the impact of post fire effects (including erosion, looting and vandalism) on historic properties and cultural resources within the Project APE, and may result in adverse effects to precontact, historic, and ethnographically important resources. Erosion may also adversely affect the regeneration of culturally important plant species, notably including huckleberry.

Alternative II - Proposed Action

The Preferred Alternative will allow for avoidance of known historic properties and cultural resources through flagging and avoidance of the small number of previously recorded sites within the APE. The recommendations provided by the CRD will allow for an opportunity to document previously unrecorded sites through explicit Inadvertent Discovery protocols and communication with restoration/planting crews. Restoration activities will result in the stabilization of sediments through revegetation (and will reduce potentially adverse erosion-related effects within burned areas). Forthcoming consultation on best practices for huckleberry management will be designed to enhance habitat for these important cultural resources. No Adverse Effects are anticipated under this alternative.

D. WILDLIFE

Alternative I - No Action
The Lionshead Fire has altered the structure of vegetation across the burned area. Areas where the fire burned with high intensity lost a large percentage of both above and belowground woody and herbaceious vegetation. With few to no remaining live trees to serve as a seed source across large portions of the proposed treatment area, it could take decades or more for trees to naturally reestablish themselves on the landscape. Instead, the area would likely remain a brush-dominated landscape for a long time to come.

Most of the burned areas where the structure was altered and high levels of plant mortality occurred provided critical escapement and thermal cover to mule deer, rocky mountain elk, and bighorn sheep. However, the loss of timber stands will allow for the establishment of shrub, grass, and forb species, which would provide increased forage for large game species. Additionally, early successional species and shrub/brush-specialists will benefit from a more open habitat.

Over the long-term, burned areas that do not regenerate from root crowns, rhizomes, or the seed bank due to high levels of burn severity may be suppressed by invasive weeds. Most of the invasive species are unpalatable to wildlife and do not provide adequate cover for game and non-game species. Once these species establish in an area, it is very difficult for native species of shrubs, grasses, and forbs to come back. Establishment and ultimate dominance of the invasive

species also alters the fire regime, favoring more frequent fires. Most native perennial species cannot tolerate fire at the more frequent return interval. Restoration of these areas is costly and often involves intensive weed management activities and re-planting of native species.

Alternative II – Proposed Action
Treating the burned areas will allow for much faster regeneration of forest stands. This will benefit forest specialists in the long term and provide thermal and escapement cover for wildlife species more quickly than a natural regeneration.

With the loss of canopy cover that shades out herbaceous species, forage for large game species and other herbivorous wildlife is expected to be abundant in the short-term. In areas treated with herbicide to reduce competition with planted trees, some of that forage will be reduced. However, since site prep is not being implemented across the treatment area, we still expect there to be a significant increase in available forage. Treating areas where competition is expected to be high with herbicide will also reduce ground fuels, minimizing the risk of another large-scale, high severity fire soon after the first.

E. FISHERIES

Alternative I - No Action
The no action alternative could be quite variable to the vegetation resources of the project area. Short term recovery would not occur without seeding the moderate to high burn severity acres of the sagebrush, greasewood, and riparian plant communities. In sites that are in early- or mid-seral condition, with few perennial grasses, the chances are high that the burned area could become dominated by cheatgrass. In light of increased fire activity and the competitive nature of cheatgrass, the shrub component would likely be slow to reestablish, if at all. Once a site becomes dominated by cheatgrass, it would be difficult and expensive to alter the vegetation to a perennial grass dominated community.

No action could prolong elevated sediment transport into streams due to delayed vegetation recovery. Excessive levels of fine sediment in stream channels affects the growth, survival, and reproduction of salmonids by: 1) interfering with gill function; 2) impeding feeding success and growth; 3) interfering with egg incubation and fry emergence; and 4) impeding juvenile recruitment. The longer it takes vegetation to recover in burned areas, the greater the amount of of fine sediment entering streams. Therefore, the faster riparian and upland vegetation within the burn area recovers, the better it is for local and anadromous salmonid populations and their critical habitat.

