In Reply Refer to:
FWS/R1/ES/IFWO/2024-0084691-001
FWS/R1/ES/IFWO/2024-0084691-002
FWS/R1/ES/IFWO/2024-0084691-003

Matthew Davis, Forest Supervisor
Payette National Forest
500 North Mission Street
McCall, Idaho 83638

Kathryn A. Werback, District Commander
U.S. Army Corps of Engineers, Walla Walla District
201 N. 3rd Avenue
Walla Walla, Washington 99362-1876

Subject: Stibnite Gold Project – Valley and Lemhi Counties, Idaho – Biological Opinion, Concurrence, and Conference

Dear Matthew Davis and Kathryn Werback:

This letter transmits the U.S. Fish and Wildlife Service's (Service) letter of concurrence, conference concurrence, and biological opinion (Opinion) for the Stibnite Gold Project on the effects of the subject proposed action to species and habitats listed under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.; [Act]). In a letter dated March 25, 2024, and received by the Service on March 26, 2024, the Payette National Forest (Forest) requested consultation under section 7 of the Act. The letter included a biological assessment (Assessment) describing effects of the proposed subject action to bull trout (*Salvelinus confluentus*), bull trout designated critical habitat, whitebark pine (*Pinus albicaulis*), North American wolverine (*Gulo gulo luscus*), Canada lynx (*Lynx canadensis*), northern Idaho ground squirrel (*Urocitellus brunneus brunneus*), and monarch butterfly (*Danaus plexippus*).

Through the Assessment, the Forest determined that the subject proposed action may affect and is likely to adversely affect bull trout, whitebark pine, North American wolverine, and bull trout designated critical habitat. Our Opinion concludes that the subject proposed action will not jeopardize the continued existence of bull trout, whitebark pine, or North American wolverine and will not destroy or adversely modify designated critical habitat for bull trout. The Forest also determined that the subject proposed action may affect but is not likely to adversely affect Canada lynx and northern Idaho ground squirrel. The Service concurs with the Forest's determination and presents our rationale below.

Further, the Forest assessed the effects of their proposed action and made a not likely to jeopardize the continued existence of determination for the monarch butterfly. The Forest requested to conference on monarch and requested Service concurrence with their determination. After reviewing the Assessment, we concur with your determination for monarch butterfly and present our rationale below.

Informal Consultation

Proposed Action

The Stibnite Gold Project proposes to develop mine operations to produce gold and silver doré (semi-pure alloy of gold and silver)**,** and antimony concentrates from ore deposits associated with mining claims. The mining action area occurs in Valley County, Idaho, in the Stibnite Mining District, approximately 50 miles east of McCall, Idaho, and the restoration project occurs in Lemhi County, Idaho, approximately 12 miles northwest from Leadore, Idaho. The proposed action phases include geophysical investigation, construction, operations, exploration, closure and reclamation, and post-closure monitoring. Development of the mineral resource will include construction of access and haul roads, construction of supporting infrastructure, open pit mining, ore processing, placement of tailings in a Tailing Storage Facility (TSF), and placement of development rock. Mine operations will occur on patented mining claims on private lands and on unpatented mining claims and other areas of federal public lands administered by the Payette National Forest (Forest). Supporting infrastructure corridors (access and transmission line) are located on the Boise National Forest (BNF), Idaho Department of Lands (IDL), Reclamation, and non-federal lands. The proposed action will take place over a period of approximately 20 to 25 years, not including the long-term, post-closure environmental monitoring and potential long-term water treatment. The proposed action is fully described in the accompanying Opinion and in the Assessment (pp. 14-244).

Environmental design features (EDF; USFS 2024, Appendix B) are intended to minimize effects to Canada lynx and Northern Idaho ground squirrel (NIDGS). The EDFs include, but are not limited to:

- Activities will be modified when practicable to maintain key features of Canada lynx denning habitat or to avoid disruption of denning activities.
- The action area will be surveyed for evidence of breeding, denning, or occurrence of Canada lynx to avoid and minimize effects to this species to the extent practicable during construction-related activities.
- Construction activities will be modified to avoid disruption of Canada lynx denning activities when and where species are present.
- Speed limits will be posted (20 miles per hour [mph] or in some cases 15 mph) for the Burntlog Route, haul roads, and light vehicle access roads for the proposed action.

Slower speed limits will be posted at known wildlife crossings and along defined migratory corridors during migration season.

- If a Canada lynx is sighted, adjustments will be made to operations on a temporary basis.
- Appropriate sound dampening and muffling equipment will be utilized to minimize noise excursion from equipment and facilities. When possible, high noise activities will be scheduled at the same time. Equipment will be monitored and maintained to reduce noise related impacts.
- Electric line power will be utilized during operations to eliminate diesel generator noise, except in emergency situations when grid power is down or temporary use in remote areas where it is not practical to run power lines.
- Pre-construction NIDGS surveys will be conducted during mid-June by two experienced biologists in areas of lower elevation where suitable habitat is indicated by habitat modeling. All potential NIDGS habitat will be surveyed out to 328 feet (100 meters) on either side of the transmission line alignment or facility. Data on NIDGS presence (visual or auditory confirmation, active burrows, runways, fecal pellets, and other sign) will be recorded and GPS coordinates used to identify NIDGS locations.
- NIDGS occupied areas will be flagged and protected from all equipment and human disturbance during construction, operations, closure, and post-closure/monitoring activities out to 0.5 mile from the edge of the occupied area to protect active NIDGS from proposed action activities between late March to early September. The occupied areas will also be protected during the hibernation period out to 500 feet.
- If a NIDGS sighting occurs during construction, the area will be vacated, activities halted, and the Forest and the Service notified on how to proceed.

Canada Lynx

Species and Habitat Presence in the Action Area

There are seven Lynx Analysis Units (LAUs) within the action area, covering approximately 656,493 acres (Assessment, p. 475). The seven LAUs; Stibnite, Yellowpine, Burntlog, Landmark, Warm Lake, East Mountain, and West Mountain; are further classified into existing suitable habitat, source habitat capacity, and unsuitable habitat, where source habitat capacity has the potential to develop into suitable Canada lynx habitat in the future (Assessment, p. 478). Within the action area, there are approximately 124,196 acres of suitable habitat and 225,507 acres of source habitat capacity (Assessment, p. 478). There is no Canada lynx designated critical habitat within the action area. The Lemhi restoration project area is not within any LAUs and the nearest LAU (Hayden Basin), located approximately five miles away, is currently not occupied by Canada lynx.

Surveys conducted between 1999 and 2003 using the National Lynx Protocol detected a single Canada lynx on the BNF at two locations in the Bear Valley area, approximately 18 miles southeast of the action area, but there were no detections on the Forest (Assessment, p. 479). The Forest conducted Canada lynx detection surveys on the BNF Cascade Ranger District (in the Burntlog and Yellowpine LAUs) between 2001 and 2003, and no Canada lynx were detected during the hair snag/DNA surveys. The closest confirmed Canada lynx detection resulting from formal surveys was on the Lowman Ranger District (BNF) in 1999, approximately 60 miles south of the Village of Yellow Pine (Assessment, p. 479). Field surveys using motion activated cameras and hair snags at bait stations were conducted in 2013 and 2014 within the Stibnite, Yellow Pine, Burntlog, Landmark, and Warm Lake LAUs. No Canada lynx were detected at any of the cameras or in any of the hair samples, and no tracks were observed during placement, servicing, or removal of the cameras or bait stations (Assessment, p. 479). The lack of Canada lynx detections from historical surveys and the large body of hair snag and remote camera survey work, both in the action area and in the larger context of the surrounding ranger districts, suggests Canada lynx are rare in the Forest and BNF, and detections are more likely to result from a dispersing or transient individual rather than a resident (Assessment, p. 479). Although Canada lynx denning habitat exists on the BNF and is predicted to exist in the future across the Forest, there are no verified Canada lynx dens or confirmed evidence of breeding. At present, occurrence of Canada lynx in the action area cannot be confirmed (Assessment, p. 479).

Potential Impacts and Effects from the Proposed Action

A full analysis of effects to Canada lynx from the proposed action is described in the Assessment (pp. 479-484). Effects to an individual or population may occur due to habitat loss and fragmentation, increased competition for resources, vehicle collisions, or disturbance from noise and light.

Geophysical investigation will occur at 40 sites along the proposed Burntlog Route to determine the feasibility of construction. Only four of the total of 40 investigation sites occur within or near unburned lynx habitat: one is a track-boring site, one is a helicopter drill site, and two are truck rig boring sites. Lynx could also be affected through habitat alterations from project activities which could reduce already limited habitat. Approximately 0.6 acres will be disturbed through minor brush clearing and tree removal (Assessment, p. 185). It is likely that less than 0.6 acres of suitable lynx habitat will be disturbed, as most of the investigation sites are not within suitable lynx habitat. Acres of disturbance from geophysical investigation is included in the total acres of modeled lynx habitat and overlaps acres of disturbance within the larger mine project.

Roadways, existing and new, may displace or alter the movement of transient Canada lynx. Construction and use of new access roads will fragment habitat and could act as a barrier to movement. Increased traffic associated with proposed action activities along the new and existing roads will discourage Canada lynx from crossing these roads. Currently there are no known resident individuals within the action area, there is no known denning habitat, and the Forest and BNF are considered secondary Canada lynx habitat. Secondary areas, delineated for the recovery plan outline, are those areas with historical records of Canada lynx presence, but have fewer records than in core areas and have no recent documentation of presence or reproduction (Assessment, p. 479). Proposed EDFs will be implemented to monitor for lynx, maintain habitat, and adjust operations due to lynx sightings. Although proposed action activities may disturb or displace Canada lynx, due to the improbability of occurrence in the action area, classification as secondary habitat, and the implementation of EDFs, effects to Canada lynx from displacement are expected to be insignificant.

Over the course of the proposed action, 258.7 acres of modeled lynx habitat will be disturbed from activities within the mine site, access roads, and utilities, with 92.5 acres of that lost throughout the duration of the proposed action. Loss of habitat will cause fragmentation, increased competition for resources or habitat, and displacement of individuals from the affected area into nearby habitat. Vegetation removal will be small in scale and is not expected to measurably change the amount of suitable habitat available for transient lynx. The 258.7 acres of vegetation (out of the 124,196 acres of current suitable habitat in the action area) disturbed or removed from the proposed action are expected to have insignificant effects to Canada lynx due the small amount of vegetation affected.

Increased traffic and human presence from proposed action activities may affect Canada lynx through increased risk of vehicle collisions and increased competition for resources. The proposed action includes construction of 15 miles of new road, including new segments to the existing Burntlog Route. Plowing of the Burntlog Route will open new corridors for predators. This could increase the predation on snowshoe hares by other predators or become a source of mortality for prey species, which could affect food availability for transient Canada lynx. Due to the unlikelihood of Canada lynx occurring in the action area, effects to lynx from increased competition for resources is expected to be insignificant. Construction and the year-round operation of the Burntlog Route could be a source of mortality for transient Canada lynx, but this is not expected because Canada lynx have not been documented in the action area, the action area does not contain prime denning habitat, and their movements are often nocturnal when limited vehicle traffic occurs (Assessment, p. 482). Upon closure, the new segments of the Burntlog Route will be decommissioned, recontoured, and reclaimed, which will remove impacts associated with traffic or human access in the long-term (Assessment, p. 483). Impacts from traffic will be minimized via traffic controls and public access restrictions. If a transient individual wanders into the action area, the training of personnel about lynx and slow speed limits is expected to reduce effects to Canada lynx from increased traffic to insignificant levels.

Noise and light disturbance from proposed action activities through all phases may displace transient Canada lynx. Canada lynx often avoid large developments (e.g., ski resorts, facilities, etc.); therefore, it is likely that the mine site area boundary will be a barrier to Canada lynx movement (Assessment, p. 481). A transient lynx may pass through or near the action area, but individuals disturbed by increased noise or light will be able to move away from the disturbance, resulting in insignificant effects to those individuals. Construction associated with utility corridors, substations, communication towers, and off-site facilities are expected to be temporary in nature, while long-term effects are expected throughout the proposed action along roadways, near substations, and off-site facilities. Additionally, increased recreational access, a net gain of 2.3 miles of groomed Over Snow Vehicle (OSV) trails, a 2-acre parking area, and a new 1.9-mile groomed access trail that will cross modeled Canada lynx habitat will cause further impacts during winter due to noise. Noise-reduction strategies (e.g., limiting work to daylight hours and utilizing light shields/downshielding, or directional lighting), employed along access roads, utility corridors, and near communication towers and off-site facilities during the proposed action are expected to minimize the intensity and duration of disturbance (Assessment, p. 483) and reduce impacts to transient Canada lynx to insignificant levels.

Northern Idaho Ground Squirrel (NIDGS)

Species and Habitat Presence in the Action Area

The NIDGS may occur within specific elevations, topography, and vegetation types in the action area (Assessment, p. 479). There is no occupied habitat within the action area, but there are approximately 17,917 acres of modeled suitable habitat (Assessment, p. 485). Idaho Department of Fish and Game monitoring data from 2017 documented 308 individuals at 29 colony sites on Forest lands. The closest occupied site documented is approximately 10 miles south of the action area (Assessment, p. 487). Field surveys were conducted in 2018 and 2019 within modeled suitable habitat, covering almost the entire disturbance footprint of the proposed action, and no observations of NIDGS or signs of activity were documented (Assessment, p. 488). Although no NIDGS or signs of their activity were observed during the surveys, there is a small possibility that NIDGS may occur in the future within suitable habitat (Assessment, p. 488). The Lemhi restoration project area is not within the known NIDGS range and does not have the vegetation communities associated with this species.

Potential Impacts and Effects from the Proposed Action

A full analysis of effects to NIDGS from the proposed action is described in the Assessment (pp. 488-490). No occupied habitat is present in the action area; however, effects were analyzed considering that modeled suitable habitat in the action area could be occupied in the future. Effects to NIDGS could occur from vehicle collisions, habitat loss and fragmentation, disturbance from human presence and noise, and displacement.

Road construction, improvement, and maintenance activities and their associated vehicle traffic, as well as increased proposed action vehicle traffic, could impact NIDGS. An increased risk of mortality due to collisions, particularly during the warmer months when the species is active may result in areas where proposed action components cross modeled suitable habitat. Surveys of modeled suitable habitat will be required before construction activities occur, and all staff and contractors will adhere to speed limits and be trained to reduce wildlife collisions. Due to implementation of EDFs and the lack of documented occupancy in modeled suitable habitat, effects to NIDGS from vehicle collisions are expected to be discountable. Vehicle traffic may create noise disturbance that could cause NIDGS to flee the area and find suitable habitat elsewhere. Effects to NIDGS as a result of increased traffic is expected to be insignificant.

Construction of the utility corridors, substations, and communication towers, as well as maintenance activities in the rights-of-way, will lead to temporary disturbance of approximately 34.5 acres and a loss of 8.8 acres of modeled suitable habitat through the life of the mine. Additionally, construction of new off-site facilities will lead to a loss of approximately 19.3 acres of modeled suitable habitat through the life of the mine. These activities may affect NIDGS through loss and fragmentation of modeled suitable habitat, disturbance from human presence and noise, and displacement. Portions of existing and new roads that overlap modeled suitable habitat may act as a barrier to NIDGS movement and dispersal. Increased habitat fragmentation between colonies could impact dispersal between populations, which could lead to genetic and demographic consequences. If NIDGS sites are determined to be occupied, EDFs such as speed limits, seasonal restrictions, site buffers, and monitoring will be used to avoid or reduce impacts to NIDGS populations. Therefore, effects to NIDGS as a result of habitat fragmentation is expected to be insignificant. Disturbance from human presence and noise may cause individuals to flee the area, causing them to seek suitable habitat nearby. Effects to NIDGS from disturbance and human presence are expected to be insignificant.

The EDFs, such as seasonal restrictions, site buffers, and monitoring will be used to avoid or reduce impacts to NIDGS populations. Furthermore, site checks and formal surveys will be conducted prior to ground-disturbing activities in modeled suitable habitat. Because of the low likelihood of occurrence in the action area, the required and proposed EDFs to continuously monitor modeled suitable habitat, and trained personnel that can identify and reduce impacts if sites are identified as occupied in the future, effects to NIDGS as a result of the proposed action are expected to be insignificant or discountable.

Concurrence

Based on the Service's review of the Assessment, we concur with the Forest's determination that the action outlined in the Assessment and this letter, may affect, but is not likely to adversely affect Canada lynx or Northern Idaho ground squirrel. This concurrence is based on EDFs that reduce impacts of the proposed action to Canada lynx and northern Idaho ground squirrel habitat to insignificant and discountable levels.

This concludes informal consultation. Further consultation pursuant to section 7(a)(2) of the Act is not required. Reinitiation of consultation on this action may be necessary if: (1) new information reveals effects of the action that may affect listed species or designated critical habitat in a manner or to an extent not considered in the assessment, (2) the action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in the analysis, or (3) a new species is listed or critical habitat designated that may be affected by the proposed action. If none of the reinitiation triggers have been met, the Forest will conduct a supplemental information report within ten years, and every ten years thereafter, of the letter of concurrence to determine if reinitiation is warranted. In addition, there will be an informal briefing during a Level 1 meeting annually by March of each year to outline the events covered by this concurrence from the previous year, discuss any concerns, and ensure no reinitiation triggers have been met.

Informal Conference

Monarch butterfly

Environmental Design Features

The EDFs (USFS 2024, Appendix B) are intended to minimize effects to monarch butterfly include, but are not limited to:

- Speed limits will be posted (20 mph or in some cases 15 mph) for the Burntlog Route, haul roads, and light vehicle access roads for the proposed action. Slower speed limits will be posted at known wildlife crossings and along defined migratory corridors during migration season.

- In areas where milkweed and monarch butterflies may be present, surveys for milkweed and flowering nectar plants will be conducted by a qualified botanist prior to construction.
- If suitable monarch habitat (milkweed and nectar sources) is found, these areas will be marked on the ground with stakes and flagging in order to ensure these areas are avoided, to the extent practicable, for equipment staging and proposed action activities.
- Conduct proposed action activities, such as mowing, grubbing, and pesticide and herbicide application, in suitable habitat outside of the estimated timeframe (June through September) when monarchs are likely present, as feasible.
- Avoid the application of pesticides and herbicides on milkweed plants and define buffer zones to protect milkweed occupied areas from nearby areas where pesticides and herbicides are applied.

Species and Habitat Presence in the Action Area

Monarch butterflies are generally limited to elevations at or below 5,600 feet (Assessment, p. 503). Approximately 198,592 acres at or below 5,600 ft exist within the action area, including the entire 138.3-acre Lemhi restoration project area (Assessment, p. 503). Due to limited milkweed occurrence, monarch butterfly presence on the Forest is likely more closely associated with migration than with breeding (Assessment, p. 506). Monarch butterfly and milkweed suitability models in Idaho show the predicted suitability for milkweed species and monarch butterflies on the Forest in the action area to be low (Assessment, p. 506). Surveys have not occurred in the action area for monarch butterfly and according to the Service Monarch Conservation Database, only one acre of milkweed with 21 individual plants has been mapped in Valley County, Idaho, and no milkweed has been mapped in Lemhi County, Idaho. Therefore, while monarch butterflies may occur during the summer and early fall in the action area within suitable vegetation communities, the probability is low (Assessment, p. 506). A full environmental baseline for monarch in the action area is detailed in the Assessment (pp. 503-506).

Potential Impacts and Effects from the Proposed Action

A full analysis of effects to the monarch butterfly is in the Assessment (pp. 506-509). Proposed action activities associated with access road construction and operation, road maintenance, and related traffic may affect monarch from direct mortality through vehicle collisions and disturbance from light, noise, fugitive dust, and increased human activity. Construction and operation of access roads is not planned to occur in suitable habitat but may impact individual monarch through vehicle collisions from increased traffic. The likelihood for this is low, primarily due to vehicles adhering to the proposed action's speed limits and the limited amount of suitable habitat along access roads. Light, noise, and fugitive dust impacts associated with road maintenance and vehicle traffic within suitable habitat (potentially high levels depending on the mining phase) are likely to disturb or displace monarch. Road maintenance activities will be conducted to manage fugitive dust emissions, and noise and light reduction strategies will help reduce impacts. Due to the project's speed limits, fugitive dust management, noise and light reduction measures, and the limited amount of suitable habitat along project access roads, effects to monarch from roads and traffic are expected to be insignificant.

Monarch butterfly exposure to hazardous materials and chemical contamination may occur due to proposed action activities in all phases. The EDFs implemented will include proper transport, containment, handling, and storage of products. A Hazardous Materials Handling and Emergency Response Plan will address procedures for responding to accidental spills or releases of hazardous materials to minimize environmental effects. Therefore, there is little chance of monarch being exposed to hazardous materials and effects are expected to be discountable.