Alternative II - Proposed Action
The Proposed Action includes ground and aerial seeding of native and desirable introduced grasses and forbs in areas of moderate to high burn severity or high vegetation mortality. To protect the seeding investment, protective fencing is also proposed. The Proposed Action would also include the control and detection of non-native plants with approved herbicides. The establishment of native and/or desirable introduced perennial grasses and forbs would benefit the understory. The seeded species would effectively compete and ultimately replace the invasive non-native annuals and create an ecosystem that is resistant and resilient to fire and other light and moderate disturbances. The Proposed Action would also help to reduce the Fire Regime Condition Class to either 1 or 2.

The planting and seeding treatments will promote soil stabilization in areas that have undergone heavy losses of vegetation. This will help mitigate transport of fine sediments into streams within the burn area. Installation of protective fencing will also benefit fish populations, as it will help keep livestock and wild horses out of sensitive and fire damaged areas, which will in turn further

reduce ground disturbance and sediment transport.

Care should be taken to ensure that herbicides are not introduced into streams or riparian areas, either directly or through soil leaching. Adherence to proper standard operating procedures, as described above, as well as the standards set in the Tribes' *Integrated Resource Management Plan*, should be strictly followed to minimize these risks. Additional care should be taken to minimize the use of roads when implementing the treatments. Forrest roads are a primary contributor of fine sediments into streams. Minimizing road use as much as possible will help mitigate sediment inputs into streams due to increased traffic associated with the reforestation treatments.

F. FOREST RESOURCE

Alternative I - No Action
The no action alternative could be quite impactful to the forest resources of the project area. Short term recovery would not occur without planting the moderate to high burn severity acres of the conifer tree communities.

In sites that are in early or mid–seral condition, with few perennial grasses, the chances are high that the burned area could become dominated by ceanothus and manzanita. In light of increased fire activity and the competitive nature of these shrubs, the tree component would likely be slow to reestablish, if it were to recover at all. Once a site becomes dominated by ceanothus and manzanita, it would be difficult and expensive to alter the vegetation to a conifer dominated community.

Alternative II - Proposed Action
The Proposed Action includes reforestation of native and desirable conifer species including Douglas-fir, ponderosa pine, western white pine, western larch and noble fir in areas of moderate to high burn severity or high vegetation mortality in the commercial forest. To enhance the likelihood of success after the initial year site preparation in management groups 1, 2, 3 and 4 will be prescribed due to heavy brush competition. To protect the seedling investment, gopher trapping in management groups 3 and 4 is also proposed. The goal is to insure the target number of seedlings are surviving to meet reforestation goals in the management plan. The Proposed Action would also include the monitoring the effectiveness of the treatments with stocking surveys. The establishment of native and/or desirable conifers would benefit the tribal economy over time. The planted species would effectively compete and ultimately replace the brush species and create an ecosystem that is more resilient to fire.

G. NOXIOUS WEEDS

Alternative I - No Action
The no action alternative could be quite variable to the vegetation resources of the project area. Short term recovery would not occur without reforestation of high burn severity acres of the sagebrush, greasewood, and riparian plant communities.

In sites that are in early or mid–seral condition, with few perennial grasses, the chances are high that the burned area could become dominated by invasive annual grasses like cheatgrass and medusahead, if those grasses were present before the fire. In light of increased fire activity and the competitive nature of invasive annual grasses, the shrub component would likely be slow to reestablish, if it were to recover at all. Once a site becomes dominated by cheatgrass or medusahead, it would be difficult and expensive to alter the vegetation to a perennial grass dominated community.

Alternative II - Proposed Action
The Proposed Action includes ground and aerial seeding of native and desirable introduced grasses and forbs in areas of moderate to high burn severity or high vegetation mortality. To protect the seeding investment, protective fencing is also proposed if horses and livestock inhabit the vicinity. The Proposed Action would also include the control and detection of non-native plants with approved herbicides. Without the herbicide treatment, pre-seeding, annual grasses will outcompete the newly established perennial grasses and the system will remain in a degraded state. The establishment of native and/or desirable introduced perennial grasses and forbs would benefit the understory. Herbicide treatment in conjunction with perennial grass seeding will effectively compete and ultimately replace the invasive non-native annuals and create an ecosystem that is resistant and resilient to fire and other light and moderate disturbances. The Proposed Action would also help to reduce the Fire Regime Condition Class to either 1 or 2.

CHAPTER 5.0 – Cumulative Impact Analysis

All resource values have been evaluated for cumulative impacts. Cumulative effects are the environmental impacts resulting from the incremental impacts of a Proposed Action, when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. The rehabilitation treatments for the Lionshead Fire, as proposed in this plan, do not result in an intensity of impact (i.e. major ground disturbance, etc.) that would cumulatively constitute a significant impact on the quality of the environment. A five year reasonably foreseeable timeframe was used since this is the maximum timeframe allowed for implementation and monitoring of the rehabilitation plan.

Previous fires and other management activities that have burned in the area prior to the Lionshead Fire have resulted in the introduction of noxious weeds. Monitoring measures in the emergency stabilization plan and the establishment of planted conifers may have help slow establishment of invasive weeds and allowed native trees, shrubs, forbs, and grass species to recover.

Northern spotted owl populations would continue to decline without reestablishment of the forest component, continuing the trend which led to their listing under the Endangered Species Act. The rehabilitation actions taking place on the fire will accelerate future habitat creation.

Impacts to wildlife include, but are not limited, to the loss or alteration of forage and cover, wildlife may be displaced and avoid areas once inhabited due to the loss or alteration of forage and cover, migration routes may shift, and breeding territories may by abandoned. Unburned habitat within the fire area will continue to serve to support individual owls in the near term.

Roads have been created within and adjacent to the burn area that are associated with various activities such as, but not limited to, access for timber sales, range improvements, hunting, and fire suppression activities. Dozer lines have been created and used in the fire suppression tactics. Soil disturbing activities can cause changes to soil characteristics, such as pulverization or mixing of soil layers, removal of soil either by wind or water erosion, and composition changes when soils become hydrophobic as a result of heat from fires. Changes in the soil characteristics can result in changes to vegetation types and communities as well as changes to runoff and erosion rates. Cumulative impacts to soils may be short term, lasting until soil crusts or vegetation reestablishment occurs or long term due to physical changes and natural elements, such as weathering and erosion.

Cumulative effects on Cultural Resources for this Project are strongly correlated with the potential for erosion to affect intact archaeological deposits. Revegetation and replanting will contribute to the mitigation of these erosional effects. The potential for the removal (looting) of artifacts from sites (based on the increased ground visibility after the burn) will also be mitigated by effective revegetation.

Cumulative impacts to vegetation can include changes in vegetation types and communities. Establishment of nonnative invasive plant or noxious weed species or annuals, such as cheatgrass, can change the characteristics of a vegetation type or community by replacing and eliminating native species from the plant community. Reforestation may retain the characteristics of the vegetation type or community dependant upon the plant species. Conifer seedlings may be used to reestablish native species that have been lost as a result of fire or introduce new species, native or nonnative, to the vegetation type in order to compete with nonnative invasive plant or noxious weed species in order to help restore a productive, diverse and sustainable vegetation community. Changes in vegetation type and plant communities can result in other impacts such as the loss of trees for a multitude of benefits including carbon sequestration, timber value, job generation, loss or alteration of habitat, including forage and cover for wildlife; and the lack of plant diversity and age classification, which may also increase due to wildland fires.

Annual changes in fire occurrence consist of factors such as fuel loads, change in vegetation, and climatic conditions. Wildland fire ignitions are primarily the result of lightning strikes but may also be caused by humans. Wildland fire may impact soils dependant upon the temperatures of the fire. Soils may burn or become hydrophobic. The primary resource impacted by wildland fires is to vegetation. Impacts to vegetation are also dependant upon the temperatures of the fire, which are relative to several factors such as fuel types. Impacts may include, but are not limited to, changes in successional stages of vegetation communities, alteration of habitats for wildlife, and modification of fuel loading.