The proposed action includes the loss of approximately 59.7 acres of suitable habitat along utility corridors, at substations and, at communication towers, plus an additional 17.2 acres of habitat associated with off-site facilities. Most habitat loss and fragmentation will last through the life of the mine. An additional 44.5 acres of suitable habitat will be lost along riparian areas of the Lemhi River in the restoration project area, but habitat loss and fragmentation are expected to be temporary and insignificant. Construction activities within suitable habitat will likely displace individuals temporarily, from June to September, but monarch butterflies are highly mobile and wide ranging, allowing them to move to suitable habitat outside of the action area. Monarch EDFs will minimize these impacts by requiring surveys for milkweed and flowering nectar plants in suitable habitat, avoidance measures if monarch are found, and vegetation management measures to reduce impacts to monarch, milkweed, and nectar plants. Furthermore, noise and light reduction strategies will be used to reduce effects to monarch from project related operations and facilities. Therefore, due to the use of EDFs to survey, protect vegetation, reduce impact of vegetation related activities, and reduce noise and light impacts to habitat, effects to monarch from habitat loss and fragmentation are expected to be insignificant.

Conference Concurrence

Based on the Service's review of the Assessment, we concur with the Forest's determination that the action outlined in the Assessment and this letter, is not likely to jeopardize the continued existence of the monarch butterfly. This conference concurrence for monarch is based on the low predicted suitability for milkweed species and monarch butterflies in the action area, the implementation of EDFs to minimize effects, and the mobility and wide range of the species that reduce impacts of the proposed action to monarch butterfly to insignificant and discountable levels. Although the Act does not require conferencing on proposed species or critical habitat, the Forest assessed the effects of the proposed action to the monarch butterfly and requested a conference. Therefore, this letter shall serve as our conference concurrence that the proposed action is not likely to adversely affect the monarch butterfly. If the monarch butterfly is listed under the Act during the term of this action and there have been no significant changes that could warrant reanalysis of effects to the monarch butterfly, the Forest should contact the Service in writing to affirm the validity of the conference concurrence and request it be adopted as a standard concurrence to ensure continued coverage under the Act.

Thank you for your continued interest in the conservation of threatened and endangered species. If you have any questions regarding this consultation, please contact Carla Wise of this office at carla_wise@fws.gov.

Sincerely,

LISA ELLIS Digitally signed by LISA ELLIS
Date: 2024.09.05 11:25:33
-06'00'

Lisa Ellis
State Supervisor

Enclosure: Appendices

cc: USFS (Knesek, Rymerson, Peterson)
NOAA (Lind, Sandow)
USACE (Wilson)
Nez Perce Tribe (Lopez, Kash)
Shoshone Bannock Tribe (Tyler, Cutler)
Shoshone Paiute Tribe (Mason, Gibson)
IDFG (Flack, Bassista, Edelmann)

BIOLOGICAL OPINION
FOR THE
STIBNITE GOLD PROJECT

2024-0084691-001

U.S. FISH AND WILDLIFE SERVICE
IDAHO FISH AND WILDLIFE OFFICE
BOISE, IDAHO

LISA ELLIS Digitally signed by LISA ELLIS
Date: 2024.09.05 11:26:11 -06'00'

Lisa Ellis

State Supervisor

Date ___September 5, 2024_______________

Table of Contents

List of Tables

List of Figures

1. BACKGROUND

1.1 Introduction

This document represents the U.S. Fish and Wildlife Service's (Service or USFWS) biological opinion (Opinion) on the effects to bull trout (*Salvelinus confluentus*), bull trout designated critical habitat, North American wolverine (*Gulo gulo luscus*), and whitebark pine (*Pinus albicaulis*), from the Stibnite Gold Project. In a letter dated March 26, 2024, and received on the same day, the Payette National Forest (Forest) requested formal consultation with the Service under section 7 of the Endangered Species Act of 1973, as amended (16 USC 1531 et seq.; [Act]).

This Opinion is primarily based on the Forest's biological assessment titled *Stibnite Gold Project Biological Assessment* (Assessment; USFS 2024, entire) dated July 2024, and other sources of information cited herein. The Assessment is incorporated by reference in this Opinion.

1.2 Consultation History

A chronology of this consultation is presented below. A complete decision record for this consultation is on file at the Service's Idaho Fish and Wildlife Office in Boise, Idaho.

2017	Informal consultation began with the Forest Service to prepare the Assessment.
June 21, 2018	Regularly scheduled (monthly) consultation meetings were initiated with participation of the Forest / AECOM, Perpetua (applicant), the Service, National Marine Fisheries Service (NMFS), U.S. Army Corps of Engineers (USACE), and the U.S. Environmental Protection Agency (EPA). Meetings continued through March 2020 and covered a wide variety of topics related to analysis methodology, data, Assessment preparation, etc.
2020	Regularly scheduled (monthly) consultation meetings were initiated with participation of the Forest, Perpetua, the Service, NMFS, and USACE. Meetings continue to occur as of signing of this document.
May 11, 2023	The Service received the first draft proposed action portion of the Assessment for review.
June 9, 2023	The Service returned comments on the first draft proposed action to the Forest.
June 13, 2023	Conference call with Perpetua, Rio ASE (Perpetua contractor), Forest, Stantec (non-federal representative), the Service, and NMFS regarding details of Perpetua's proposed Lemhi River Restoration.
July 31, 2023	The Service received the remainder of the first draft Assessment (baseline and effects analysis) for review.

August 30, 2023	The Service returned comments on the first draft Assessment to the Forest.
October 26, 2023	The Service received the revised second draft Assessment from the Forest with an initiation request for formal and informal consultation.
September 5, 2023	Conference call with NMFS, Forest, and Stantec regarding comments on the effects analysis for aquatic species.
November 22, 2023	The Service provided the Forest with comments on their second draft Assessment, determined the Assessment to be insufficient, and consultation could not be initiated.
March 26, 2024	The Service received the revised third draft of the Assessment from the Forest and requested to initiate informal and formal consultation.
April 24, 2024	The Service sent an email to the Forest deeming the Assessment to be sufficient and initiated formal and informal consultation on the date the Assessment was received.
June 17, 2024	The Service sent a letter to the Forest requesting a 30-day extension of the consultation period due to the complexities of the project, the number of species involved, and the need for solicitor review. This would put the consultation package issued on September 7, 2024.
July 25, 2024	The Service received the revised Assessment incorporating the proposed Burntlog Route geophysical investigation into the Stibnite Gold Project. In their letter, the Forest said that they are aware that we expressed a need for additional time to complete consultation and that they are committed to working with us to help get to a final Opinion as timely as possible.

2. PROPOSED ACTION

This section describes the proposed Federal action, including any measures that may avoid or minimize adverse effects to listed species or critical habitat, and the extent of the geographic area affected by the action. The term “action” is defined in the implementing regulations for section 7 as “all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas” (50 CFR 402.02).

2.1 Action Area

The term “action area” is defined in the regulations as “all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action” (50 CFR 402.02). An action includes activities or programs “directly or indirectly causing modifications to the land, water, or air” (50 CFR 402.02). In this case, the area where land, water, or air is likely to be affected includes private, state, and public lands administered by the PNF, the Boise National Forest (BNF), and the U.S. Bureau of Reclamation (Reclamation) in Valley and Lemhi counties, Idaho. The action area includes the Stibnite mine operations (defined as the watersheds impacted by the proposed action [Figure 1]); the Lemhi restoration project plus

100-foot buffers upstream and to the southwest, 328 feet downstream, and out to Idaho State Highway (SH) 28 to the northeast (Figure 2); and the Big Creek and Hargrave Creek culvert replacements located within the Upper Big Creek subwatershed.

The Stibnite project area includes the mine site, associated access roads, and utilities and facilities that are in Valley County, Idaho. The area is situated approximately 98 miles (mi) by air and 146 mi by road northeast of Boise, approximately 44 mi by air and 68 mi by road northeast of Cascade, and approximately 10 mi by air and 14 mi by road east of the village of Yellow Pine, Idaho. Activities within the mine operations boundary area (mine site) will occur within approximately 820 acres of private lands (including 535 acres of patented mining claims owned or controlled by the applicant [who requires formal approval or authorization from a Federal agency as a prerequisite to conducting the action]), approximately 2,372 acres of National Forest System (NFS) lands, 13 acres of Reclamation lands, and 62 acres of Idaho Department of Lands.

The culvert replacements are located 15 mi east of Cascade, Idaho within the Payette River basin inside the BNF. The project includes three stream crossings (two on Big Creek and one on Hargrave Creek, a tributary to Big Creek), which were previously determined to be fish barriers based on field verification completed by Rio ASE in 2022 using the San Dima Protocol. The existing crossings on Big Creek are on Road 497A and the Hargrave Creek crossing is located on Road 497I.

The Lemhi restoration project area is located entirely on private lands on the Upper Lemhi River approximately 12 mi northwest of Leadore, Idaho (Figure 2). The reach of the Lemhi project extends approximately 7,000 ft from river mile (RM) 42.62 to RM 41.32 on the mainstem of the Lemhi River on the western side of SH 28. This restoration is required by the USACE, who is an action agency, and is part of the proposed action.

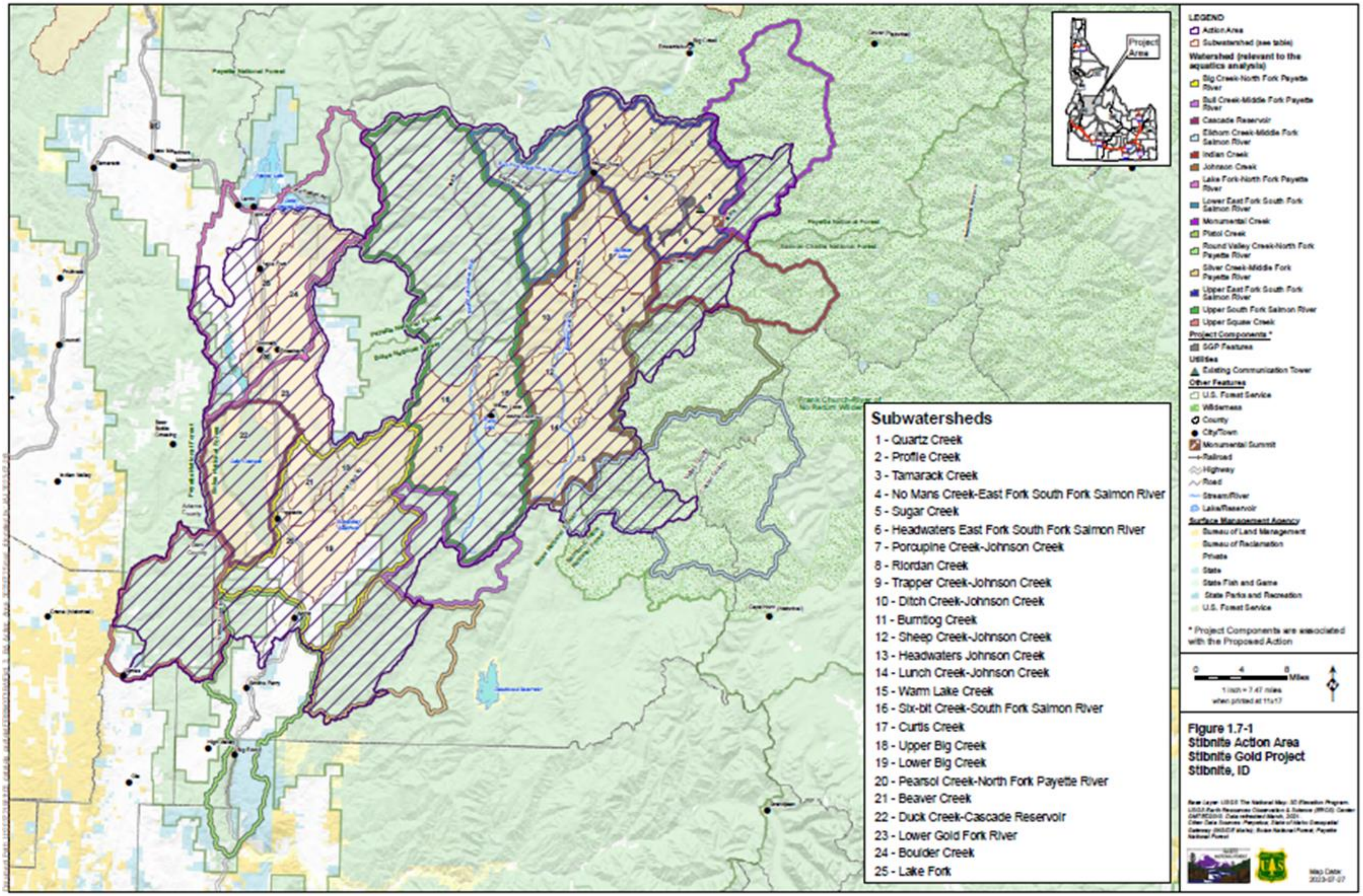

Figure 1. Stibnite project area (USFS 2024, Figure 1.7-1).

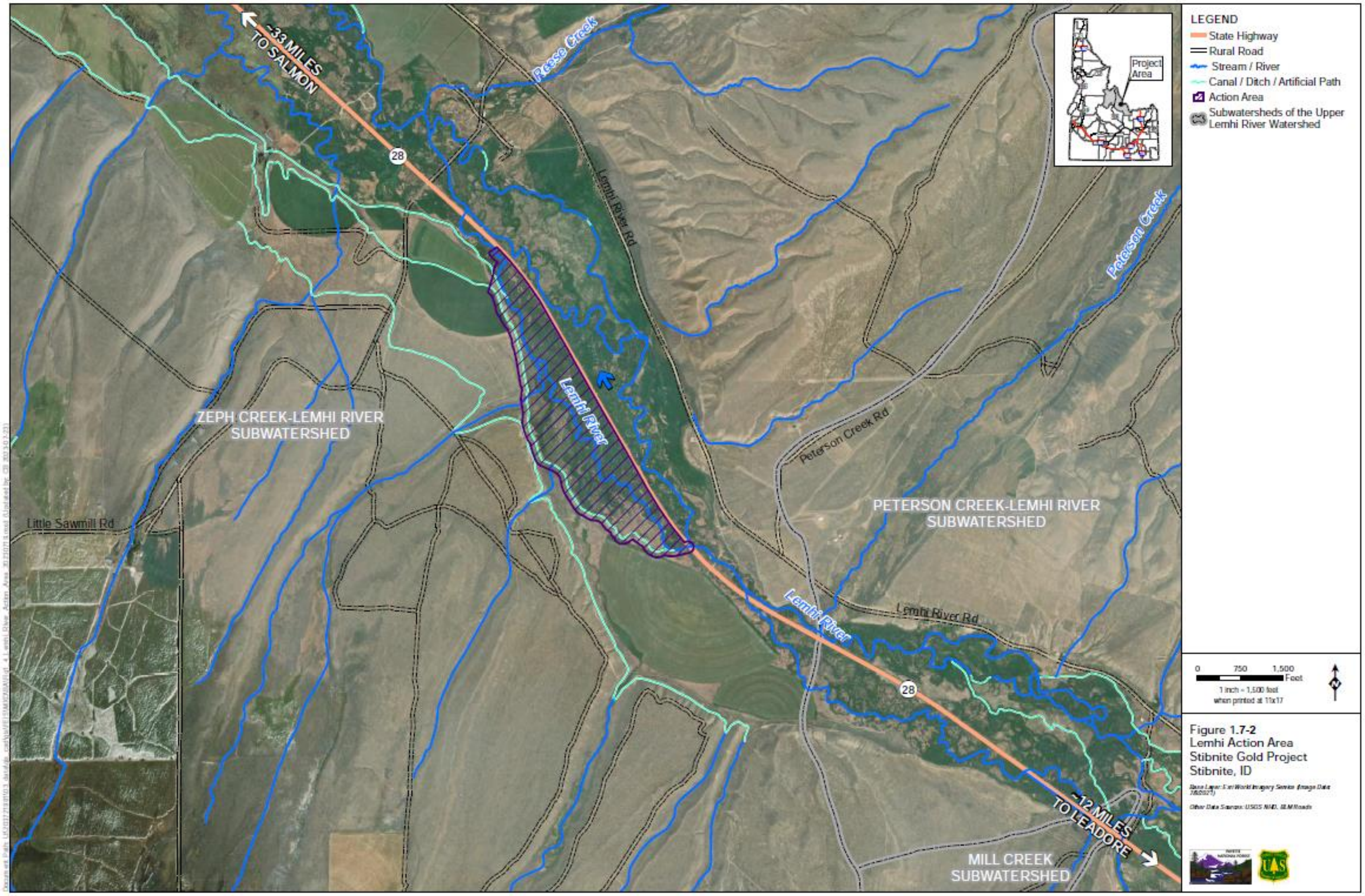

Figure 2. Lemhi restoration project area (USFS 2024, Figure 1.7-2).

2.2. Description of the Proposed Action

2.2.1 Overview

The proposed action is described in detail in the Assessment (USFS 2024, pp. 14-244), which is incorporated by reference in this Opinion. The Forest proposes to permit the development of a mining operation that produces gold and silver doré and antimony concentrates from ore deposits associated with mining claims in the action area. The estimated recoverable mineral resource consists of 4.2 million ounces of gold, 1.7 million ounces of silver, and 115 million pounds of antimony.

Development of the mineral resource will include construction of access and haul roads, construction of supporting infrastructure, open pit mining, ore processing, placement of tailings in a Tailings Storage Facility (TSF), and placement of development rock. New access to the mine site will be provided by the proposed Burntlog Route, which will be a combination of geophysical investigation; widening the existing Burntlog Road (Forest Road [FR] 447), Thunder Mountain Road (FR 50375), and Meadow Creek Lookout Road (FR 51290); and constructing new connecting road segments of approximately 15 mi (

Figure 3). Development of the Burntlog Route will entail 340.9 acres of new cut and fill activity (including borrow sources) along existing and newly constructed roadways.

To provide electric power for the proposed action, an existing powerline will be upgraded and a new transmission line from a new Johnson Creek substation to the mine will be constructed. Additional off-site support facilities to be constructed along access corridors include the Stibnite Gold Logistics Facility (SGLF) and the Burntlog Access Route Maintenance Facility. The SGLF will house administrative offices, the assay laboratory, and a warehouse, and the maintenance facility will be the headquarters for road maintenance and snow removal. The proposed facilities and access roads are shown on

Figure 3 and Figure 4. The mine site operations area boundary (mine site) shown on

Figure 3 and Figure 4 is the boundary within which public access will be controlled.

Complete site reclamation will be completed according to the Reclamation Closure Plan (Tetra Tech 2021, entire) along with mitigation actions to offset effects to jurisdictional waters under an approved Army Corps of Engineers Compensatory Mitigation Plan (Tetra Tech 2023, entire) that includes off-site mitigation along the Lemhi River (Rio ASE 2023, entire) and Big Creek in the Payette watershed (Tetra Tech 2023, p. 2-4).

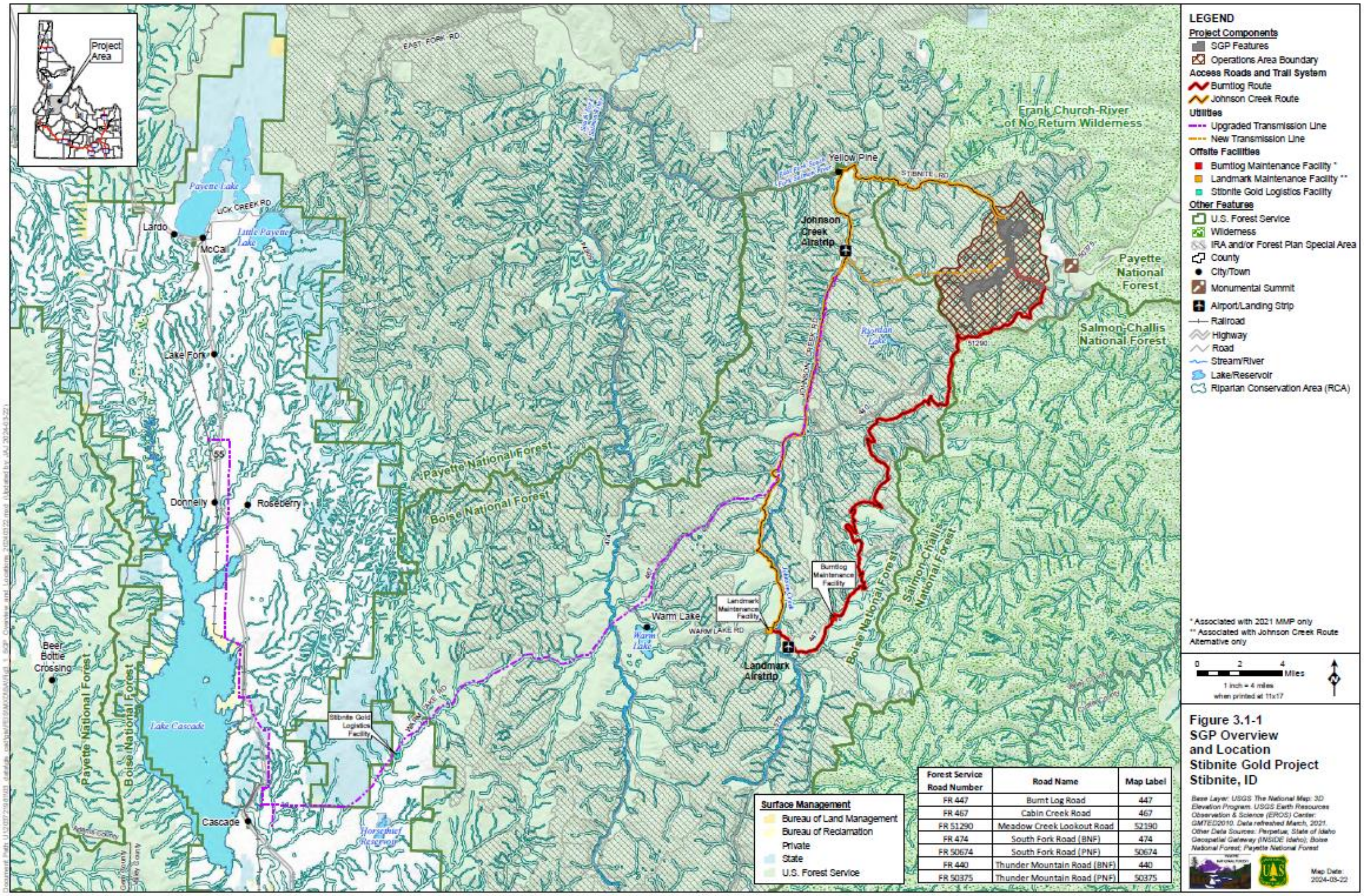

Figure 3. Stibnite project area: mine site, associated access roads, and off-site facilities (USFS 2024, Figure 3.1-1).