CHAPTER 6.0 – Consultation and Coordination

A. LIST OF ENTITIES AND/OR INDIVIDUALS CONSULTED

Bureau of Indian Affairs
Darryl Martinez, Post Wildfire Recovery Coordinator
Juliette Jeanne, Deputy BAER Coordinator
Eirik Thorsgard, NWRO Archaeologist

U.S. Fish and Wildlife Service
Carla Burnside, Zone Archaeologist Eastern Washington and North Idaho

B. LIST OF PREPARERS

Rich Botto, Forester, CTWS BAER Team
Marissa Cent, Wildlife Biologist, CTWS BAER Team
Mike McKay, Hydrologist, CTWS BAER Team
Suzi Miller, Vegetation Specialist, CTWS BAER Team
Christian Nauer, Archaeologist, CTWS BAER Team
Cody Payne, Fisheries Biologist, CTWS BAER Team
Eric Phillips, Forester, CTWS BAER Team
Austin Smith Jr., Wildlife Biologist, CTWS BAER Team
Vernon Wolf, Team Leader, CTWS BAER Team

CHAPTER 7.0 – References

Baker, C, and Lovtang, J 2016, *Natural Production Monitoring, January 28, 2016, Monitoring Wild Populations of Spring Chinook Salmon (Oncorhynchus tshawytscha) and Summer Steelhead (Oncorhynchus mykiss) in Tributaries of the Lower Deschutes River within the Boundaries of the Confederated Tribes of the Warm Springs of Oregon Reservation*, The Confederated Tribes of the Warm Springs Reservation of Oregon, Branch of Natural Resources, Fisheries Resource Warm Springs, OR.

Baker, C, Lyman, J, and Combs, C 2019, *Bull Trout Distribution and Abundance in the Waters on and Bordering the Warm Springs Reservation*, The Confederated Tribes of the Warm Springs Reservation of Oregon, Branch of Natural Resources, Fisheries Research Program, Warm Springs, OR.

Baker, C, Lyman, J, and Combs, C 2017, *Bull Trout Distribution and Abundance in the Waters on and Bordering the Warm Springs Reservation*, The Confederated Tribes of the Warm Springs Reservation of Oregon, Branch of Natural Resources, Fisheries Research Program, Warm Springs, OR.

Bash, J, Berman, C, and Bolton, S 2001, *Effects of Turbidity and Suspended Solids on Salmonids*, Washington State Transportation Commission, and United States Department of Transportation, Seattle, WA.

Bennett, D, Connor, W, and Eaton, C 2003, 'Substrate composition and emergence success of fall Chinook salmon in the Snake River', *Northwest Science*, vol. 77, no. 2, pp. 93-99.

Bianchi, D 1963, 'The effects of sedimentation on egg survival of rainbow trout and cutthroat trout', Masters Thesis, Montana State College, Montana.

Bilby, R, Sullivan, K, and Duncan, S 1989, 'The generation and fate of road surface sediment in forested watersheds in southwestern Washington', *Forest Science*, vol. 35, no. 2, pp. 453-468.

Bjornn, T, and Reiser, D 1991, 'Habitat requirements of salmonid streams' in Meehan W (ed), *Influence of Forest and Rangeland Management on Salmonid Fishes and their Habitats*, pp. 83-138 American Fisheries Society Special Publication 19, Bethesda, MD.

Boostrom, G, and Baker, C 2017, *Natural Production Monitoring Progress Report, Jan. 1, 2015 – Dec. 31, 2016: Monitoring Wild Populations of Spring Chinook Salmon (Oncorhynchus tshawytscha) and Summer Steelhead (Oncorhynchus mykiss) in Tributaries of the Lower Deschutes River within the Boundaries of the Confederated Tribes of the Warm Springs of Oregon Reservation*, The Confederated Tribes of the Warm Springs Reservation of Oregon, Branch of Natural Resources, Fisheries Resource Warm Springs, OR.

CTWSO 2018a, *Mill Creek at Potter's Ponds Restoration Project Post-Implementation Status Report*, The Confederated Tribes of the Warm Springs Reservation of Oregon, Branch of Natural Resources, Fisheries Habitat Program, Warm Springs, OR.

CTWSRO 2018b, *Forest Roads Analysis Report for the Warm Springs Reservation*, The Confederated Tribes of the Warm Springs Reservation of Oregon, Branch of Natural Resources, Fisheries Habitat, Warm Springs, OR.

CTWSRO and BIA 2012, *Integrated Resources Management Plan for the Forested Area and Rangelands, IRMP 2012*, The Confederated Tribes of the Warm Springs Reservation of Oregon, Branch of Natural Resources, Warm Springs, OR.

Furniss, M, Roelofs, T, and Yee, C 1991, 'Road construction and maintenance', in Meeham, W.R. (ed.) *Influences of Forest and Rangeland Management on Salmonid Fishes and their Habitats*, U.S. Department of Agriculture, Forest Service: American Fisheries Society Special Publication 19, pp. 297-323.

Gregory, R, and Northcote, T 1993, 'Surface, planktonic, and benthic foraging by juvenile Chinook salmon (*Oncorhynchus tshawytscha*) in turbid laboratory conditions', *Canadian Journal of Fisheries and Aquatic Sciences*, vol. 50, no. 2, pp. 223-240.

Jensen, D, Steel, E, Fullerton, A, and Pess, G 2009, 'Impact of fine sediment on egg-to-fry survival of Pacific salmon: A meta-analysis of published studies', *Reviews in Fisheries Science*, vol. 17, no. 3, pp. 348-359.

Jones, J, and Grant, G 1996, 'Peak flow responses to clear-cutting and roads in small and large basins, Western Cascades, Oregon*', Water Resources Research*, vol. 32, no. 4, pp. 959-974.

Karoglanian, K, 2016*, Stream Habitat Survey Report 2011-2016*, The Confederated Tribes of the Warm Springs Reservation of Oregon, Branch of Natural Resources, Fisheries Habitat Program, Warm Springs, OR.

Koski, V 1966, 'The survival of Coho salmon (*Oncorhynchus kisutch*) from egg deposition to emergence in three Oregon coastal streams', Masters Thesis, Oregon State University, Oregon.

Lovtang, J, and Houslet, B, 1996, *Jefferson Creel Level II Stream Survey*, Deschutes National Forest Sisters Ranger District, Sisters, OR.

Luce, C, and Black, T 1999, 'Sediment production from forest roads in Western Oregon', *Water Resources Research*, vol. 35, no. 8, pp. 2561-2570.

Luce, C, and Wemple, B, 2001, 'Introduction to special issue on hydrologic and geomorphic effects of forest roads', *Earth Surface Processes and Landforms*, vol. 26, no. 2, pp. 111-113.

MacDonald, L, Sampson, R, and Anderson, D 2001, 'Runoff and road erosion at the plot and road segment scales, St. John, U.S. Virgin Islands', *Earth Surface Processes and Landforms*, vol. 26, no. 3, pp. 251-272.

Megahan, W, and Kidd, W 1972, *Effect of Logging Roads on Sediment Production Rates in the Idaho Batholith*, U.S. Dept. of Agriculture, Forest Service, Intermountain Forest & Range Experiment Station, Ogden, UT.

Meyers, C, Sparkman, M, and Klatte, B 2005, 'Sand seals in Coho salmon redds: Do they improve egg survival?', *North American Journal of Fisheries Management*, vol. 25, no. 1, pp. 105-121.

NMFS 2009, *Middle Columbia River Steelhead Distinct Population Segment ESA Recovery Plan*. Available from: https://www.salmonrecovery.gov/Files/RecoveryPlans/mid-c-plan.pdf [20 June 2019].