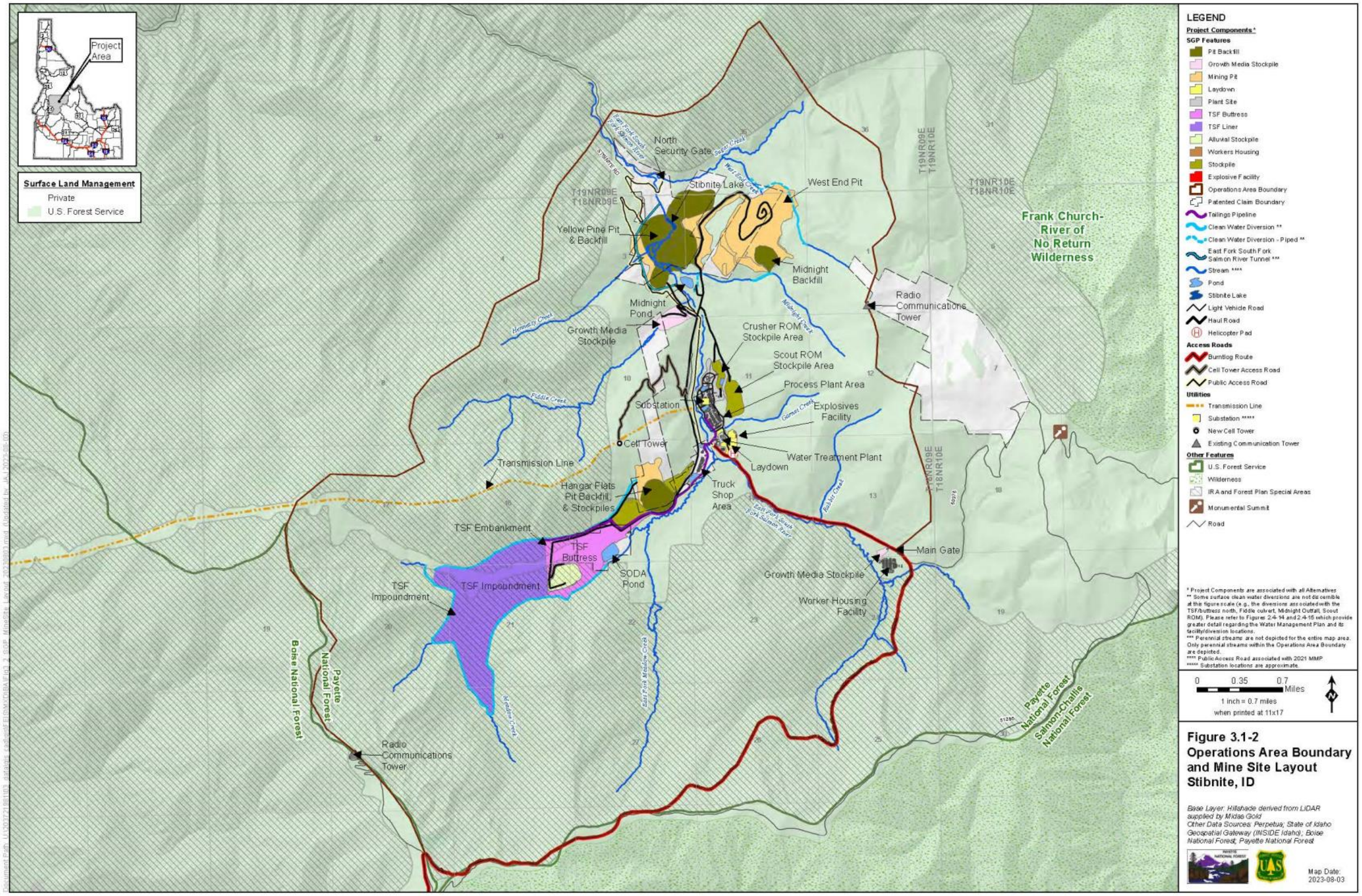

Figure 4. Mine site operations area boundary and layout (USFS 2024, Figure 3.1-2).

The components of the proposed action are described in the following sections via terms of overall land management, affected areas, and project phases: construction, operations and exploration, and closure and reclamation, including post-closure monitoring.

2.2.2 Land Management and Affected Areas

Table 1 provides a summary of land management and acres of disturbance by project component.

Table 1. Land management and acres of disturbance by component for the proposed action (Perpetua 2021c, entire).

Component	Disturbance	Private (Applicant)	Private (Other)	Payette National Forest	Boise National Forest	Salmon-Challis National Forest[4]	Bureau of Reclamation	Idaho Dept of Lands	Total
Mine Site	New Disturbance	48.2	0	767.9 + 65[2]	0	0	0	0	881.1
Mine Site	Previously Disturbed	456.7	0	402.3	0	0	0	0	859.0
Off-site Facilities	New Disturbance	24.3	0	0	4.5	0	0	0	28.8
Off-site Facilities	Previously Disturbed	0	0	0	0	0	0	0	0
Access Roads	New Disturbance	0	0	81.6[5]	253.8	5.5	0	0	340.9
Access Roads	Previously Disturbed	1.9	4.5	26.9	102.5	8.7	0	0	144.5
Utilities[1]	New Disturbance	2.9	105.9	61.4	221.8	0	3.5	26.0	421.5
Utilities[1]	Previously Disturbed	1	174	19.4	350.6	0	9	36.1	590.1
Disturbance Totals	Total New Disturbance	75.4	105.9	910.9 + 65[2]	480.1	5.5	3.5	26.0	1,672.3
Disturbance Totals	Total Previously Disturbed	459.6	178.5	448.6	453.1	8.7	9	36.1	1,593.6
Total Disturbance		**535.0**	**284.4**	**1,424.5**	**933.2**	**14.2**	**12.5**	**62.1**	**3,265.9**[3]

[1] Utilities include both existing and new utility corridors and access routes. Some existing utility access routes will be upgraded.
[2] Approximately 65 affected acres associated with temporary surface exploration pads and roads (project component) have an unknown land ownership because the exact locations of these exploration areas are not yet known; however, these are included in the PNF project subtotal.
[3] Items, subtotals, and totals may not add up to grand total due to rounding.
[4] Approximately 14 acres of land is administered by the PNF but is within the boundary of the Salmon Challis National Forest.
[5] Includes 0.6 acres of disturbance from geophysical investigation of the Burntlog Route.

2.2.3 Site Preparation, Access, and Infrastructure

2.2.3.1 Overview

The proposed action includes construction of surface facilities, haul roads, and water management features. The designs for project components and the associated regulatory requirements are in the Assessment (USFS 2024, pp. 20–25, Table 3.4-1). Supporting infrastructure will include transmission lines, substations, communication sites, access roads, and a fish tunnel. Additionally, removal of some features from past mining activities (legacy mining features) will be initiated during the construction phase. Fifteen to 20 temporary trailers will be installed on private lands adjacent to the existing exploration camp (located in the proposed ore processing area) to accommodate construction crews. These temporary trailers will be used during site preparation and early construction until the worker housing facility is constructed.

Prior to site preparation and construction of surface facilities, vegetation will be removed from operating areas. Trees, deadwood, shrubs, and slash not needed to construct windrows at the edge of Burntlog Route disturbance (to function as sediment barriers), will be chipped, and suitable soil will be separately salvaged and stockpiled (except for a small portion that will be 'live handled') for use as part of site reclamation and restoration. Portions of the salvaged soil will be blended with the chipped wood to create growth media. All growth media placed in stockpiles will be stabilized, seeded, and mulched to protect the stockpiles from wind and water erosion.

The existing potable water supply system that sources groundwater from a well at the exploration camp under an existing groundwater right (77-7141) will be used and expanded for the construction camp. The existing system will be supplemented with deliveries of potable water if needed. Supplemental water sources (i.e., water deliveries) will be used by personnel in remote construction areas. Sanitation during construction will be provided through the existing sewage treatment system adjacent to the exploration camp. In addition, portable sanitary facilities will be located throughout the proposed action and at remote construction areas.

Geophysical investigation will include drilling, test pit excavation, dynamic cone penetrometer testing, and sample collection to explore and characterize geotechnical conditions along the Burntlog Route to confirm that geotechnical conditions align with engineering designs for the roadway and stream crossings. The geotechnical investigation will assess 24 locations along the Burntlog Route via 40 borings, test pits, or cone penetrometer tests during Mine Year minus 3. The investigation will result in 0.6 acres of ground disturbance, which overlaps the ground disturbance for building the Burntlog Route. Of the 40 investigation sites, 4 will be dynamic cone penetrometer tests using handheld equipment; 14 will be test pits approximately 3 feet wide, 10 to 15 feet deep, and 10 feet long using a track mounted excavator; 8 will be boreholes using truck or track mounted hollow stem augur/core rig; and 14 will be boreholes using a helicopter assisted core rig.

Construction of the Burntlog Route will occur from both ends of the route at the same time on a seasonal basis (May to November), but construction could occur outside of this time period if conditions are snow-free. The southern portion workforce will be housed in three temporary trailer camps located within construction borrow sources or staging areas. The northern portion workforce will be housed at the temporary trailer construction camp at the mine site. Some construction workers could be housed in Cascade, Idaho.

Pre-construction water management activities will include best management practices to reduce erosion and sediment delivery to streams. These water management features will include sedimentation ponds; run-on water diversion ditches, trenches, and/or berms; runoff water collection ditches; silt fence; water bars; culverts; energy dissipation structures; terraces; or other features specified in the Multisector Stormwater Permit for construction. In the second and third years of construction, mine contact water will be generated by stormwater runoff at the West End pit, Yellow Pine Pit (YPP), Tailings Storage Facility (TSF) embankment, legacy Hecla heap leach, and the Spent Ore Disposal Area (SODA) but will be contained as described in Section 2.2.4.10.

2.2.2.2 Growth Media Stockpiles

Suitable growth media within the area proposed for operations will be salvaged following vegetation clearing and moved to growth media stockpiles (GMSs) either within the Fiddle Valley or at the worker housing facility. Other short-term GMSs will be located within the footprint of the TSF. Growth media from the new construction of the Burntlog Route will be stockpiled in the borrow source areas used for construction and widening of the route and in windrows along the edges of fill slopes. The GMSs will be stabilized, seeded, and mulched to protect the stockpile from wind and water erosion. A total of approximately 1,657,246 bank cubic yards (BCY) of suitable soils (growth media [GM] and seed bank material [SBM]) will need to be salvaged from the proposed action for reclamation. A total of approximately 860,373 BCY of GM, chipped wood blend, and SBM are available for salvage at the proposed action.

To achieve the reclamation success criteria and offset the growth media deficits, 1.5 million bank cubic yards of unconsolidated overburden (chiefly alluvial and glacial materials from YPP) will be stored in the Fiddle GMS for use as cover material for reclamation of the TSF, TSF Buttress, and Hangar Flats pit backfill.

2.2.3.3 Access Roads

During the construction phase, the proposed action will be accessed by routes that will cross 43 streams along existing roads that will be used for mine site access (e.g., Johnson Creek), and cross 28 streams for the Burntlog Route, including the existing Burntlog Road (Table *3*). In addition to the stream crossings, approximately 6.5 mi (18 percent [%] of its 36-mi length) of the Johnson Creek Route is in close proximity to streams (i.e., within 100 ft). The number of vehicle trips per day (one way trip) is used as a metric for potential increases in erosion and sedimentation. A total of 65 vehicle trips per day will occur during the construction phase, consisting of 20 light vehicles and 45 heavy vehicles (e.g., bulldozers, rollers, graders, excavators, pickup trucks, crew-haul vehicles). The 65 trips will be along the Johnson Creek route (USFS 2023c, p. 41).

During the mining and ore processing operations phase (approximately 15 years), a total of 50 vehicle trips per day are anticipated on average (year-round) utilizing the Burntlog Route. The 50 trips will consist of 17 light vehicles and 33 heavy vehicles. Busing or vanpooling will be provided for the applicant and contractor employees from the SGLF to the SGP. The associated parking area will accommodate approximately 300 vehicles. To the degree practicable, the use of busing and vans for employees and contractor transportation to the SGP and the worker housing facility will be mandated. During the closure and reclamation phase, traffic along the Burntlog Route will be reduced to a total of 27 vehicle trips per day (year-round).

Warm Lake Road

Warm Lake Road (County Road [CR] 10-579) is a two-lane (one lane each direction), asphalt-paved roadway with lane markings and is open year-round to all vehicles from SH 55 to Warm Lake. Warm Lake Road starts in Cascade at an intersection with SH 55, a major north-south transportation corridor. This intersection will be used by all mine-related traffic through all phases of the proposed action. Warm Lake Road continues eastward for approximately 35 mi, ending at Johnson Creek Road (CR 10-413) at Landmark. Warm Lake Road is under the jurisdiction of Valley County, who currently does not maintain the road in winter beyond Warm Lake Lodge. During years with adequate snowpack, an 8-mi segment of the Warm Lake Road route east of Warm Lake Lodge is used as an over snow vehicle (OSV) route, allowing access into Landmark and other areas.

The proposed action will require year-round passenger and delivery truck access from the onset of construction through the life of the mine. The Warm Lake Road is suitable for this use in its current condition. Wintertime maintenance east of Warm Lake Lodge will be conducted to ensure safe, year-round access to the sole route of ingress/egress for all mine support traffic. Maintenance will include snow removal and road sanding, as appropriate, to maintain a safe driving surface. Commitments for wintertime maintenance of Warm Lake Road will be documented in a Road Maintenance Agreement with Valley County. Wintertime maintenance and use of Warm Lake Road will result in two changes to current traffic conditions:

- Warm Lake Road east of Warm Lake Lodge will not be available as a recreational OSV route from the start of construction through reclamation of the proposed action. To replace this recreational use, a dedicated alternative OSV route will be established from the Warm Lake area to Landmark via the Cabin Creek/Trout Creek drainages and adjacent to the Johnson Creek Road. Establishing this replacement OSV route will minimize the interactions between proposed action traffic and recreational traffic in the winter.
- Expanded wintertime public vehicle access on Warm Lake Road east of Warm Lake Lodge will commingle proposed action and public travel.

Changes to the SH 55 and Warm Lake Road intersection will improve access for large trucks carrying equipment and supplies to the proposed action and will facilitate turns from SH 55 onto Warm Lake Road and from Warm Lake Road back onto SH 55. Any changes proposed to the intersection will need to be approved and implemented by the Idaho Transportation Department. Aside from modifications of the intersection, Warm Lake Road and its supporting infrastructure (i.e., for stormwater management) are not being expanded or modified.

The Forest is not a party to the applicant’s Road Maintenance Agreement with Valley County, the owner of the Warm Lake Road, Johnson Creek Road, and Stibnite Road. Therefore, the Forest will not be involved in the review, implementation, or enforcement of the agreement from a road maintenance perspective. However, as part of proposed action approval, the Forest will require the proposed action implementation of environmental requirements pertaining to road use and maintenance indicated in this document (USFS 2024, pp. 215–225, Table 3.9-1, and Appendix B) .

If road maintenance requires more substantial efforts than typical maintenance (e.g., landslide or avalanche recovery), the Forest will engage with Valley County and the applicant on efforts that will affect Forest lands outside the current road footprint and roadside support structures (e.g., ditches, culverts). Maintenance activities within the existing road footprint and support structures will not require additional Forest engagement. Activities involving Forest land not currently utilized by the road and support structures will require additional Forest engagement and potential permitting.

Johnson Creek Route

During the initial construction period of the Burntlog Route (approximately 2 to 3 years), mine-related traffic will access the proposed action from SH 55, north of the city of Cascade, via Warm Lake Road for approximately 35 mi, then north on Johnson Creek Road (CR 10-413) for approximately 25 mi to the village of Yellow Pine, and from Yellow Pine east approximately 14 mi to the mine site via the Stibnite Road (CR 50-412). The portion of the route that includes both the Johnson Creek Road and Stibnite Road is known as the Johnson Creek Route. This route is primarily situated topographically adjacent to the valley bottom, paralleling Johnson Creek and then the East Fork South Fork Salmon River (EFSFSR).

Johnson Creek Road is a county-maintained, native-surface road that is open to vehicles with seasonal restrictions due to snow. During the winter, Valley County plows approximately 10 mi of Johnson Creek Road from Yellow Pine south to Wapiti Meadow Ranch and grooms the remaining 17 mi of Johnson Creek Road from Wapiti Meadow Ranch to Warm Lake Road at Landmark for OSV use. Valley County does not plow Warm Lake Road from Warm Lake to Landmark; this section is a designated groomed OSV route. Warm Lake Road east of Warm Lake Lodge will not be available as a recreational OSV route from the start of construction through reclamation. To replace this recreational use, a dedicated alternative OSV route will be established from the Warm Lake area to Landmark via the Cabin Creek/Trout Creek drainages and adjacent to the Johnson Creek Road. Establishing this replacement OSV route will minimize the interactions between mining traffic and recreational traffic in the winter.

The Stibnite Road portion of the route is also a county-maintained native surface road, open to all vehicles with seasonal restrictions due to snow. This road is plowed in the winter by the applicant through an agreement with Valley County to allow site access for exploration activities. Seasonal restrictions and measures will restrict access and remain in place during the three-year construction period (USFS 2024, Appendix B, p. B-15). Upon construction of the Burntlog Route, winter plowing of the Stibnite Road for mine site access will be discontinued. Stibnite Road connects to Thunder Mountain Road on the southeastern portion of the Stibnite site and currently provides seasonal (non-winter) public access through the site.

Minor surface improvements (such as ditch and culvert repair, adding gravel, removing winter snow, resurfacing (i.e., gravel addition) if required, and summer dust suppression) will occur on the Johnson Creek Route to reduce sediment runoff and dust generation. However, there will be no road alignment modification or widening of the road prism of these existing roads along the Johnson Creek Route, as the current road is able to accommodate the equipment and materials needed for transport during the construction period. The road varies in elevation from approximately 4,750 to 6,700 ft above mean sea level (amsl) with an average grade of 1.5 to 2% with occasional local segments with grade up to approximately 8. Resurfacing, dust suppression, and repairs will be conducted on an as needed basis and will generally be completed annually following the winter season. Dust suppression using water application will be frequent (i.e., every few weeks) during the summer season.

Use of chemical dust suppressants such as magnesium chloride will occur near the start of the summer season. Water application will utilize over-the-road water trucks (e.g., 2,000 gallon) that will fill from diversion points authorized by Idaho Department of Water Resources (IDWR) water rights approval (e.g., from the groundwater well at the Landmark Maintenance Facility).

Prior to construction of the Burntlog Route, the Johnson Creek Route will be used for fuel transport using precautionary measures including (1) staged spill response kits, (2) pilot cars equipped with spill response kits, (3) radio contact with hauling trucks, (4) only day-time fuel deliveries, and (5) driver training on route. Once the Burntlog Route is completed, fuel transport using the Johnson Creek Route will be discontinued.

Portions of Johnson Creek Road (i.e., Landmark to Wapiti Meadows) are currently used as a groomed OSV trail during winter, and use of the Johnson Creek Route by mine-related construction traffic will conflict with this existing groomed OSV trail. Thus, while the Burntlog Route is under construction, a temporary 16-foot-wide groomed OSV trail adjacent to Johnson Creek Road between the proposed Cabin Creek Groomed OSV Route and Landmark will be constructed (Section 2.2.3.4). However, the OSV trail from Trout Creek Campground to Wapiti Meadows will be closed until construction of the Burntlog Route is complete. Once mine traffic moves to that route, then the OSV route will return to Johnson Creek Road and will reconnect Landmark with Wapiti Meadows.

The applicant has an existing agreement with Valley County for maintenance of Johnson Creek and Stibnite roads, including performing maintenance measures to repair segments that have deteriorated. Appropriate revisions to the road maintenance agreement will be established for use of the Johnson Creek Route as a construction route and to ensure year-round access in accordance with Valley County’s public road easement stipulations. Once construction of the Burntlog Route has been completed (2-3 years), the Johnson Creek Route will no longer be used by mine-related traffic.

Burntlog Route

Geophysical investigation will include drilling, test pit excavation, dynamic cone penetrometer testing, and sample collection to explore and characterize geotechnical conditions along the Burntlog Route to confirm that geotechnical conditions align with engineering designs for the roadway and stream crossings. The geotechnical investigation will assess 24 locations along the Burntlog Route via 40 borings, test pits, or cone penetrometer tests and will result in 0.6 acres of ground disturbance, which overlaps the ground disturbance for building the Burntlog Route.

The Burntlog Route will connect the eastern end of Warm Lake Road (at Landmark) to the mine site (to the northeast) by widening and improving approximately 23 mi of existing roads, including the full length of the existing Burntlog Road (FR 447) and segments of Meadow Creek Lookout Road (FR 51290) and Thunder Mountain Road (FR 50375). The three road segments will be connected with two new road segments totaling approximately 15 mi. Burntlog Road is currently a native surface road that is open year-round to all vehicles with seasonal restrictions due to snow. The last 0.25 to 0.5 mi of the existing road is closed and motorized traffic prohibited. Meadow Creek Lookout Road is a native surface road, open year-round to all vehicles. The Burntlog Route is primarily situated topographically on mid-slopes and ridgeline. Improvements on the existing roads that comprise the Burntlog Route include:

- Straightening tight corners to allow for improved safety and traffic visibility,
- Maintaining grades of less than 10% in all practicable locations,
- Placing sub-base material and surfacing with gravel,
- Application of a road binding agent (i.e., magnesium chloride) in localized segments to suppress dust, increase stability, and reduce sediment runoff,
- Widening the existing road surface (currently approximately12 ft wide) to a 21-foot-wide travel way (approximately 26 ft including shoulders), and
- Installing side-ditching, culverts, guardrails, and bridges, where necessary, with environmental design features to provide fish passage and limit potential sediment delivery to streams.

Figure 5 shows the proposed Burntlog Route and the proposed new road construction. A segment of new road construction for the Burntlog Route will be located on the south side of the Riordan Creek drainage and cross Riordan Creek north of Black Lake. The approximately 5.3-mi road segment will have 12 stream crossings, three of which cross perennial streams. Along the Burntlog Route, culverts designed and installed to allow fish passage will be used for fish-bearing stream segments crossed by the route. Upon construction of the Burntlog Route, the route will be used for fuel transport and include precautionary measures: (1) staged spill response kits, (2) pilot cars equipped with spill response kits, (3) radio contact with hauling trucks, (4) only day-time fuel deliveries, and (5) driver training on route. The elevation of this road segment is approximately 8,000 to 8,600 ft, and the average grade of this road segment will be 5 to 6%. After road construction is completed, public use will be allowed on Burntlog Route when other public access roads are blocked by mine operations.

Construction of new segments of the Burntlog Route will utilize cut and fill techniques to create a level surface for installation of the roadway. Most cut and fill will be conducted by mechanical construction equipment (i.e., dozers, rollers, graders) to relocate and compact unconsolidated materials then place a gravel road surface. In instances where consolidated bedrock material is encountered in cut areas, blasting may be used to break up the bedrock to complete the cut. Areas requiring blasting will typically occur on steeper side slopes in upland areas where unconsolidated soil and cover materials overlying bedrock may have limited thickness.

The connection segment between the end of Burntlog Road and Meadow Creek Lookout Road is approximately 11 mi and will cross Trapper Creek 0.5 mi east of the intersection of Trapper Creek Road (FR 440) and FR 440A and continue northeast towards Black Lake and on to the Meadow Creek Lookout Road. The second connector between the Meadow Creek Lookout Road and Thunder Mountain Road will be approximately 4 mi and links up with Thunder Mountain Road approximately 2 mi south of the mine site. Minor surface improvements (e.g., blading) will occur on the portions of the existing Thunder Mountain Road and Meadow Creek Lookout Road that will not become part of the Burntlog Route to provide a safe road surface for transportation of construction equipment required to build the Burntlog Route. There will be no road alignment modification or widening of the portions of the existing roads that are not part of the Burntlog Route.

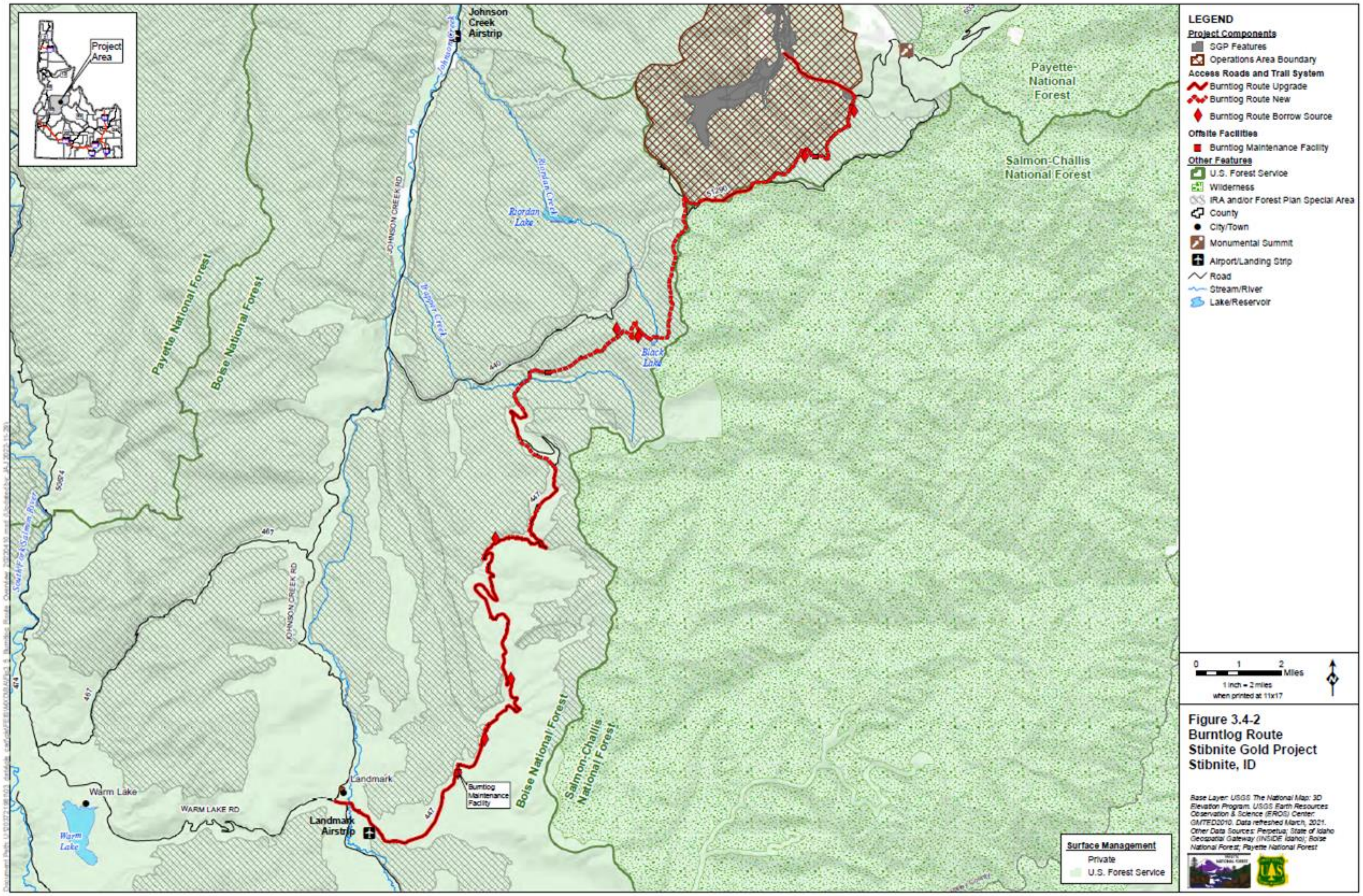

Figure 5. The Burntlog Route from Landmark to the mine site (USFS 2024, Figure 3.4-2).

Burntlog Route Borrow Sources, Staging Areas, and Construction Camps

Up to eight borrow sites will be established along the Burntlog Route to meet construction and ongoing maintenance throughout the life of the mine and to support decommissioning following mine closure while avoiding Riparian Conservation Areas (RCA). Additionally, these eight borrow areas will be utilized for staging of equipment and supplies. Three construction camps will be located within the disturbance created by borrow sources or staging areas. The construction camps will be for trailer parking, and each trailer will be equipped with fresh water and sanitary waste storage.

Culverts and Bridges

Construction of the Burntlog Route (i.e., improvement of the existing FS 447 plus new road development) will require installation of bridges and culverts to cross existing stream segments and to manage stormwater diverted from the roadway. Design criteria for bridges and culverts consider the criteria described in the Forest Service Structures Handbook (USFS 2014, entire), the Valley County Roadway Design Guide (Valley County 2008, entire), and NMFS guidelines (NMFS 2022b, entire). These criteria are summarized in Table 2.

Table 2. Bridge and culvert design criteria (USFS 2024, Table 3.4-2).

Item	Bridges	Stream Crossing Culverts[1]	Relief Culverts[2]
Design Storm	100-year	100-year	25-year
Minimum Size	Span 120% of bankfull width for 1.5-year event	100-year peak discharge and span 120% of bankfull width for 1.5-year event	25-year peak discharge
Minimum Cover	Not applicable	Manufacture's specification	12 inches to finished grade
Minimum Width	Full roadway plus three feet	No applicable	Not applicable
Freeboard	Three to five feet	Headwater to not exceed 0.8 diameter	Headwater to not exceed 0.8 diameter
Loading	AASHTO-93	AASHTO-93	AASHTO-93

[1] Culverts that cross stream segments containing perennial flows.
[2] Culvert that do not cross flowing streams but instead manage stormwater.

Bridges and culverts that have been installed within the last 20 years that are in good condition will be retained if possible. Six of the installed bridges that cross stream segments with fish passage will be new or upgraded, while 7 stream crossing culverts that cross segments with fish passage (based on drain area analyses and environmental DNA [eDNA] data) will be new, upgraded, or replaced. In addition to the Burntlog Route access road crossings, there will be one haul road crossing of the EFSFSR in the mining area along with an existing box culvert. Design information for the crossings with fish passage are summarized in Table *3*. Final designs for bridges, culverts, and plate arches are pending geotechnical assessment of the crossing locations.

Table 3. Design information for fish crossing bridges and culverts (USFS 2024, table 3.4-4).

Stream	Description	Structure Type (ft)	Bankfull Width (ft)	Minimum Span (ft)	Drainage Area (mi^2)	Streambed Material (D50 mm)	Upstream Channel Slope (%)	Downstream Channel Slope (%)
Johnson Creek	Existing bridge to be upgraded	Bridge (80)	61.4	75	46.9	Sand and gravel	0.15	0.37
Burntlog Creek	Existing bridge to be upgraded	Bridge (24)	-	-	3.1	-	-	-
East Fork Burntlog Creek	Existing bridge to be upgraded	Bridge (20)	12.9	16	2.1	-	-	-
Tributary to East Fork Burntlog Creek	Retain existing bridge installed in 2021	Bridge (60)	-	-	4.3	-	-	-
Trapper Creek	New bridge installation	Bridge (30)	17.3	21	6.4	32 – 45	-0.16	0.22
EFSFSR	New bridge installation	Bridge (20)	10.2	12	4.3	22 – 32	3.49	2.30
Mudlake/ Peanut Creek	Existing corrugated metal pipe culvert to be upgraded	Corrugated metal pipe (8)	5.7	6.8	0.4	<2 over gravel	1.37	2.79
Peanut Creek	Retain existing corrugated metal pipe culvert installed in 2008	Plate Arch (13 x 5.1)	5.2	6.3	1.3	25 – 40	5.06	1.53

Stream	Description	Structure Type (ft)	Bankfull Width (ft)	Minimum Span (ft)	Drainage Area (mi^2)	Streambed Material (D50 mm)	Upstream Channel Slope (%)	Downstream Channel Slope (%)
Tributary to East Fork Burntlog Creek	Existing corrugated metal pipe culvert to be replaced with box culvert	Aluminum Box (11 x 4.3)	6.9	8.3	0.6	20 – 35	5.21	10.81
Tributary to East Fork Burntlog Creek	Existing corrugated metal pipe culvert to be replaced with box culvert	Aluminum Box (11 x 4.3)	7.8	9.4	0.6	30 – 45	4.83	4.40
Tributary to East Fork Burntlog Creek	Existing bottomless box culvert to be retained	Concrete Box (20)	11.6	3.9	1.4	80 – 120	11.35	9.66
Tributary to East Fork Burntlog Creek	Existing corrugated metal pipe culvert to be upgraded	Corrugated metal pipe (5)	1.7	2.1	0.1	10 – 20	2.80	12.81
Tributary to Trapper Creek	Existing corrugated metal pipe culvert to be replaced with box culvert	Aluminum Box (12.3 x 4.5)	9.4	11.3	1.0	30 – 45	2.10	8.59
Riordan Creek	New culvert installation	Corrugated metal pipe (6)	3.9	4.7	0.3	65 – 90	11.15	16.00
Rabbit Creek	Existing corrugated metal pipe culvert to be upgraded	Corrugated metal pipe (6)	4.0	4.8	0.7	16 – 23	22.00	6.20

Stream	Description	Structure Type (ft)	Bankfull Width (ft)	Minimum Span (ft)	Drainage Area (mi^2)	Streambed Material (D50 mm)	Upstream Channel Slope (%)	Downstream Channel Slope (%)
EFSFSR	Existing box culvert to be retained	Box	26.5	-	-	128 – 181	-0.58	3.70
EFSFSR	New bridge installation	Bridge	20.9	-	-	75 – 125	-	-

Site preparation, staging, and sequencing of instream work (i.e., Burntlog Route stream crossings) is described in the Fish and Aquatic Resources Mitigation Plan (Brown and Caldwell, Rio ASE, and BioAnalysts 2021, Section 5.4.7). A planning team with representation from project management, engineering, and fish biology will be assembled to coordinate with construction personnel and equipment operators to plan the staging and sequence for work area isolation, fish capture and removal, and dewatering, including:

- scheduling in an appropriate in-stream work window (see Section 2.4.2.2),
- establishing the length of channel to be isolated for each crossing,
- conducting work area isolation and fish salvage in consideration of habitat requirements, flow and temperature conditions, and exposure to turbidity or other unfavorable conditions, and
- dewatering via a bypass flume or culvert with diversion by sandbags, sheet piling, or cofferdam.

When stream segments require dewatering for bridge or culvert installation, they will be isolated using methods including block nets, sandbags, diversions, pumps, sheetpiling, flashboards, coffer dams, or other structures. The method used will depend on the stream segment location, diversion sequencing, operational requirements, segment length, segment slope, flow conditions, depth, and fish salvage. All isolation barriers will be monitored during installation and operation. Partial dewatering will be conducted during low-flow periods to facilitate stream segment isolation and fish salvage. Whenever possible, dewatering will not begin until fish have been captured and removed for relocation. However, depending on the location and water depth, it may be necessary to partially draw down the water first to perform fish removal. Partial dewatering before fish salvage operations begin may also improve fish capture efficiency by reducing the total volume of stream habitat that needs to be salvaged. In those cases, dewatering pumps will be screened to meet NOAA Fisheries and Idaho Department of Fish and Game (IDFG) standards to avoid entrainment of juvenile fish. Fish capture from work isolation areas will consist of the following measures:

- slowly reducing flow in the work area to allow some fish to leave volitionally,
- installing block nets upstream and downstream of the isolation area with the nets secured to stream channel bed and banks until fish capture is complete and exclusion of fish from the work area is necessary,
- hourly monitoring of block nets during instream disturbance in the work area,
- block nets in place for more than one day will be monitored daily to ensure they are secured to banks and are free of organic accumulation plus monitored every four hours for fish impingement if located in bull trout spawning and rearing habitat (unless a variance is granted by the Forest and the Service),
- seining the isolated area to capture and relocate fish,
- if areas are isolated overnight, minnow traps will be placed overnight in conjunction with seining,
- collecting any remaining fish by hand or dip nets as dewatering continues, and

- if all other techniques have been exhausted, electrofishing may be used to capture remaining fish under electrofishing conservation measures.

Captured fish will be relocated as quickly as possible to pre-planned release areas using aerated and shaded transport buckets holding limited numbers of fish of comparable size to minimize predation. Upon completion of the instream work, flow diversions will be removed slowly to allow gradual rewatering of the isolated stream segment to minimize turbidity. Once the stream segment is rewatered, the upstream and downstream block nets will be removed.

Erosion and sediment control for in-water work for the Burntlog Route will be consistent with controls used for other aspects of the proposed action. Turbidity monitoring and protocols will include:

- turbidity monitoring will be required and shall be completed in accordance with designated protocols (for the type of planned work),
- work will be performed in a manner that does not cause turbidity exceedances within the waterway,
- if turbidity exceedances do occur, the work will stop to address the turbidity issues, and
- construction discharge water will be collected to remove debris and sediment and will meet turbidity requirements for discharging back to receiving streams.

Sediment control measures will include the implementation and use of the following as needed in appropriate locations:

- in-stream work will conform with the work, turbidity, and dewatering procedures as specified in design conservation measures (Rio ASE 2023, entire) and adhere to Bonneville Power Administration Habitat Improvement Program conservation measures,
- placement of fine mesh silt fences and straw waddles,
- minimization of equipment wet crossings with vehicles and machinery crossing at right angles to the main channel whenever possible,
- no construction equipment stream crossings will occur within 300 ft upstream or 100 ft downstream of an existing redd or spawning fish,
- after construction, temporary stream crossings will be removed and banks restored while adhering to turbidity requirements,
- cofferdams and diversion structures will have one foot of freeboard,
- dewatering pump discharge will be released onto floodplain areas away from wetlands and construction activities where discharge will fully infiltrate prior to reaching wetlands and surface waters unless otherwise approved,
- any return flows from dewatering discharge will meet turbidity requirements,
- bag fill materials will be clean, washed, and rounded material meeting standard specifications for drain rock, streambed aggregate, streambed sediments, or streambed cobbles,

- work activities within the ordinary high-water channel will conform with the water quality standards established for the project.

Road Maintenance Measures

Road maintenance will be conducted following project design, Forest requirements, and requirements of the Road Maintenance Agreement with Valley County. Routine maintenance includes resurfacing, fixing holes, grading, ditch cleaning, and use of traffic signs. For non-routine road maintenance, such as activities outside the current road prism, new construction, or re-construction, the Forest will engage with Valley County when activities involve repairs or new infrastructure that departs from the current roadway and infrastructure footprint. The Forest will focus on enforcement of its existing requirements when activities occur within the current footprint.

To assess road conditions and fulfillment of requirements, the Forest will meet annually with the applicant to discuss road maintenance needs, road maintenance activities, and best management practices that must be employed to minimize impacts to federally protected resources. The Forest will present an annual summary of the implemented and planned road maintenance activities to the Interest Agency Review Board (see Section 2.4.1). These activities and reports will include the status of road maintenance measures for the proposed action including:

- use of gravel for road surfacing that meets American Association of State Highway and Transportation standards, design specifications for particle size (90 to 100 passing 1 inch, 85 to 95% passing 3/4 inch, 70 to 83% passing 3/8 inch, 47 to 62% passing No. 4 sieve, 27 to 40% passing No. 16 sieve, 18 to 27% passing No. 40 sieve, and 10 to 16% passing No. 200 sieve), percent fracture (75, one face), and plasticity index (4 to 10), and does not rapidly degrade into fine material,
- avoids side casting of snow where it has the potential to dam adjacent streams,
- use of dust suppressants magnesium chloride, calcium chloride, or lignin-based chemicals such as lignin sulfonate with Interested Agency Review Board approval required for use of any other dust suppressant (see also Section 2.4.1),
- application dust abatement centered in the road so that all the chemical is absorbed before leaving the road surface when the road is within 25 ft of stream channels,
- avoid installation of berms along the outside edge of roads unless an outside berm was specifically designed to be part of the road and low-energy drainage is provided for,
- grade and shape roads in a manner that conserves existing surface material and designed drainage,
- remove fines that cannot be bladed into the road surface by end hauling to areas outside RCAs for disposal (i.e., no side casting of materials); slides and rock failures of more than one half cubic yard will be hauled to disposal sites outside RCAs; scattered clean rocks (i.e., 1-inch plus) may be raked or bladed off the road except within 100 ft of streams,
- maintain blocked motorized access on all roads and road segments that are not open to the public, particularly service roads for the power transmission line, and

- gravel roads through RCAs when the roads will be used daily or used by heavy equipment.

2.2.3.4 Public Access

During construction of the proposed action and completion of the Burntlog Route, to the degree practicable, the public will continue to have access on Forest roads currently available to the public and following construction road use with seasonal restrictions per current conditions will return. However, current public access on Stibnite Road will be restricted for a period of approximately one year while a new through-site public access road is constructed. A new 4-mi long, 12-foot-wide gravel road will be constructed to provide public access from Stibnite Road (FR 50412) to Thunder Mountain Road through the proposed action (Figure 4**)**. The road will be constructed on a widened bench on the west side within the YPP, then head south of the YPP, where this road will utilize an underpass to cross under a haul road and continue southward, parallel to and on the east side of the mine haul road on a partially revegetated portion of a former haul road. Southwest of the ore processing area, the public access road will connect with Thunder Mountain Road and continue toward the worker housing facility, exiting the proposed action to the southeast.