NOAA 2006, *71 FR 834 – Endangered and Thtreatened Species: Final Listing Determinations for 10 Distinct Population Segments of West Coast Steelhead*. Available from: https://www.govinfo.gov/content/pkg/FR-2006-01-05/pdf/06-47.pdf [20 June 2019].
NWPCC 2005, *Deschutes Subbasin Plan*. Available from: https://www.nwcouncil.org/sites/default/files/EntirePlan_1.pdf [12 June 2019].

ODFW 2016, *Oregon Department of Fish and Wildlife, Sensitive Species List*. Available from: https://www.dfw.state.or.us/wildlife/diversity/species/docs/2016_Sensitive_Species_List.pdf [20 June 2019].

ODFW 2010, *Conservation and Recovery Plan for Oregon Steelhead Populations in the Middle Columbia River Steelhead Distinct Population Segment.* Available from: https://www.dfw.state.or.us/fish/CRP/docs/mid_columbia_river/Oregon_Mid-C_Recovery_Plan_Feb2010.pdf [20 June 2019].

ODFW and BPA 1999, *Aquatic Inventories Project Physical Habitat Surveys, Confederated Tribes of Warm Springs 1999*, Oregon Department of Fish and Wildlife, Natural Production Program, Corvallis, OR.

ODFW and CTWSRO 1998, *Aquatic Inventories Project Physical Habitat Surveys, Warm Springs River Basin 1998*, Oregon Department of Fish and Wildlife, Natural Production Program, Corvallis, OR.

Reid, L, and Dunne, T 1984, 'Sediment production from forest road surfaces', *Water Resources Research*, vol. 20, no. 11, pp. 1753-1761.

Reiser, D, and White, R 1988, 'Effects of two sediment size-classes on survival of steelhead and Chinook salmon eggs', *North American Journal of Fisheries Management*, vol. 8, no. 4, pp. 432-437.

Ricker, S 1997, *Evaluation of salmon and steelhead spawning habitat quality in the Shasta River Basin*, California Department of Fish and Game, Sacramento, CA.

Shepard, B, Leathe, S, Weaver, T, and Enk, W 1984, 'Monitoring levels of fine sediment within tributaries of Flathead Lake and impacts of fine sediment on bull trout recruitment', *Wild Trout III Symposium*, Yellowstone National Park, Wyoming 24-25 February.

Sigler, J, Bjorn, T, and Everest, F 1984, 'Effects of chronic turbidity on density and growth of steelheads and Coho salmon', *Transactions of the American Fisheries Society*, vol. 113, pp. 142-150.

Suttle, K, Power, M, Levine, J, and McNeely, C 2004, 'How fine sediment in riverbeds impairs growth and survival of juvenile salmonids', *Ecological Applications*, vol. 14, no. 4, pp 969-974.

Trombulak, S, and Frissell, C 2000, 'Review of ecological effects or roads on terrestrial and aquatic communities', *Conservation Biology*, vol. 14, no. 1, pp. 18-30.

USFWS 1998, *63 FR 3167 – Endangered and Threatened Wildlife and Plants: Determination of Threatened Status for the Klamath River and Columbia River Distinct Population Segments of Bull Trout*, Available from: https://www.govinfo.gov/content/pkg/FR-1998-06-10/pdf/98-15319.pdf [20 June 2019].