During operations, the public access road will provide seasonal use, open to all vehicles; access will not be provided in winter when impassable (current county maintenance standards), and signs will inform the public of seasonal and temporary closures. Vehicles passing through the action area will be required to check-in with mine personnel at the North or South entry points and will receive a safety briefing and will also be required to check-out with personnel upon exiting. For safety purposes, public access will be separated from other proposed action roads by berms, security fencing, and the underpass to allow the public road to pass beneath the mine haul road. No stopping or deviating from the public access road will be allowed. Proposed action access will be restricted to any vehicles due to concerns related to public or employee health and safety, such as during road construction and maintenance, blasting, highwall scaling, mining in the immediate area of the road, and similar operations.

Public access will continue along Johnson Creek Road and Burntlog Road. Total closures of half-day to multiple days could occur during construction work on Stibnite Road between the village of Yellow Pine and the mine site, part of Thunder Mountain Road, and Burntlog Road. The long duration road closures will primarily occur in the mine site area associated with modification of the Yellow Pine Pit wall to start construction of the fishway/tunnel and construction of a light vehicle underpass below the mine equipment haul road.

Public use of the Burntlog Route will provide motorized access to Meadow Creek Lookout Road (FR 51290) and Monumental Summit. Other routes available for public use are shown on

Figure 3. Public access by foot via existing trails or on roads will be restricted within the mine site shown in Figure 4. Security personnel, fencing (including wildlife exclusion fencing), and signs will restrict public access to vehicular traffic on the designated public access roadway inside the boundary.

Warm Lake to Landmark Groomed OSV Trail

Due to year-round access to the mine site along the Burntlog Route, an existing, approximately 8.5-mi-long groomed OSV trail from Warm Lake to Landmark will be closed for the life of the proposed action. To replace this recreational use, a dedicated alternative OSV route will be established from Warm Lake area to Landmark via the Cabin Creek/Trout Creek drainages and Johnson Creek Road. The trail will be established largely along existing roads using a snowplow wing attachment requiring some vegetation and tree removal for safe snowplowing.

Near Warm Lake, an approximately 2-acre parking area will be established west of South Fork Road on FR 474B. A new 3.2-mi groomer access trail will be established from the parking area to the Forest Warm Lake Project Camp south of Paradise Valley Road (FR 488) where the groomer will be stored. An approximate 0.1-mi segment will be groomed from the intersection of Paradise Valley Road and FR 488A to Warm Lake Road. The Cabin Creek Road (FR 467) portion of the groomed OSV trail will extend approximately 13 mi to the Trout Creek Campground on Johnson Creek Road. Portions of Cabin Creek Road will require stream crossing improvements, localized road widening, and surface grading to support the OSV route grooming equipment.

Johnson Creek Groomed OSV Trail

From Trout Creek Campground to Landmark, an approximately 8-mi temporary groomed OSV trail will be created and maintained on NFS lands adjacent to the west side of Johnson Creek Road (CR 10-413). Portions of the temporary groomed OSV trail (approximately 16 ft wide) will be established using a snowplow wing attachment requiring some vegetation and tree removal to allow for safe snowplowing. In areas where topography and vegetation prevent using the wing attachment to establish the groomed OSV trail, sections will merge with Johnson Creek Road. During construction, the replacement OSV route will include an additional 0.34-mi segment east along the Warm Lake Road connecting Johnson Creek Road to Deadwood-Stanley Road (FR 579).

Warm Lake Area OSV Connection

A 16-foot-wide groomed OSV trail will be created and maintained north of Warm Lake Road to connect the southern end of the Cabin Creek Road OSV trail to the Warm Lake Road (FR 579). It will also provide access to North Shoreline Drive (FR 489) from the Cabin Creek Road OSV trail. This 0.3-mi route will be used throughout construction and operations and will require the removal of some vegetation and trees.

Temporary OSV Closure Trout Creek Campground to Wapiti Meadows

OSV access will be temporarily halted between Trout Creek Campground and Wapiti Meadows (about 9 mi north of Trout Creek Campground on Johnson Creek Road) for approximately two to three years during construction of the Burntlog Route. Once construction of the Burntlog Route has been completed, the Johnson Creek Route will no longer be used by mine-related traffic, and the OSV route will be returned to the unplowed Johnson Creek Road and extended northward to provide approximately 17 mi of groomed OSV access between Landmark and Wapiti Meadows. Resumption of OSV access between Trout Creek Campground and Wapiti Meadows will occur following construction of the Burntlog Route.

2.2.3.5 Traffic

Traffic associated with construction will occur year-round, depending upon road and weather conditions. Construction-related traffic and material hauling will be most concentrated from May through November, and personnel will be transported primarily using buses and vans. The total estimated annual average daily traffic (AADT) for construction activities driving from SH 55 to the SGLF and between the SGLF and the mine site is listed in Table 4. Supplies and deliveries for the proposed action during construction will access the SGLF using SH 55 to Warm Lake Road and will use SH 55 through Cascade and other communities along SH 55 south of Cascade including Banks and Horseshoe Bend.

Approximately two-thirds of all mine-related traffic will originate south of Warm Lake Road and will use SH 55 through Cascade and other communities along SH 55 south of Cascade including Banks and Horseshoe Bend. Approximately one-third of all mine-related traffic originating north of Warm Lake Road will use SH 55 through the communities of Donnelly, Lake Fork, and McCall. Through McCall, mine-related traffic will generally use Deinhard Lane and Boydstun Street. Employees will be encouraged to use company provided shuttle buses as transport to the SGLF from towns along SH 55. Busing or vanpooling will be provided for the applicant and employees from the SGLF to the mine site and to the worker housing facility. The associated parking area will accommodate approximately 300 vehicles.

Table 4. Construction and operations traffic (USFS 2024, Table 3.4-5).

Phase	Route	Transport Type	AADT
Construction	SH 55 to SGLF	HV	30
Construction	SH 55 to SGLF	LV	169
Total			**199**
Construction	SGLF to Mine Site	HV	45
Construction	SGLF to Mine Site	LV	20
Total			**65**
Operations	SH 55 to SGLF	HV	25
Operations	SH 55 to SGLF	LV	131
Total			**156**
Operations	SGLF to Mine Site	HV	33
Operations	SGLF to Mine Site	LV	17
Total			**50**
Reclamation and Closure	SH 55 to Mine Site	HV	15
Reclamation and Closure	SH 55 to Mine Site	LV	12
Total			**27**

AADT – annual average daily traffic; HV – heavy vehicle; LV – light vehicle
SGLF to Mine Site - Stibnite Gold Logistics Facility to Stibnite Gold Mine Site via the Johnson Creek Route during construction and via the Burntlog Route during operations
SH 55 to SGLF – State Highway 55 to Stibnite Gold Logistics Facility

2.2.3.6 Water Use and Water Treatment During Construction

During construction, mine-impacted water will be generated and will require treatment before being discharged to receiving streams. Water treatment plants will be modular, vendor-supplied equipment package skids placed on improved pads with covers and freeze protection for sensitive piping and equipment located in the process plant and Yellow Pine Pit work areas to treat for analytes including cadmium, copper, lead, mercury, silver, thallium, zinc, arsenic, and antimony. Peak capacity on-site for construction water treatment requirements is expected to be 300 gallons per minute (gpm; or 0.67 cubic ft per second [cfs]) with average flows of 18 gpm (0.04 cfs) and 128 gpm (0.29 cfs) during the first and second years of mine site construction, respectively. Water treatment plant residuals will be sent to the TSF for disposal. See Section 2.2.4.10 for additional details.

2.2.3.7 Transmission Line Upgrades

To serve the 60-megawatt (MW) load requirement for the proposed action, Idaho Power Company (IPC) will rebuild or construct 72.8-mi of transmission line and associated facilities (Figure 3). The existing Cascade to Warm Lake 69-kilovolt (kV) transmission line, and much of the Lake Fork to Cascade and the Warm Lake to Yellow Pine 69-kV transmission lines, will be rebuilt to 138-kV clearances and capacity (Perpetua 2021b). A new Johnson Creek Substation will be constructed and a new 9.1-mi, 138-kV transmission line will be built between the new Johnson Creek Substation and the new Stibnite Substation. The existing single-phase distribution line between the proposed Johnson Creek Substation and the village of Yellow Pine will remain intact. A new single-phase underground distribution line, within the existing road right-of-way (ROW), will be built along Johnson Creek Road between the Johnson Creek Substation and Wapiti Meadows to the south. The existing 69-kV transmission line between the Cascade Dam and the Cascade Substation will remain unchanged except for tying the two lines into the new Cascade Switching Station. A new 69-kV line will be constructed to connect the Cascade Switching Station to the existing grid to the south.

Changes to the existing IPC system for operations will include:

- Upgrade approximately 59.1 mi of the existing 12.5-kV and 69-kV transmission lines between the Lake Fork and Johnson Creek substations to 138-kV service. The ROW will be 50 to 100 ft (depending on slope aspect), and existing transmission line support structures will be replaced with taller structures.
- A new approximate 9.1-mi, 138-kV line will be constructed from the Johnson Creek substation to a new substation at the mine site (Figure 4), partially within a former transmission line ROW. The ROW for the new transmission line will be approximately 100 ft wide. Transformers will reduce the voltage from 138-kV to 34.9-kV for distribution to facilities through overhead distribution lines or underground conduits.
- Upgrade the substations located at Oxbow Dam, Horse Flat, McCall, Lake Fork, and Warm Lake.
- A new substation (Johnson Creek substation) approximately 0.7 mi south of the Johnson Creek airstrip will be built to provide low voltage distribution to Yellow Pine and electricity to the proposed action. The substation is outside RCAs; (USFS 2023d, Figure 5-5b).

New construction of the Scott Valley and Thunderbolt Tap substations, a new switching substation near Cascade (Cascade switching station), and the removal of the existing Scott Valley substation will include the following:

- Reroute approximately 5.4 mi of transmission line to avoid the Thunder Mountain Estates subdivision. The reroute will parallel Warm Lake Road for approximately 2.4 mi before crossing onto Forest and Idaho Department of Lands (IDL) land for approximately 1.7 mi. The portion crossing IDL property will require a ROW easement. An additional 1 mi of 69-kV transmission line will be required along Thunder City Road linking the existing transmission line out of Emmett to the reroute. Approximately 2.7 mi of transmission line will no longer be required and will be removed.
- Reroute approximately 0.9 mi of transmission line to approximately 600 ft north of its current location between Cascade and Donnelly to use an old railroad grade on private property and the existing transmission line will be removed.
- Install approximately 3 mi of new underground power distribution along Johnson Creek Road from the Johnson Creek substation south to Wapiti Meadows. This underground power distribution line is within the existing Johnson Creek Road in a segment that does not cross Johnson Creek (Perpetua 2021b, Maps 59 through 62). Utilities associated with the proposed action (existing transmission line upgrades and structure work, ROW clearing, new transmission line, and transmission line access roads) will cross 37 different streams (USFS 2023a, pp. 160-161, Table 7-24). Of the 37 streams that will be crossed, 26 will be related to the upgrade of existing Idaho Power Company transmission lines, where the existing transmission line ROW crosses various streams. The existing transmission line currently crosses multiple streams, including Little Creek (tributary to Big Creek), Cabin Creek, Trout Creek, and Riordan Creek. The ROW overlaps with 132.4 acres of RCAs (USFS 2023d, pp. 81–82, Table 7-5). However, the utility poles are not directly along the creeks or within the RCA, and the line is currently kept cleared for access when necessary. Upgrades of these lines, while requiring a wider clearing zone, will be limited to trimming of trees that pose a fire risk to the power line.

The transmission line extends across lands managed by the BNF, Forest, Reclamation, IDL, and private lands. Table 1 includes the transmission line segments (Utilities) by land ownership crossed. Both temporary and permanent disturbances will be required for the construction of the transmission line and substations. While existing structure locations will be used when possible, the removal and installation of new structures will require temporary disturbance.

Each transmission line structure site needs a construction space large enough to remove the existing structure, excavate structure foundation holes, and install new structure poles and any guys and anchors. Temporary disturbance is based on a 100-ft by 60-ft pad for each structure location. Some temporary disturbance areas will be 100-ft by 100-ft pads.

Transmission Line Structures

The transmission line structures will use standardized IPC structure types, including single-pole and H-frame structures in a variety of configurations. Where possible, single-pole structures will be installed rather than H-frame structures to minimize the structure disturbance footprint.

Distribution underbuild is a construction method where the distribution voltage circuit is constructed underneath the transmission circuit to reduce the number of power poles. Single-pole structures will be used in areas where distribution underbuild is present, shorter structure spans are needed, smaller corridors are used, or a limited structural footprint is required. Typical spans for single-pole structures will be approximately 300 ft in length. The H-frame structures typically comprise two poles and will be used for areas where longer spans, increased structural capacity, or mountainous terrain is encountered. Typical spans for H-frame structures will be approximately 600 ft in length. Structure heights will vary between 45 and 80 ft depending upon structure type and terrain. However, structure heights greater than 80 ft could be required in isolated instances. The estimated number of each type of structure by line segment is available in the Plan of Development (POD) for Electrical Transmission, Stibnite Gold Project (Perpetua 2021b, entire).

Foundations

Structure foundations will include direct embedded wood poles. Angle structures and dead-end structures may require the excavation and placement of guy anchors to complete the structure installation. In locations where guy anchors will not be feasible and designed steel poles will be necessary, structures will be supported by drilled pier caisson foundations.

Conductors

Electrical transmission and distribution lines use metallic conductors to allow the flow of current, which are designed in a manner that balances current flow, strength, and sagging characteristics. Alternating current transmission lines use three phases for each transmission circuit. The IPC standards require a minimum ground clearance of 24.5 ft for all new construction of 138-kV transmission lines. Additionally, the transmission lines will include fiber-optic cables and 3/8-inch steel overhead ground wire.

Overhead Ground Wire and Electrodes

Overhead ground wires are required to provide a transmission system with protection from the adverse effects of lightning. The shielding of the transmission system will be provided by an optical ground wire, which is a steel-coated, fiber-optic cable that provides the same levels of system protection as steel overhead ground wire, but also includes a core of fiber-optic cables used for communications.

Distribution Underbuild

Distribution underbuild (the lower voltage line) will be co-located on the transmission line structures under the primary 138-kV voltage (the higher voltage line). Distribution underbuild is usually the last remaining conductor to be installed after the transmission conductors, overhead ground wire, and optical ground wire are finished.

Grounding

Grounding a transmission line is required to operate and maintain the facility safely. The grounding process is achieved by electrically connecting structure hardware to a ground rod buried within the earth. This electrical connection of hardware allows the safe flow of current and does not allow the build-up of voltage that could cause a mechanical failure or safety concern.

An electrical effects study is required to determine the methods and equipment needed to safely mitigate the site-specific current flows through these adjacent facilities. Typically, all metallic structures within the ROW will be grounded, including buildings, fences, and pipelines. If the electrical effects study determines that structures outside of the ROW require grounding, measures to safely ground those facilities will be required.

Other Nonelectrical Hardware

For utilities where avian protection and aircraft warnings are required, non-electrical hardware may be installed on the line. This hardware or marking could include bird flight diverters, marker balls, tower lighting, or tower painting. Structures will be marked or protected from avian intersect using the guidelines and methodologies detailed in the Avian Power Line Interaction Committee (APLIC) recommendations. Any Federal Aviation Administration (FAA) requirements will be in accordance with the FAA Circular 70/7460 document (FAA 2020, entire), which details the operational requirements for structures exceeding a safe operational elevation in relation to air space.

Access Roads

In addition to the transmission line work detailed above, the existing road network used to access these structures may require maintenance or improvements to allow construction equipment safe access into the power line corridor. While the existing road network proximate to the transmission line ROW will be used to the maximum extent possible, some new service roads (roads used solely for the proposed action) could be needed to reach structure locations without existing access.

Additionally, overland service routes will be required from the existing access road to reach structure locations without current access. These overland service routes will not require blade work (i.e., recontouring). A 14-foot-wide ROW is being requested for the existing and proposed roads outside of the power line corridor ROW to accommodate construction and maintenance equipment. For FR 467, a 16-foot-wide ROW is being requested to accommodate OSV.

During construction, the new section of transmission line between the Johnson Creek substation and the mine site will require major improvements to Horse Heaven Road (FR 416W), NFS Trail 233 (no name), and approximately 4 mi of new spur roads will be constructed. Minor upgrades to Cabin Creek Road (FR 50467) will also be required.

Road maintenance requirements prior to construction will vary depending on the type of road, level of use, and condition of the road. However, maintenance generally will consist of clearing vegetation and rocks, as well as repairing cut and fill slope failures to allow for a 14-ft-wide road surface. In most cases, the roads will be left as close to an undeveloped nature (i.e., two-track road) as possible without creating environmental degradation (e.g., erosion or rutting from poor water drainage). Equipment to perform the required road maintenance will include hand tools (e.g., chainsaws), track driven machines (bulldozers and graders) and crew-haul vehicles (such as 4-wheel-drive pickups and off-highway vehicles [OHV; includes all terrain vehicles, utility task vehicles, and side-by-sides]). Roads will be opened and cleared for use by trucks transporting materials, excavators, drill rigs, bucket trucks, pickup trucks, and crew-haul vehicles. Specific actions, such as installing water bars and dips to control erosion and stormwater, will be implemented to reduce construction impacts and will follow standard designs.

Access road construction and disturbance can be summarized into five types of access roads:

Existing (No Improvement) – These existing roads provide access to structures and will not require improvement. Minor maintenance activities such as pruning of vegetation for construction vehicle access and applying water to the road to reduce dust may be required.

Existing (Minor Improvement) – These existing roads provide access to structures and should not require significant improvement to utilize for construction. Existing road widths typically vary from 14-ft-wide access roads to 24-ft-wide gravel roads with 14 ft being the minimum needed to accommodate construction traffic. Minor maintenance activities such as applying water to the road to reduce dust and improve workability of the soil for blading and compaction, and blading may be required during and after construction to support construction traffic and return the road to a preconstruction condition.

Existing (Major Improvement) – These existing roads provide access to the structures and may require major reconstruction work. These roads appear to be in questionable condition and will likely require major reconstruction to support construction traffic. Existing road widths may be as narrow as 8 ft for primitive two-track roads that need reconstruction to widen the driving surface to 14 ft, with curve widening and turnouts added to accommodate construction traffic. Overall disturbance width is estimated to be 20 ft, which includes cut/fill slopes and other impacts associated with reconstruction. Maintenance activities such as applying water to the road, to reduce dust and improve workability of the soil, and blading may be required during and after construction to support construction traffic. Aggregate and crushed rock placement may be required to maintain the existing road.

New (Overland Travel) –These roads traverse existing agricultural fields or open areas and are not expected to require grading work to support construction traffic. No permanent road construction is anticipated on these routes, and any earthwork or aggregate imported will be reclaimed after construction. Temporary driving surface is estimated to be 14 ft to accommodate construction traffic. Sections of road that cross wet fields or wetlands may have temporary matting installed to provide a stable surface to support construction equipment without disturbing the ground. Minor work such as grade smoothing at ditches or large rock removal may be required to provide a drivable surface.

New (Bladed) – New bladed roads are typically required where the existing ground has a significant cross slope or traverses terrain that needs to be bladed smooth. Construction of the road prism will require excavation and placement of fill material to provide a stable driving surface. The driving surface is constructed to a minimum width of 14 ft and includes curve widening and turnouts to accommodate construction traffic. Overall disturbance width is estimated to be an average of 35 ft, which includes cut/fill slopes and other impacts associated with construction. Earthwork quantities are typically balanced for each road by adjusting the grade to balance material being cut versus filled. Surfacing rock is not typically placed on these roads unless required by stakeholders or needed to support construction traffic.

Substations

The IPC determined there will be a need to increase the 230/138-kV transformer capacities at the Oxbow and Horse Flat substations to support the proposed action activities load. A 20 megavolt amps reactive capacitor bank will also need to be installed at the McCall Substation for voltage support under abnormal (element out of service) conditions. A new 138/69-kV switching substation will be required to be located near Cascade. Several smaller substations along the transmission line from Cascade to Yellow Pine will also need to be upgraded from 69-kV to 138-kV. A 138-kV metering substation will be placed in the Johnson Creek area to feed the village of Yellow Pine and serve as a metering point for the Stibnite 138-kV line. The substations will be operated and maintained by IPC. Additional details regarding the upgrades needed to existing substations and the construction of new substations are available in the Electrical Transmission POD (Perpetua 2021b, entire).

Periodic inspections of the transmission lines and supporting structures will be required and conducted as described below. Depending on the results of the inspection, maintenance work may be scheduled for immediate follow up (e.g., in the case of imminent failure or safety issues) or follow up in subsequent years (e.g., issues that need to be repaired but do not cause an imminent problem). The activities presented below are considered routine operation and maintenance activities. Subject to specific terms, conditions, and stipulations of the ROW grant and reporting requirements contained herein, these activities may be conducted by IPC as necessary and without prior notification to the Forest:

- Routine air patrols to inspect for structural and conductor defects, conductor clearance problems, and hazardous trees. These are typically conducted from a helicopter, and personnel include a pilot and line patrolmen.
- Routine ground patrols to inspect structural and conductor components. A vast majority of inspections will require either a pickup truck or OHV. Patrols may rely on direct line of-sight or binoculars. Patrols are typically conducted in the spring and fall.
- Climbing surveys to inspect hardware or make repairs. Personnel access these structures by pickup, OHV, or on foot.
- Line and structure inspections may be conducted using unmanned aerial vehicles.
- Structure or conductor maintenance from a bucket truck. Routine cyclical vegetation clearing to trim or remove tall shrubs and trees to prevent encroachment into the minimum vegetation clearance distance consistent with IPC standards.
- During all vegetation clearing activities, IPC will ensure there is no disturbance of the soil surface that will create an added risk of erosion, the promotion of the establishment or expansion of invasive species (including noxious weeds), damage to cultural resources, sensitive species, or ESA listed species.
- Removal of hazard trees within, or adjacent to, the ROW that pose a risk of falling into conductors or structures and causing outages or fires. Wood pole inspection and treatment to retard rotting and structural degradation.
- Routine inspection and maintenance of authorized service and access roads (length and width and alignment of road remains the same), such as blading the road to maintain the surface condition and drainage, removing minor physical barriers (i.e., rocks and debris), replacing culverts or rock crossing, and rehabilitating after major disturbances requiring heavy equipment (such as slumping). Heavy equipment will travel and maneuver on existing service and access roads.

- Vegetation removal on service roads to allow the necessary clearance for access and provide for worker safety. Removal is conducted by hand crews using chain saws or by mechanical means. Plants that will not interfere with the safe operation of vehicles and equipment will be left in place.
- Installation of bird protection devices, bird perch discouragers, and relocation or removal of bird nests. Under the authority of the Migratory Bird Treaty Act, the Bald and Golden Eagle Protection Act, or Idaho Code, the appropriate permits will be acquired from the Service and/or Idaho Department of Fish and Game (IDFG), prior to relocation or removal of nests.
- Reduction of fuel loads around wood poles in fire-prone areas by (1) removal of vegetation within a 20-foot radius or treatment with herbicide from the approved Forest list by a certified applicator, and in accordance with the Pesticide Use Permit or (2) application of fire-retardant coating to the base of wood poles. If herbicide is used, IPC will report to the Forest the amount used for the Forest’s herbicide application yearly report.
- In-kind structure replacement (such as replacing a cross-arm, replacing an insulator, replacing a single wood pole with a single wood or steel pole). A bucket truck or other rubber-tired vehicles may be located on or off a road.
- Non-cyclical vegetation clearing to remove saplings or larger trees in the ROW consistent with IPC standards.
- Structure or conductor maintenance in which earth must be moved, such as for the creation of a landing pad for construction or maintenance equipment.
- Follow-up restoration activities, such as seeding, noxious-weed control, and erosion control. To minimize the potential for wildland fires to damage structures, reseeding activities will not occur within a 20-ft radius around structures.
- Conductor replacement, which requires the use of several types of trucks and equipment and grading to create a safe work area to hang and pull the conductor into place.

Substation maintenance activities will include equipment testing, preventative repair, and procedures for providing continual service and maintaining electrical service. Typical substation maintenance does not require ground-disturbing activity, although ground disturbance could be required to replace damaged equipment, oil containment facilities, or other miscellaneous items.

2.2.3.8 Communication Towers and Repeater Sites

A microwave relay communications tower was installed in 2013 on private land to the east of the action area. The existing communications tower will be upgraded by anchoring the existing tower pad, extending the tower 20 ft in height, upgrading the antenna by adding a dish or second antenna, and installing new high frequency radios capable of increasing bandwidth to 1,000 megabits per second. Alternatively, the applicant in partnership with IPC and local communication providers could add fiber optic cable to the transmission line between Cascade and Stibnite. The existing microwave relay tower is shown in Figure 4.

The existing two-way radio system will need to be expanded at the mine site and along the Burntlog Route to allow rapid communication between equipment operators and ground personnel and to allow broadcast of emergency messages. The two-way radio system will be supported by a series of repeaters placed on public and private land.

A series of very high frequency (VHF) radio repeaters will be placed along the Burntlog Route as needed. The VHF repeaters will be placed near the existing Meadow Creek Lookout and Thunderbolt Lookout communication sites, the new Burntlog Maintenance Facility, and on private parcels, as needed. The 10-ft-tall towers on 3-ft by 3-ft concrete pads will be supported by solar panels, support hardware, and a backup battery case. Given their location at existing or proposed facilities, no additional disturbance for equipment installation or access will be required for their construction or maintenance. Each site will be accessed annually (at a minimum) or as required for maintenance. No additional disturbance for equipment installation or access will be required.

A cell tower also will be installed to facilitate area communications. The proposed cell tower will be approximately 60 ft tall and will include surface disturbance of approximately 30 ft by 60 ft (0.04 acre) and utilize an existing access road. The cell tower location will be near the proposed transmission line alignment upslope of the Hangar Flats pit (Figure 4).

2.2.3.9 Off-site Facilities

Off-site facilities will be required to support mine-related activities. Administrative offices, a transportation hub, and warehousing and assay laboratory will be located at the proposed SGLF, while road maintenance and snow removal activities will be supported by the applicant from the proposed Burntlog maintenance facility. Additional off-site facilities that will be constructed and operated are described below.

Stibnite Gold Logistics Facility

The SGLF will be located along Warm Lake Road on private land (approximately 7 mi northeast of Cascade), with access to SH 55. The SGLF will require approximately 25 acres of disturbance to accommodate employee parking, an assay laboratory building, a core sampling logging storage facility, warehouses, laydown yards, equipment inspection areas, a truck scale, and an administration building for personnel. The facility will be surrounded by a security fence. One point of ingress/egress will access office parking and the mine personnel card-entry gate, while another ingress/egress will access the truck yard via a guard shack. The parking and assembly area will accommodate approximately 250 light vehicles for employees using bus or van pooling to the proposed action activities.

Supply truck drivers will be required to check in at the SGLF and direct them to either proceed to a designated area or unload at the warehouse for temporary storage and consolidation of their load. A truck scale will be located at the SGLF to verify loads going into or out of the warehouse area. The check-in process will include general safety and road readiness inspection of incoming trucks and equipment being transported to locations within the action area. Heavy equipment transport vehicles will be inspected for items such as presence of weeds, excessive soil on earth moving equipment, safety equipment, installed and maintained engine brake muffling systems, and general safety checks of equipment. In addition, the Scott Valley substation will be located within the property boundary north of the SGLF, surrounded by a separate security fence. The

SGLF will require a domestic groundwater well to service the facility. This well and associated water right will require permitting through the Idaho Department of Water Resources (IDWR).

Burntlog Maintenance Facility

The Burntlog maintenance facility will be located within a previously disturbed borrow source site 4.4 mi east of the junction of Johnson Creek Road and Warm Lake Road and will be accessed via the Burntlog Route with two points of ingress/egress. The facility footprint will be approximately 3.5 acres and will not be fenced. The facility will include three main buildings: a 7,000 ft^2 maintenance building; a 7,000 ft^2 aggregates storage building; and a 4,050 ft^2 equipment shelter. It will also contain a fuel station, electric generator, propane tank, outdoor storage area, and worker sleeping quarters. It will house sanding/snowplowing trucks, snow blowers, road graders, and support equipment in the equipment shelter or maintenance buildings. The Burntlog maintenance facility will require a domestic groundwater well to service the facility. This well and associated water right will require permitting through the IDWR.

This facility will include a double-contained fuel storage area housing three above-ground 2,500-gal fuel tanks for on-road diesel, off-road diesel, and unleaded gasoline. Additionally, a 1,000-gal used oil tank will be located inside the maintenance facility, and a 1,000-gal propane tank will be located at the facility for heating.

Additional features of this facility could include covered stockpiles of coarse sand and gravel for winter sanding activities, temporary or emergency on-site housing for road maintenance crews during periods of heavy snow removal needs and other winter maintenance activities, and communications equipment including a tower. This facility could also serve to support snowmobile trail grooming and grooming equipment storage as needed. If these additional features are implemented, all disturbance is already included in the Burntlog Maintenance Facility footprint.

2.2.4 Mine Operations

The proposed action will consist of mining three primary mineral deposits and the re-mining of historical tailings using conventional open pit shovel and truck mining methods. Ore from three open pits (Yellow Pine, Hangar Flats, and West End pits) will be sent to either the crusher, located near the processing plant, or one of several ore stockpiles in various locations within the mine site (Figure 4). Pre-stripping, or removing the overlying soil and rock (i.e., development rock) to access the mineral deposit, will commence during the construction phase in Mine Year minus 2. Ore removal and processing will begin in Mine Year 1 (operations phase) and continue year-round for approximately 15 years. Mine operations will occur in the area of two historical open pit mined areas (Yellow Pine and West End) and one new open pit (Hangar Flats) that includes former underground mining and mineral processing facilities.

Ore mined from the three open pits will be hauled directly to the primary crusher area; however, during extended periods when the ore tonnage or ore type from the pits exceed the availability of the ore processing plant, the ore will be stockpiled and processed at a future time. Development rock (also commonly referred to as waste rock) will be hauled to the TSF embankment or placed in one of four destinations: the TSF Buttress or the Yellow Pine, Hangar Flats, and West End open pits once they are mined out.

2.2.4.1 Open Pits

A general sequence for mining assumes 15 years of mine operations and will be as follows:

- Yellow Pine pit – Mine Years 1 through 7
- Hangar Flats pit – Mine Years 4 through 7
- West End pit – Mine Years 7 through 12
- Stockpile mining – Mine Years 12 through 15

The YPP will be in the northern portion of the mine site, in the same general location as a historical open pit mining area. The pit will be expanded to include a shallower mining area to the northeast previously mined as the Homestake pit. The EFSFSR currently flows through the legacy YPP, forming a small pit lake (YPP lake), when the EFSFSR flowed into the pit after it was abandoned in the 1950s.

The West End pit will be in the northeast portion of the mine site, east of and at a higher elevation than the YPP, generally situated between Sugar Creek to the north and Midnight Creek to the south. The West End pit will be in the same general location as historical open pit mining where multiple open pits, mine benches, waste rock dumps, and areas of deep backfill exist. The existing Stibnite pit is within the southern portion of the West End pit, and once expanded will be known as the Midnight pit.

The Hangar Flats pit will be in the central portion of the mine site, generally encompassing steep south and southeast facing slopes and the adjacent Meadow Creek valley floor at the toe of these slopes. Historical mining activity in this area was primarily underground, but the proposed pit also will encompass the site of the former Bradley mill and smelter, the Hecla heap leach, and Stibnite Mine Inc. leach pads. Table 5 provides a summary of characteristics for each pit.

Table 5. Summary of characteristics for mine pits (USFS 2024, Table 3.5-1).

Characteristic	Yellow Pine Pit	West End Pit	Hangar Flats Pit
Acreage	222	185	66
Bottom Elevation (ft amsl)	5,360	6,180	6,080
Depth (ft) below existing ground surface	720	440	460
Highwall Height Above Valley Bottom (ft)	600 for western highwall 900 for eastern highwall	1,000 highwalls	800 for northwestern highwall
Approximate Total Tonnage Mined (in million tons)	163	198	31

Characteristic	Yellow Pine Pit	West End Pit	Hangar Flats Pit
Approximate Ore / Development Rock Tonnage Mined (in million tons)	53 / 110	50 / 148	9 / 22
Disposal Areas of Development Rock	TSF embankment, TSF Buttress, Yellow Pine backfill	Yellow Pine backfill, TSF Buttress, Hangar Flats backfill, TSF embankment, Midnight backfill	TSF embankment, TSF Buttress, Yellow Pine backfill

Source: Perpetua (2021c, Table 3-2)
amsl = above mean sea level; TSF = tailings storage facility

Partial dewatering of the open pits will occur prior to and concurrent to renewed mining. Shallow alluvial and deeper bedrock wells will be drilled adjacent to the pits to intercept and pump groundwater before it flows into the pits. During mine operations, groundwater seepage and in-pit surface water runoff will be collected for reuse in the ore processing plant or treated and discharged, according to whether there was a water deficit or surplus at a given time. Additional details on pit water management can be found in Section 2.2.4.10.

2.2.4.2 Drilling and Blasting

Drilling and blasting will be used to break ore and development rock in the mine pits (see M3 2021, p. 16-29 and USFS 2024,Section 2.9 and Appendix B). Following drilling, explosives will be used to break rock into fragments that are suitable for loading into equipment. An Explosives and Blasting Management Plan will be prepared as part of the final mine plan. This plan will include blasting measures techniques, charge sizes, and setbacks to minimize effects on fish and wildlife as described in the Fisheries and Aquatic Resources Mitigation Plan (Section 2.4.2.1). Explosives storage, transport, handling, and use will comply with applicable Department of Homeland Security, Bureau of Alcohol, Tobacco, Firearms and Explosives, Department of Transportation, and Mine Safety and Health Administration (MSHA) regulations.

2.2.4.3 Rock Loading and Hauling

Rock loading and haulage will use a development fleet and a production mining fleet. Mine development excavation required to establish haul truck access roads, access limestone, and pre-strip pits prior to production mining will use a fleet of medium sized excavators, wheel loaders, and 45-ton articulated trucks. The development fleet will also be used to salvage growth media and support reclamation activities. Production mining will use a conventional diesel truck and shovel fleet consisting of two 28-cubic yard hydraulic shovels, approximately sixteen 150-ton haul trucks, and one 28-cubic yard wheel loader. The wheel loader will be used primarily to load haul trucks during shovel maintenance and to load stockpiled ore as needed. The ore will be hauled directly to the primary crusher or the run-of-mine ore stockpile at the ore processing facilities.

2.2.4.4 Ore Management

Ore from the open pits will be hauled to and placed directly into the ore processing plant, except during periods when the amount or type exceeds the availability of the ore processing plant, the excess ore will be stockpiled in unlined facilities on top of or within other mine disturbance areas. Seven long-term ore stockpiles and one short-term stockpile will be used to manage the excess ore (Figure 4). The long-term ore stockpiles will be located on and near the TSF Buttress and Hangar Flats pit, and the short-term stockpile will be located near the crusher. The short-term stockpile will hold ore that will be processed within weeks, while the long-term stockpiles will hold ore for a period of months to years until the process has the capacity to receive the stored ore.

Highest-grade ore will be sent directly to the crusher or to the short-term stockpile area near the crusher where it will likely be processed within a few days. Lower-grade ore will be sent to the long-term ore stockpiles where it will remain for months or longer. Some of the ore sent to the low-grade ore stockpiles will be re-handled during active mine operations, and some will be re-handled and processed once open pit mining has ceased. If metal prices do not support processing of some of the long-term stockpiles, the stockpiled material will be covered as part of TSF Buttress closure activities (Section 2.2.6).

Three long-term ore stockpiles will be on the TSF Buttress on the north side of the valley. Two stockpiles will be adjacent to the Hangar Flats pit and extended onto the pit footprint after it is backfilled. The stockpile locations on the embankment and pit backfill separate them from direct exposure to the environment. A stockpile within the West End pit footprint will temporarily store ore mined during West End Road development and pre-stripping. Ore storage in long-term stockpiles peaks in Year 11 with approximately 19 million tons.

2.2.4.5 Development Rock Production and Storage

Development rock from the three open pits will be sent to five different permanent destinations over the mine life including the TSF embankment and rind fills, the TSF Buttress, the mined-out Yellow Pine open pit, the mined-out Hangar Flats open pit, and the Midnight area within the mined-out West End open pit. In addition to these five areas, other destinations will receive development rock from the three open pits including a temporary ore stockpile base within the West End open pit, a foundation for stockpiling growth medium and recovered seed bank material, a reclamation materials stockpile located on the TSF Buttress, and miscellaneous projects such as road fills and ore stockpile foundations. The development rock production rate will vary throughout the life of the mine because the cut-off grades demarcating ores from development rock will vary due to fluctuating economic conditions. At individual open pits, the determination between ore and development rock is initially based on the mine plan and the delineation of the ore and development rock as determined through production mapping and analysis of blast hole cuttings in the grade control program. Approximately 280 million tons of development rock from active mining areas will be used to construct the TSF embankment and buttress and placed in the mined-out pits, as described in Table 6.

Table 6. Development rock management summary (Perpetua 2021b, entire).

Characteristic	TSF Buttress[1]	Hangar Flats Backfill[1]	Midnight Backfill	Yellow Pine Backfill	TSF Embankment[3]
Location	Meadow Creek valley southwest of Hangar Flats pit	Backfill into Hangar Flats pit	Backfill into south portion of West End pit north of Midnight Creek	Backfill into the YPP	In the Meadow Creek drainage west of the Hangar Flats
Source	Hangar Flats pit, YPP, and West End pit	YPP and West End pit	West End pit	West End pit, YPP, and Hangar Flats pit	Hangar Flats pit, YPP, West End pit, historical SODA, and Hecla heap leach legacy materials
Million Tons[2]	81	18	7	113	61
Acres	120	41	18	180	88
Height (ft)	460	460	320	740	Initial embankment: 245 Final embankment: 460
Steepest Surface Grade (Horizontal: Vertical)	Overall 3:1	Varies from 5:1 to 2.5:1	3:1 north (pit) side 2:1 south side matching undisturbed slope	Varies from 5:1 to approximately 2.5:1	2:1 inter-bench (upstream) 2:1 overall (downstream) TSF slopes will meet IDWR and engineering standards, reviewed by IDWR to obtain Approval for Construction

[1] The TSF Buttress was formerly referred to as the Hangar Flats Development Rock Storage Facility. To be consistent with the naming convention used for the other backfilled pits, the proposed action uses the term Hangar Flats pit backfill for the backfilled Hangar Flats pit.
[2] Limited amounts of development rock will be used to construct haul roads and pad areas for site facilities. In addition, some development rock may be crushed and screened for use as road surfacing material and/or concrete aggregate. The Development Rock Management Plan (Brown and Caldwell 2022, entire) specifies testing to determine which development rock can be used for these applications. A cutoff arsenic concentration of 500 mg/kg corresponds to rock material generating low concentrations of metals (e.g., arsenic and antimony) when leached based on humidity cell testing of site lithologies.
[3]The source of development rock for TSF construction includes material from the SODA and the Hecla heap leach facility.
Key: IDWR = Idaho Department of Water Resources; SODA = Spent Ore Disposal Area; TSF = tailings storage facility

After the main portion of the YPP pit has been mined and mining commences in the northern portion of the pit, development rock will be end-dumped into the YPP as backfill. The dumped development rock will not be mechanically compacted, except as it nears the final reclaimed surface elevation of the backfilled area.

The upper lifts of the backfill will be placed by direct dumping and compaction. The final backfill will be covered with a geosynthetic liner and soil/rock cover, and the EFSFSR and Stibnite Lake will be established across the backfill in a geosynthetic-lined stream/floodplain corridor. The inclusion of the lined Stibnite Lake on the YPP backfill will help buffer temperature extremes in the EFSFSR and replace the fish habitat of the existing YPP lake. The 16-million-gallon lake feature is designed based on results of lake temperature modeling to reduce diurnal temperature fluctuations, particularly to lower the maximum temperature. As a consequence of reducing diurnal fluctuations, the average water temperature at the lake outlet is expected to increase (Brown and Caldwell 2021c, entire; Rio ASE 2021, entire). Development rock to backfill the YPP will be sourced predominantly from the West End pit, with minor quantities originating from the Yellow Pine and Hangar Flats pits.

Upon construction of the Stibnite Lake feature, it will be filled with 16 million gallons of water diverted from the EFSFSR upstream from the tunnel location. This diversion will flow through the restored portion of the EFSFSR located on top of the YPP backfill until entering the Stibnite Lake feature. Once it is filled, it will outflow to another segment of restored stream channel on top of the YPP backfill, which subsequently enters the EFSFSR channel north of the YPP. The diverted flow rate will be a portion of the total EFSFSR flow for a period of several weeks to minimize sediment generation from the restored stream channel to maintain flows in the EFSFSR and tunnel to support fish habitat and passage. The diverted portion will be based on the available flow in the EFSFSR while maintaining habitat and passage and will fill Stibnite Lake feature slowly (i.e., a 1 cfs diversion will require approximately 24 days to fill the feature).

Once mining ceases at the Hangar Flats pit, development rock to backfill the Hangar Flats pit will be sourced predominantly from the West End pit. The Midnight pit, a portion of the West End pit in the southeast corner of the pit near Midnight Creek, will be backfilled concurrent to mining the West End pit, with development rock from the West End pit once mining in the area to be backfilled is completed.