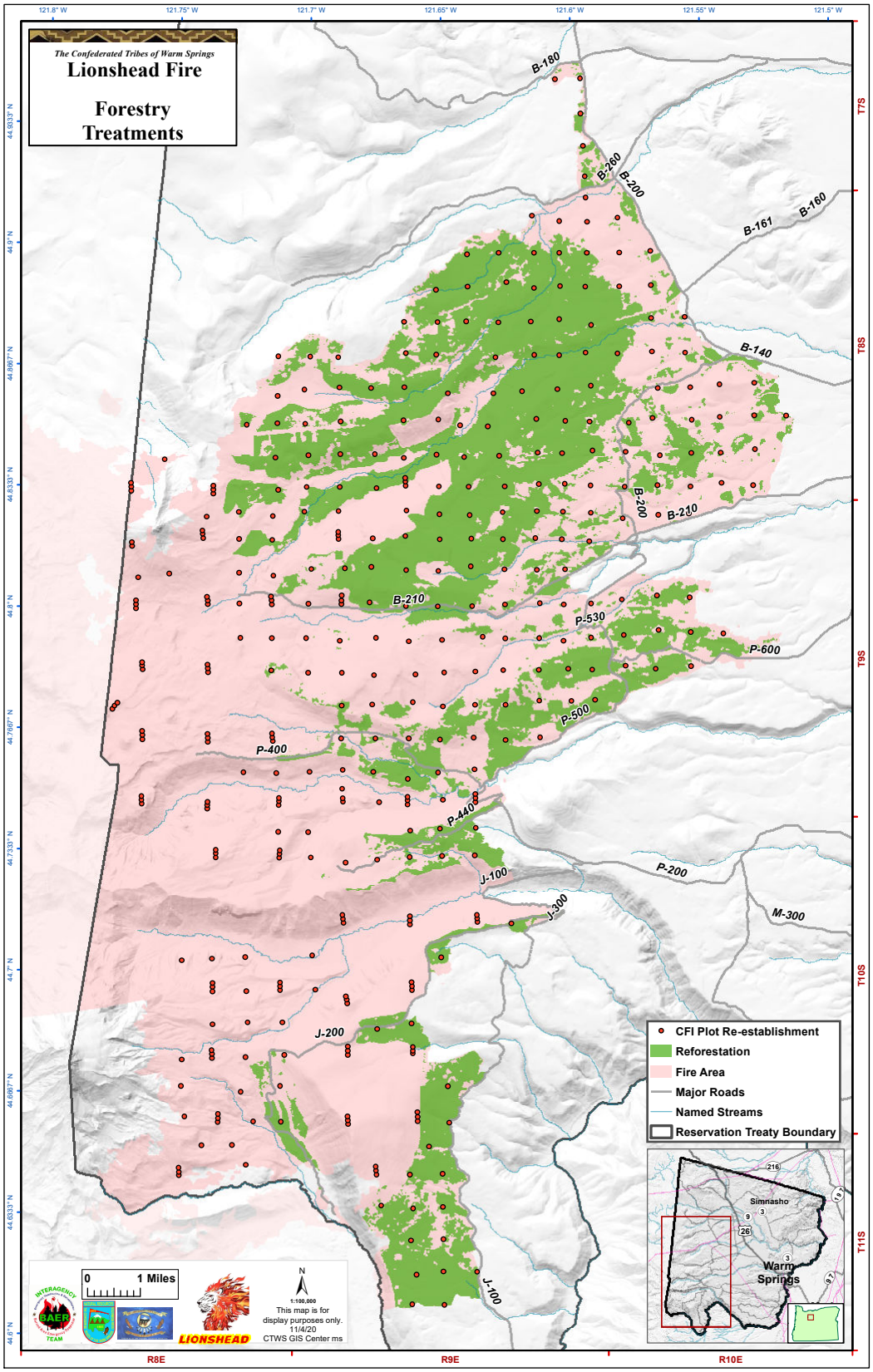
Way, S, and Collamer, L 2020, *Evaluate Status and Limiting Factors of Pacific Lamprey in the Lower Deschutes River, Fifteenmile Creek and Hood River*, Confederated Tribes of the Warm Springs Reservation of Oregon, Branch of Natural Resources, Fisheries Research Program, Warm Springs, OR.

Wemple, B, Jones, J, and Grant, G 1996, 'Channel network extension by logging roads in two basins, Western Cascades, Oregon', *Water Resource Bulletin*, vol. 32, no. 6, pp. 1195-1207.

Appendix A

Federally Listed, Proposed, Candidate Species and Species of Concern under the Jurisdiction of the Fish and Wildlife Service which may occur within Jefferson County, Oregon

See Supporting Documents



Appendix A

Lionshead Rehabilitation Plan Treatment Map