In addition to the permanent development rock storage described above, a temporary development rock storage facility (DRSF) will be constructed within the West End pit during road construction and pre-stripping activities. This temporary DRSF will contain approximately 2.5 million tons and serve as the base for the West End In-Pit stockpile. The purpose of this DRSF is to reduce the need for mixing the smaller development haul truck traffic with production haul truck traffic for safety purposes, and to provide a base for stockpiling ore encountered during road development and pre-stripping within the West End pit. Since this is a temporary DRSF entirely within the footprint of the West End pit, it will be rehandled during regular mine operations at the West End pit and relocated to other facilities for permanent development rock storage.

Geotechnical investigations were conducted supporting the design of the development rock backfills. Because backfills will be below grade, they will not be susceptible to mass failure events in the post-closure period. Development rock in the above grade TSF embankment will be placed per a design that will not be susceptible to mass failure events in the post-closure period (Tierra Group 2021, entire).

Surface water and groundwater management for facilities that permanently store development rock are discussed in Section 2.2.4.10, Surface Water and Groundwater Management. A Development Rock Management Plan, which describes procedures and methods for mining, haulage, and placement of development rock that is produced and stored across the action area during operations, will be followed (Brown and Caldwell 2022, entire).

2.2.4.6 Spent Ore and Legacy Tailings Removal in Meadow Creek

The Meadow Creek Valley contains legacy materials created from historical mining activities. Legacy materials include development rock, spent ore in the unlined SODA, the Bradley Mill Tailings, and run-of-mine and crushed ore in the historical lined heap leach pads. An Environmental Legacy Management Plan (Perpetua 2021a, entire) describes procedures and methods for active management of legacy materials encountered during construction and mining operations. While the TSF is being built and expanded, the 7.5 million tons of spent ore within the unlined SODA and other areas (Hecla and Stibnite Mine Inc. leach pads) will be removed and reused as construction material. Physical and chemical testing of the legacy material will determine if the material is suitable for construction uses (e.g., TSF starter dam material) and determine the final placement of the material. Legacy tailings removal will be a component of early ore processing using water to mobilize legacy tailings and collecting excess water in the SODA contact water pond. The water will be initially sourced at approximately 800 gpm (1.7 cfs) from dewatering wells, industrial supply wells, and the EFSFSR freshwater intake, then re-circulated with an expected reclaim efficiency of 80%. Water not reclaimed will be entrained in the tailings within the TSF or lost to evaporation. The temporary water addition and pumping facility to make up for entrainment and evaporation will be an enclosed, heated structure located within the limits of the SODA.

The legacy tailings will be pumped to the ore processing facility. During the first four years of ore processing operations, the three million tons of Bradley tailings underlying the SODA will be removed and reprocessed using approximately 1.5 million gallons of water recirculated daily per the water usage forecasts for the overall proposed action.

If other legacy materials are encountered during construction, they will be removed and hauled off site to an appropriate disposal facility, placed in the TSF, used as pit backfill or construction material, or left in place, depending on testing to determine physical and chemical suitability. Physical suitability will be based on the material’s geotechnical characteristics (e.g., grain size, shear strength) compared to the geotechnical specifications of the facility at their location. Chemical suitability will be based on the potential for leaching of the materials to affect water quality (i.e., acid-base accounting and kinetic geochemical testing) as described in the Environmental Legacy Management Plan (Perpetua 2021a, entire). Legacy development rock not used for TSF construction purposes or reprocessed will be placed in pit backfills or used for the TSF Buttress.

2.2.4.7 Ore Processing

During operations, approximately 115 million tons of ore will be mined from the three proposed pits and processed at the mill facilities during the approximately 15-year process facility operation. At full operation, targeted ore production will range from 20,000 to 25,000 tons per day, which will be transported to the processing facility to separate the gold, silver, and antimony from the ore. Additional details on ore processing can be found in proposed action's updated feasibility study (M3 2021, Section 17).

Ore feed for processing will be sourced from either the open pits, Bradley tailings, the SODA, the short-term stockpiles, or long-term stockpiles. Ore will be hauled directly from the pits to the primary crusher whenever the mill can receive the ore based on grade and metallurgy. If the ore requires short-term stockpiling due to process constraints or haul truck congestion at the primary crusher, it will be placed in the short-term stockpile. Ore that is lower value than other ore available at the time of pit mining will be placed in long-term stockpiles.

Ore will be hauled to the crusher, either directly from one of the three open pits or from the ore stockpiles and will be crushed and ground to reduce the size of the rock to separate the gold, silver, and antimony-bearing minerals from the host rock. The ore processing area will be designed to provide for containment of ore processing materials, chemicals, wastes, and surface runoff. Potentially hazardous chemicals and wastes will be stored within buildings or areas with both primary and secondary containment. Surface runoff within the ore processing area will be directed to a contact water pond for collection. Any leaks or spills escaping both primary and secondary containment will flow to the contact water pond for collection and will not discharge off site.

The ore processing will result in production of an antimony mineral concentrate, gold- and silver-rich doré, tailings, and other waste products (e.g., small quantities of other non-saleable metals recycled back into the process). Tailings disposal is discussed in Section 2.2.4.8, Tailings Storage Facility.

Crushing and Grinding

Mined ore will be hauled to the crusher and direct-dumped into the jaw crusher or stockpiled at the uncovered run-of-mine stockpile area near the crusher. Stockpiled ore will be loaded into the crusher dump pocket, based on crusher availability, using a loader. The run of mine stockpile feeds the process, and the residence time for material in the stockpile will be short (i.e., days). There will not be sufficient time for infiltration through the stockpile material to the subsurface. Surface water runoff from the run-of-mine ore stockpile area will be captured and directed to a pond and be used in the ore processing facility (Section 2.2.4.10).

Following crushing, the crushed ore will be transported via conveyor to a dome-shaped, covered stockpile. Dust emission controls, such as water sprays or bag house dust collectors, will reduce dust from crushing, conveying, and stockpiling. Apron feeders below the crushed ore stockpile will convey the ore to a semi-autogenous grinding mill followed by a ball mill for additional size reduction of the ore. Grinding will occur within an enclosed building to reduce noise levels and facilitate maintenance of the milling equipment. Grinding with process water will reduce the ore to the size of fine sand in a water slurry for further processing.

On-site Lime Generation

Ground limestone and lime are needed for pH adjustment in the ore processing plant. Rather than trucking these materials to site from an off-site source, a limestone bed in the West End pit is of suitable quality and quantity to satisfy the life-of-mine proposed action requirements for lime. Over the life of the mine, approximately 130,000 to 318,000 tons of limestone will be mined annually, averaging approximately 240,000 tons per year. Approximately 25 to 30% of the limestone mined annually will be crushed and run through an on-site lime kiln to produce metallurgical lime powder, with the remainder (70 to 75%) crushed and stockpiled for direct use as limestone. Both ore and limestone will be temporarily stored at the run-of-mine stockpile area

The on-site lime generation will require additional equipment, which will be placed within the ore processing area. This equipment will include: limestone crusher and conveyor; propane-fired kiln (200 tons per day output capacity); kiln combustion air system including preheat heat exchanger, propane storage tank plus vaporizer, air compressor, receivers, and dryers for plant air and instrument air at kiln area; roll crusher for kiln product discharge; conveyors for moving feed and product materials; off-gas fume filter for kiln discharge; dust collector kiln feed bin; storage bin for kiln feed material; and storage bin for lime products. The limestone crusher, screens, conveyors, and feed bins will not be enclosed. Dust will be controlled in a similar manner to the ore crushing and conveying process through the use of water sprays or bag house dust collectors.

Antimony Flotation

Two flotation circuits will be utilized; one circuit produces an antimony concentrate, and the other produces a gold-rich sulfide concentrate. Ore high in antimony will be processed by the antimony circuit to produce an antimony concentrate (M3 2021, Section 13.5). Following grinding, the ground ore slurry will be mixed with lime and small amounts of sodium cyanide, or equivalent, to inhibit flotation of the gold-bearing minerals (pyrite and arsenopyrite). Lead nitrate, or equivalent, will be added followed by a sulfur- and phosphate-bearing organic chemical. These chemicals make the stibnite mineral particles hydrophobic, where the particles then attach to air bubbles and float to the surface in the stibnite flotation tanks. The gold-bearing mineral particles, which do not adhere to the bubbles in the stibnite flotation tanks, will drop to the bottom of the flotation tanks and be routed to the subsequent gold flotation circuit for further processing. The antimony flotation facility will have interior curbing high enough to contain 110% of the volume of the largest tank to guard against tank failure and spills.

The stibnite-laden bubbles form a froth and will be collected from the top of the stibnite flotation tanks. The stibnite concentrate froth will be subjected to one or two additional flotation steps to further clean the concentrate, and then the resultant antimony-rich concentrate will be thickened and filtered. The final antimony concentrate will be placed in 2-ton supersack containers ready for shipment off site for further refining.

Antimony Concentrate Transport

The antimony concentrate will contain approximately 55 to 60% antimony by weight. The remaining balance, 40 to 45% by weight, of the concentrate includes sulfur and common minerals with trace amounts of gold, silver, and mercury. For safe transportation of antimony concentrate, sealed 2-ton super sacks containing the concentrate will be loaded into a shipping container at the processing facility. The concentrate will be loaded by forklift and hooked lifting racks to safely move the super sacks, which are equipped with lifting straps, into fully enclosed shipping containers for the full course of their transport from the mine site to their destination. The super sacks and shipping container will provide primary and secondary containment for the antimony concentrate (Perpetua 2022a, Section 3.2.3). The concentrate will be trucked via SH 55 to a commercial truck, train, barge, or ship loading facility depending on the refinery location. An estimated one to two truckloads of antimony concentrate will be hauled off site each day.

Gold and Silver Flotation

Low-antimony mill feed will be processed in the gold flotation circuit only, bypassing the antimony circuit (M3 2021, p. 17-7). Gold and silver flotation is similar to that described for stibnite flotation and will be housed in the same building. The flotation building will have interior curbing high enough to contain 110% of the volume of the largest tank. The flotation froth, with particles containing gold and silver, will be collected and pumped to the gold concentrate thickener to further separate the gold and silver mineral particles from the process water that will be recycled. The particles from gold flotation that do not float will become the tailings slurry. The gold and silver concentrations of the tailings will be regularly monitored and, if the concentrations are high enough to warrant further processing, they will be sent to the leaching circuit; otherwise, the tailings will be thickened to recycle additional process water and then routed to the TSF.

Oxidation and Neutralization

An autoclave pressure-oxidation system will be used to oxidize the gold- and silver-bearing sulfide minerals comprising the gold and silver concentrate to liberate the gold and silver for subsequent leaching. Before the gold concentrate is pumped into the autoclave, it will be mixed with appropriate amounts of ground limestone to maintain a constant free acid level of approximately 10 grams per liter in the autoclave. This value was established through bench and pilot-scale metallurgical testing to promote the formation of stable, crystalline arsenic compounds in the autoclave. Oxygen will be injected into the autoclave to promote the oxidation reaction, and the temperature in the autoclave will be maintained at approximately 220 °C. Water will be injected into the autoclave as needed to control the temperature. After pressure oxidation, the acidic slurry containing gold and silver will be neutralized using slurried lime and other chemicals and cooled in two forced draft cooling towers. The neutralized slurry will then be sent to the leach circuit for recovery of gold and silver from the slurry. When increasing arsenic levels are observed, the oxidized slurry will be treated with hot arsenic cure (HAC) prior to neutralization. Metallurgical tests showed that this process promotes formation of the stable crystalline form of the arsenic precipitate enhancing environmental stability of arsenic.

The autoclave system will be housed in a steel frame building set on concrete foundations with interior curbing to provide secondary containment. Air emissions from the pressure oxidation facility will be captured in a series of air pollution controls, and the material collected will be disposed of as a solid waste or a hazardous waste depending on the waste characterization.

Gold and Silver Leaching and Carbon Adsorption

The gold and silver leaching component of the recovery process will be regulated by Idaho Department of Environmental Quality (IDEQ) under the Cyanidation Rule (IDAPA 58.01.13) and will be designed and operated consistent with the International Cyanide Management Code for the Manufacture, Transport, and Use of Cyanide in the Production of Gold (Perpetua 2022a p. 3-6). Gold and silver leaching and carbon adsorption will occur in a steel frame building set on concrete foundations, with secondary containment of 110% of the volume of the largest tank and may include audible alarms, interlock systems, or sumps, as spill control measures (IRMA 2018, pp. 171–174).

The leaching to recover gold and silver from the oxidized gold and silver concentrate slurry will occur in large carbon-in-pulp tanks, which will be fully contained to capture, retain, and recycle process solutions. Sodium cyanide will be added to the tanks containing the neutralized solution to form a gold-silver-cyanide complex, and activated carbon will then be added to the tanks to promote the adsorption of the gold-silver-cyanide complex onto the carbon. The pH of the slurry in the leach circuit will be closely managed at an elevated level to maintain the cyanide in a stable soluble form.

The loaded carbon, with gold-silver-cyanide complex attached, will then be collected on screens and sent to the carbon stripping circuit. Inside sealed tanks, the carbon with the gold-silver-cyanide complex will be washed with an acid solution to remove impurities, rinsed with fresh water, and stripped of the gold using a hot alkaline elution solution. The resulting gold and silver-bearing elution solution will be piped to the electrowinning and refinery area. The acid solution used during carbon stripping will be reused until it loses its effectiveness. The solution will be neutralized and sent to the tailings thickener for pumping to the TSF. Air emissions from the leaching facility will be captured in a series of air pollution controls, and the material collected will be disposed of as a solid waste or a hazardous waste depending on characterization of the waste.

Gold and Silver Electrowinning and Refining

The gold and silver electrowinning and refinery facility will be a closed-circuit system with 110% containment of the largest vessel. The elution solution, pumped into electrowinning cells, will electrolytically precipitate the precious metals into a solid sludge that will be removed from the elution solution with a filter. The solid precipitate will then be heated in a retort system to drive off and collect any contained mercury. The gold and silver precipitate from the retort will then be mixed with flux and then placed into an induction furnace and heated. The molten material from the induction furnace, consisting of gold and silver metal and slag, will be poured into molds to cool. The slag will be recycled within the mill circuit and the doré gold and silver bars will be shipped off site to refineries for further processing and refining. Air emissions from the induction furnace and retort will be treated in a series of emission controls. Mercury metal will be securely stored prior to shipment to a certified hazardous waste disposal facility.

Tailings Neutralization Circuit

Cyanide-bearing process slurry from the carbon-in-leach circuit will be neutralized within the ore processing plant to less than approximately 10 milligrams per liter weak acid dissociable cyanide before being pumped to the TSF. Residual cyanide in the slurry will be treated using a sodium metabisulfite and air system to oxidize cyanide to form cyanate. After neutralization, tailings will be routed to one or more tailings thickeners, to partially dewater the tailings before they are pumped to the TSF. The process water separated from the thickened tailings slurry will be recycled within the ore processing facility. The neutralized and thickened tailings slurry will be pumped to the TSF.

Tailings Pipeline Maintenance Ponds

Lined tailings pipeline maintenance ponds will be located at the truck shop and at the ore processing facility. Tailings slurry, from the tailings pipeline, between the mill and the TSF and process water, from the tailings reclaim pipeline, may drain by gravity into the ponds during maintenance shutdowns or if there were a leak in either pipeline. The ponds will be empty, except during maintenance or unforeseen problems with the tailings or reclaim water pipelines, pumping system, or TSF. The ponds are designed to contain the contents of the pipelines and the runoff from the pond and open-trench portions of the lined pipeline corridor from a 100-year, 24-hour storm event plus snowmelt.

2.2.4.8 Tailings Storage Facility

The TSF will be located within the Meadow Creek valley (Figure 4). The TSF, its embankment, and associated water diversions will occupy approximately 423 acres at final buildout with approximately 405 acres of new disturbance. Geotechnical and geophysical investigations have been conducted to support the design of the TSF and associated buttresses. At the end of operations, the TSF will be capable of holding approximately 120 million tons of tailings, the operational water pool, and precipitation falling within the TSF and contributing watershed up to the 24-hour probable maximum precipitation event of 11.74 in of rainfall. The TSF will consist of a rockfill embankment, a fully lined impoundment, and appurtenant water management features. The TSF buttress located immediately downstream of, and abutting against, the TSF embankment will substantially enhance embankment stability.

Design criteria were established based on the facility size and risk using applicable dam safety, water quality regulations, and industry best practices for the TSF embankment on a stand-alone basis; the addition of the buttress will substantially increase the safety factor for the design to almost double the minimum requirements. The upstream face of the TSF embankment and the Meadow Creek valley where the TSF impoundment will be located will be fully lined to minimize leakage. The TSF will be surrounded by an 8-foot high, chain-link fence designed to keep wildlife, such as deer and elk, from entering the impoundment area. The TSF includes an engineered, rockfill starter embankment. Historical development rock (i.e., waste rock), spent ore from the historical SODA and heap leach areas, and development rock from mine pits will be used for the TSF embankment construction. The TSF Buttress will be built by first constructing a ramp along the north side of the valley to access the crest of the TSF embankment and upper portions of the buttress. Historical spent ores from the SODA and Hecla heap leach will be placed as bedding on the upstream face of the embankment or impoundment fill prior to placement of the liner to minimize interaction with infiltrating surface water. The starter embankment will be constructed to an elevation of 6,850 ft (or 245 ft above the existing ground surface). The TSF buttress will then be constructed upwards to further access TSF embankment lifts while the base expands down the valley (eastward) as historical spent ore and legacy tailings are removed from the valley bottom. Engineered fill will be placed against steep slopes within the impoundment to flatten and smooth slopes to facilitate liner placement. This method of construction will allow for controlled material placement across the valley from the ramp north of the valley to the south side. The TSF buttress will provide additional short- and long-term geotechnical stability. The final embankment height will be 475 ft at a crest elevation of 7,080 ft.

TSF Underdrain System

The TSF will have an underdrain groundwater collection and conveyance system located beneath the liner. Prior to construction, the area will undergo evaluations of visually identifying intermittent wet areas (seeps), areas with flowing water (springs), or areas supporting increased plant growth when compared to surrounding areas (see M3 2021, Section 18 for additional detail)).

Groundwater underdrains will be a series of parallel drains with branching laterals, instead of a single valley bottom drain, due to the broad u-shaped nature of the Meadow Creek valley. Pipes will transition from perforated (able to collect groundwater) to solid-wall (for conveyance only) as they exit their respective collection areas (impoundment and embankment) and flow underneath the buttress to the outlet. Underdrain flows will be collected in a sump downstream of the toe of the buttress, monitored for water quality, then either discharged to Meadow Creek surface water through a permitted Idaho Pollution Discharge Elimination System (IPDES) discharge, or pumped to the ore processing facility or a contact water pond for either treatment and discharge or use as makeup water for the mill process. Make-up water is the "new" water added to the process to offset the loss of process water to evaporation and entrainment. Make-up water could be sourced from contact water collected from site facilities, groundwater pumped from wells, or stream flow diverted from the EFSFSR at a location upstream from the fish tunnel. The TSF liner system will then be installed in the TSF impoundment area over the underdrain system.

Underdrains will be installed beneath the TSF buttress to ensure that groundwater does not saturate the base of the fill and potentially lead to water quality impacts or geotechnical instability; however, little if any flow is expected in the buttress underdrains owing to lower observed groundwater levels beneath the buttress. Underdrain collection sumps and downgradient monitoring wells will be used for TSF leak detection.

TSF Liner System

Due to water quality regulations and the presence of dissolved metals (chiefly arsenic and antimony with trace mercury) and residual cyanide in the tailings pore water and supernatant pool, the TSF impoundment (including the upstream embankment face) will be composite lined with geosynthetic materials to prevent seepage of process water or transport of tailings out of the facility. A network of geosynthetic drains will be placed above portions of the geomembrane liner to reduce hydraulic head on the liner and excess pore pressure in the overlying tailings. The drains will report to a sump near the upstream embankment toe, and the water will be pumped out to the pool or reclaim system for reuse (M3 2021, p. 18-27).

A composite liner consisting of a 60-mil, single-sided, textured, linear low-density polyethylene liner over a geosynthetic clay liner will be employed to contain the tailings. Before placement of the liner within the TSF, the subgrade will be re-worked and compacted, or a minimum of 12 inches of buffer/liner bedding fill will be placed if re-working and compaction of native materials is not expected to meet subgrade design specifications as defined under IDAPA 50.01.13 (Rules for Ore Processing by Cyanidation). Geosynthetic overliner drains will be placed above portions of the liner to reduce hydraulic head on the liner and pore pressure in the overlying tailings solids during operations. The drains will direct water that migrates through the tailings to a sump near the upstream toe of the embankment, and the water will then be pumped out to the tailings pool within the impoundment or the reclaim system for reuse in the mill.

Facilities that use cyanide in their mineral extraction process are required to obtain a permit from the IDEQ and follow the Rules for Ore Processing by Cyanidation (IDAPA 50.01.13). The IDEQ entered into rulemaking on the existing regulations to change the regulatory requirements from prescriptive requirements to performance-based requirements. A temporary rule went into effect in October 2020, and the final rule was approved by the legislature in 2021. The liner system proposed for the proposed action meets the requirements of the rule under which the proposed action’s cyanidation permit is expected to be issued.

TSF Management Support Facilities

Light vehicle roads and haul roads will provide access between the ore processing facility and the TSF, and the tailings delivery and reclaim water return pipelines will parallel the haul road. Secondary containment in the event of a pipeline break will consist of a geosynthetic wrap or an open geosynthetic lined trench. Further, the pipeline corridor will drain to one of two pipeline maintenance ponds: one at the truck shop and one at the ore processing facility. Electrically powered pumps will be located at the ore processing facility to pump tailings to the TSF, and reclaim pumps will be located at the TSF to return water to the ore processing facility for reuse.

TSF Water Management

Thickened tailings slurry will be pumped to the TSF (see M3 2021, Section 18 for additional details). Geosynthetic overdrains installed above the facility liner will collect water released from the base of the tailings to reduce hydraulic head on the liner system and reduce excess pore pressure in the tailings. The TSF will be designed and operated as a closed-circuit zero-discharge facility, meaning no tailings water will be discharged during mining operations to the surface water or groundwater except in compliance with applicable permits and regulations. As the tailings consolidate, water collected in or falling on the surface of the TSF will form the supernatant pool on top of the tailings and be reclaimed for use in ore processing.

2.2.4.9 Mine Support Infrastructure

Proposed action infrastructure to support surface mining and ore processing operations will include the following:

- A one-story mine administration building that will be sided or painted and roofed in neutral colors.
- A maintenance workshop that will store materials and supplies as discussed in Section 2.2.4.14, Materials, Supplies, Chemical Reagents, and Wastes.
- A truck wash facility that will include an oil/water separation system and water treatment facilities to enable recycling of the wash water.
- A worker housing facility that will be constructed adjacent to Thunder Mountain Road (FR 50375) and will accommodate up to 500 people. This facility will include dormitories, food service, and recreation facilities, along with the supporting infrastructure of power, water supply, and wastewater treatment plant. The mine site main gate and security building will be co-located with the worker housing facility.
- Haul roads to transport ore, development rock, and reclamation materials from mining or storage areas and to transport vehicles to the maintenance workshop. A typical haul road travelway will be approximately 87 ft wide (81.1 ft of running surface and 5 ft of safety berm width). The haul roads will be built and maintained for year-round access and will be surfaced with gravel materials. Road maintenance activities will be conducted to manage fugitive dust emissions and maintain stormwater management features. The total disturbance associated with haul roads and other access roads based on the Reclamation Closure Plan is estimated to be 127.5 acres.

- Culverts will be installed where haul roads cross drainages or to direct stormwater to collection and retention structures. Culvert inlets and outlets will be lined with rock riprap, or equivalent, as needed to prevent erosion and protect water quality. Crossings of known fish-bearing streams will be constructed to support fish passage, with appropriately designed and constructed culverts or bridges.
- Service roads and paths that will provide an internal access system for employees and visitors to the site. The service roads will be 12 to 15 ft wide; some will be graveled or covered with rock aggregate, while others will be two-track roads. There will be no planned public use of the action area service roads or trails. The path system will enable pedestrian traffic to move safely throughout the mine site. Service roads and paths will be located within the overall disturbance area defined for the proposed action, and existing roads will be used to the extent possible.
- Employee and visitor parking that will be maintained during construction and operations. During construction, the gravel parking areas will be located at the new worker housing facility, near the contractor/construction laydown areas, and at the Scout Portal. As operations are initiated, gravel parking areas will be maintained for buses, vans, and other miscellaneous vehicles for employees, contractors, vendors, and visitors at the new worker housing facility, at the shop area, and near the mine administration office.

2.2.4.10 Surface Water and Groundwater Management

Water Use and Water Balance

The water balance is an accounting of inflows, outflows, and storage for various components of the mining and ore processing system. Actual volumes for water balance inputs and outputs may vary seasonally and annually from the volumes estimated. In particular, the seasonal basis for dust control is related to the time of year where the ground is not snow-covered or does not have enough ambient moisture present to control dust. This period is generally from June to October but can start earlier or extend later depending on precipitation conditions each year. Precipitation events between June and October will also result in temporary periods during and immediately following the precipitation where dust control is not required due to the presence of ambient moisture.

Water Use and Supply

Sources of water are required for ore processing, surface and underground exploration, dust control, and potable use. Water for industrial and mining uses will be supplied from water pumped from the dewatering wells located around the Hangar Flats, Yellow Pine, and West End pits; industrial water supply wells; contact water storage ponds; a surface water supply intake on the EFSFSR; and process water recycled within the ore processing and tailings circuit. Dewatering production varies over the mine life from 100 gpm (0.2 cfs) to 2,200 gpm (5 cfs); industrial supply varies between zero and 1,300 gpm (2.8 cfs); contact water varies between zero and 1,600 gpm (3.5 cfs), and EFSFSR surface diversion varies between zero and 2,020 gpm (4.4 cfs). The surface water supply intake will be located immediately downstream of the debris screen before diverted flow enters the south portal of the EFSFSR tunnel. The intake will be equipped with a fish screen designed in accordance with the NMFS Anadromous Salmonid Passage Design Manual (NMFS 2022b, entire). Dedicated wells will provide potable water for worker consumption and sanitary use. Projected water use for the proposed action is described in Table 7.

Table 7. Estimated gross fresh and recycled water usage (USFS 2024, Table 3.5-3).

Component	Construction and Start-Up (gpm)	Operations (gpm)	Closure and Reclamation (gpm)
Underground and surface exploration	50	50	0
Surface dust control (seasonal basis)	33	66	16.5
Ore processing including tailings storage	0	3,900	0
Potable or domestic use	26	12	4
Sub-Total Use	109	4,028	20.5
Contingency (10%)	11	403	2
Total Estimated Use	120	4,431	22.5

Ore processing facility operations will represent approximately 97% of water use associated with the proposed action. A separate wellfield of up to four wells will be developed in the EFSFSR drainage adjacent to the worker housing facility to provide potable water for the housing facility. The use of water from pit dewatering, contact water from precipitation runoff, surface water, and development of separate wellfields for supplemental industrial water and potable water at the worker housing facility requires permitting through the IDWR as new water rights or transfer of the place of use for one of the applicant's existing water rights (

Table 8).

Table 8. Summary of the applicant's industrial and mining water right applications (IDWR 2024, p. 4).

Application	Water Right	Source	Diversion Rate (cfs)
77-14378	77-14378	Ground Water / EFSFSR	9.60
85396	77-7122	EFSFSR	0.33
85397	77-7285	Ground Water	0.50
85398/85538	77-7293	Unnamed Stream (Hennessy Cr.)	0.25
		Total:	**10.68**

The applicant's existing groundwater rights (Table 9) are specific to historical use. While these are valid water rights, the specific points of diversion, place of use, and beneficial use does not reflect planned project activities and will need to be adjusted through the IDWR transfer process and through filing additional permit applications.

Table 9. The applicant's groundwater rights summary (USFS 2024, Table 3.5-14).

Water Right ID	Type	Source	Diversion Point	Priority Date	Beneficial Use	Diversion Rate (cfs)	Max Total Usage (acre-ft)
77-7285	Ground-water	Well	SE 1/4 of the NE 1/4, Section 15, T18N, R9E	11/7/1988	Storage and Mining	0.50	30.2
77-7141	Ground-water	Well	SW 1/4 of the SW 1/4, Section 11, T18N, R9E	6/9/1981	Domestic	0.20	11.4

Source: Midas Gold (2016a, Table 8-1)

The Forest and IDWR decisions and permitting authorizations applied to the proposed action represent different processes implemented under different authorities. As such, compliance requirements associated with the multiple agency decisions and permits are likely to overlap but are unlikely to be identical. For example, a state-based water right (a non-federal action) authorizing a diversion of groundwater and surface water for consumptive use may be less restrictive, more restrictive, or have different compliance metrics than a Forest decision (federal action) on a diversion proposed by a mining plan. While the IDWR water rights authorization will specify the maximum allowable volume of diversion, the Forest decision will be based on a proposed water diversion (as constrained by that allowable volume) plus the predicted impacts of that proposed diversion on water resources and the environmental resources dependent on them.

The Forest's decision is based on its analysis of the plan under NEPA, and enforcement of plan compliance is based on its decision rather than independent decisions by other agencies. While the Forest respects the authorities of other agencies, it does not assume their compliance responsibilities, nor does it relinquish its responsibilities to other agencies. Regarding water resources, the Forest decision is based on a predictive analysis of the variable water diversions proposed in the mine plan during weather dependent flow conditions on groundwater levels, streamflows, and the resulting implications for other environmental resources (e.g., groundwater dependent ecosystems, analyte concentrations, stream temperature, and aquatic wildlife).

The Forest's decision to allow operations to be conducted will be based on the impacts analyzed under NEPA, and compliance will be based on adherence to the actions for which that analysis was based, independent of the mine's compliance status with decisions and permits from other agencies. For example, if groundwater and surface water diversion within IDWR's water authorizations resulted in an impact to streamflow materially different from what the Forest analyzed and based its decision on, that impact would not be authorized without further analysis and approval by the Forest.

Water for Ore Processing

Ore processing is the primary driver for water use. Process water will require a continuous supply with approximately 80% of process use reclaimed from the TSF (i.e., approximately 3,000 gpm [6.5 cfs]). Water sources for ore processing include water from pit dewatering and water supply wells, contact water, EFSFSR surface water intake, and water recycled from the TSF. Outflows from ore processing include tailings slurry conveyed to the TSF and evaporative losses from various process components.

The majority of the water needed for ore processing will be recycled (reclaimed) from the TSF. Reclaim water will be pumped from the supernatant water pool at the TSF to the reclaim water tank at the ore processing facility. When processing ore using a zero-discharge system, water used in the process is recycled to the extent practicable. However, not all water in the process can be recycled. Some water is lost to the atmosphere as evaporation and some water is entrained in the pore spaces between tailings particles in the TSF. Make-up water is the "new" water added to the process to offset the loss of process water to evaporation and entrainment. Makeup water will be supplied from pit dewatering in wells located around the Hangar Flats, Yellow Pine, and West End pits; water supply wells; contact water; and surface water intake in the EFSFSR. Water will be pumped from the pit dewatering wells to freshwater tanks near the ore processing facility site. These tank facilities also could supply water for exploration drilling, development drilling, in-pit road dust control, and emergency fire suppression. The freshwater tanks will store approximately 360,000 gallons of water; 240,000 will be available for process uses, and the remaining 120,000 gallons will be maintained for fire suppression only.

Water at the TSF

Inflows to the TSF include tailings slurry and precipitation. The TSF will store tailings solids, water entrained with the tailings, and free water atop the tailings (supernatant pool). Stormwater and snow falling directly on the TSF and water from the supernatant pool, that forms as the tailings consolidate, will be stored in the TSF and reclaimed for ore processing. Water infiltrating to the base of the TSF will be captured by the liner overdrains, enter a sump, and be pumped back to the supernatant pool. The volume of available reclaim water will be influenced by the ore processing volumes, precipitation, and evaporation. The reclaim water will be pumped from the TSF to the reclaim water tank located at the ore processing facility. During periods of site-wide water excess, reclaim can be curtailed and contact water could be used directly in ore processing to facilitate emptying the contact water ponds, while retaining water in the TSF for use in an upcoming dry season. Periods of site-wide excess water coincide with the periods of greatest mine dewatering in Mine Years 4, 5, and 6. There is a potential for excess water in other years (Mine Years minus 1 through 12) if there is greater than average precipitation events contributing to more contact water collection. Local stormwater and snowmelt runoff from outside the TSF footprint and the existing Meadow Creek will be routed around the TSF.

Water for Potable Use

Potable water will be needed for worker consumption and sanitary use. Groundwater will be the primary source of water for potable use for the proposed action. An existing well located near the exploration camp in the EFSFSR drainage will be used to supply an independent water circuit, along with a separate wellfield in the EFSFSR drainage adjacent to the worker housing facility. Wells also will be drilled for potable and industrial or commercial water uses at the Burntlog Maintenance Facility and the SGLF. The applicant has applied to IDWR and received approval for water rights for these wells. The diversion at the two off-site facilities will be approximately 20 gpm (0.04 cfs).

Domestic water use at the truck shop and mill facilities also will be supplied from a potable water system. The applicant obtained an IDWR water right permit for 0.06 cfs of groundwater for this use.

Domestic use at the worker housing facility also will be supplied by groundwater. The authorized point of diversion for water right 77-7141 (0.20 cfs) will be modified for this purpose through an application for transfer. In addition, the applicant obtained permitted water rights to appropriate an additional 0.20 cfs of groundwater to supplement the currently authorized 0.20 cfs volume authorized under water right 77-7141.

Water Treatment

The proposed action's water treatment requirements, objectives, and methods are described in detail in the Stibnite Gold Project Water Management Plan (Brown and Caldwell 2021e, entire). Three water types will require treatment over the life of the proposed action: contact water from mine facilities, which includes dewatering water (construction through closure); process water from the TSF (closure); and sanitary wastewater (construction through early closure). During operations, treating and releasing contact water will generally be limited to periods when a significant amount of dewatering water is being produced, or seasonally in wet years (i.e., spring runoffs). Outside of that time, much of the collected contact water may be used in the mill. Any groundwater or contact water put to beneficial use within the mine site area will require permitting through IDWR and IDEQ prior to use. During construction and at closure, absent a water demand for ore processing, less contact water will be consumed and proportionally more will be disposed of through evaporation or treatment and discharge. From construction through early closure, the camp and offices will produce sanitary wastewater needing treatment. Additional water treatment that could be required during post-closure is discussed in Section 2.2.6.13, Post-Closure Water Treatment. Permit discharge limits will be developed according to IDEQ and Clean Water Act (CWA) requirements, and the limits will be established by the IPDES permit issued by the IDEQ.

The sources proposed for operational water treatment include:

- Contact water from dewatering of the Yellow Pine, Hangar Flats, and West End pits;
- Stormwater runoff (including snowmelt) from the pits, TSF Buttress, Bradley tailings, SODA, Hecla heap leach, run-of-mine ore stockpile area, truck shop, and ore processing facility;
- Toe seepage from the TSF Buttress and long-term ore stockpiles;
- Groundwater produced by the dewatering system; and

- Sanitary wastewater from the worker housing facility, truck shop, ore processing facility, and administrative buildings.

The conceptual water treatment system during operations will adhere to surface water quality standards for regulated constituents, most notably arsenic and antimony. The discharge quality will meet IDEQ standards for all regulated constituents. The discharge rate will be between zero and 2,000 gpm (4.3 cfs) at a primary location at the process plant (near the confluence of Meadow Creek and EFSFSR) and a secondary location on Meadow Creek east of the Hangar Flats Pit area that will be used to supplement flows in Meadow Creek if needed. The outfalls will be installed to minimize sedimentation and maintain total suspended solid (TSS) within IDEQ accepted limits. Water treatment discharge is predicted to be 2.5 °C higher than ambient flow in Meadow Creek. This effect will be offset through the use of diversion pipes around the TSF that transports cooler water from upstream, resulting in stream flow 2.3 °C cooler in the EFSFSR below the treatment plant outfalls. Thus, coupled with the timing of water treatment needs with respect to the mining sequence and dewatering excess, treatment methods and capacity will be phased. During construction and early operations, a modular, mobile, two-stage iron coprecipitation system will be utilized. Early in operations, this system will be replaced by a two-stage iron coprecipitation system located near the ore processing facility. Residuals (sludge) from the water treatment during construction will be stored in a small impoundment in the TSF footprint. During operations and closure, the residuals will be stored in the TSF. Due to contact water runoff seasonality, reuse, and equalization storage (i.e., ponds), average treatment rates are often significantly less than nominal treatment capacity, except during the Hangar Flats pit dewatering when a substantial proportion of treated water will be from relatively constant dewatering flows.

A staged water treatment strategy will be implemented. The construction time period is paired with 300 gpm of peak capacity from package iron coprecipitation systems. The first three years of operations will require 1,000 gpm of total treatment capacity, using an iron coprecipitation system that will remain until closure. During peak simultaneous dewatering of the YPP and the Hangar Flats pit, an additional 1,000 gpm of modular water treatment capacity will be brought online for approximately three years, then treatment capacity will be scaled back to 1,000 gpm for the remainder of operations and early closure.

Prior to closure, a new closure water treatment plant will be constructed to accommodate treatment of water from the TSF, which will include iron coprecipitation and the application of reverse osmosis membrane treatment. After mine closure and final reclamation of the TSF Buttress and pit backfill surfaces, contact water treatment will no longer be required because installation of a geosynthetic liner, growth material cover, and revegetation will preclude contact of surface runoff with mined materials; but process water treatment for the TSF will continue longer, through approximately year 40. The closure treatment plant will be located at the TSF Buttress as the TSF will ultimately be the only remaining water source requiring treatment.

Enhanced evaporation, using snowmaker style misters located over the lined TSF, collection ponds, or pits, will supplement the treatment system, to prevent surplus process water accumulation in the TSF and eliminate contact water inventory, if necessary, when environmental conditions are conducive to evaporation.

Predicted dewatering rates were combined with estimated volumes of mine-impacted waters from the Site-Wide Water Balance (Perpetua 2021d, p. ES-1) to forecast the volume requirements for water treatment during operations and closure. Water treatment is required whenever the volume of produced groundwater plus mine-impacted waters exceed the consumptive use demands for the proposed action. Hence, the water treatment volume estimate represents the sum of predicted mine-impacted water values (e.g., dewatering production, contact water) less the consumptive use by the proposed action (i.e., process water). These volumes ranged from 2,000 gpm during the years of highest dewatering production down to zero flow from the collection of mine-impacted waters post-closure. Estimates also included potential variability associated with meteoric conditions on the generation of contact water to develop potential contact water volumes associated with the range between the 5th and 95th percentiles of predicted volumes. The proposed action water management system is designed with storage capacity for meteoric water events so that water destined for treatment can be contained until it can be transferred to the water treatment plant for constituent removal at the plant's 2,000 gpm design rate (Table 10). Contact water storage ponds will be used to provide temporary storage of contact water flows. The location of these storage ponds is constrained by topography, other proposed mine facilities, legacy materials, and near-surface groundwater levels. The ponds are also located to manage runoff in proximity to the water-generating areas. Contact water ponds will be geomembrane-lined earthen facilities, equipped with emergency spillways and designed to contain runoff volumes associated with design storm runoff events (Table 11).

Table 10. Contact water pond locations (USFS 2024, Table 3.5-4).

Pond Name	**Location**	**Duration in Mine Years**	**Facilities Served**	**Pumped Inflow Source**
Hangar Flats Pond	In footprint of Hangar Flats Pit	-2 to 4	TSF Embankment and Buttress, Hangar Flats Pit, SODA	Gravity inflow
Soda Pond	East of TSF Buttress in footprint of SODA/Bradley tailings	3 to 17	TSF Buttress, SODA	Gravity inflow
West End Pond	Downstream and north of West End Pit in the West End Creek drainage	-1 to 9	West End Pit	West End Pit sumps
Midnight Pond	Upstream and south of the Yellow Pine Pit near the confluence of Midnight Creek and the EFSFSR	-2 to 15	West End Pit, Yellow Pine Pit	West End Pit sumps, Yellow Pine Pit sumps

Pond Name	Location	Duration in Mine Years	Facilities Served	Pumped Inflow Source
North Truck Shop Pond	In Meadow Creek valley in the footprint of the truck shop area	-2 to 17	Truck Shop	Gravity inflow
South Truck Shop Pond	In Meadow Creek valley in the footprint of the truck shop area	-2 to 17	Truck Shop, Hangar Flats Pit	Hangar Flats Pit sumps
North Plant Pond	North of Garnet Creek on the northern side of the process plant site	-2 to 17	Process Plant site, ore stockpile	Gravity inflow
Central Plant Pond	North of Garnet Creek in the central portion of the process plant site	-2 to 17	Process Plant site	Midnight Pond, South Truck Shop Pond, North Truck Shop Pond, Hangar Flats Pond
Scout Pond	North of Garnet Creek on the eastern side of the process plant site	2 to 15	Scout stockpile	Gravity inflow

Table 11. Contact water ponds design summaries (USFS 2024, Table 3.5-5).

Pond	Pond Capacity (excluding freeboard; acre-ft)	Design Storm Runoff (acre-ft)	Freeboard (ft)	Embankment Height (ft)
Hangar Flats Pond	201.8	33.9	3	35.0
Soda Pond	147.7	24.6	3	29.4
West End Pond	28.7	39.3[1]	3	60.5
Midnight Pond	83.9	16.8	3	72.7
North Truck Shop Pond	3.2	3.2	2	n/a
South Truck Shop Pond	18.3	17.9	2	n/a
North Plant Pond	7.5	7.3	2	n/a
Central Plant Pond	4.3	4.3	2	n/a
Scout Pond	9.0	9.0	2	n/a

Source: Brown and Caldwell (2021e, Table 6-2)
[1]West End Pond can contain the 100-year, 24-hour storm volume (25.8 acre-ft). Additional volume from snowmelt will be managed using in-pit sumps or pumping stored water from West End Pond to Midnight Pond or YPP.
n/a = not applicable – ponds excavated into the sub-grade

The installation of geosynthetic liner systems on the top surface of the TSF, TSF Buttress, YPP backfill, and Hangar Flats backfill inhibits the generation of contact water in the post-closure period, plus drainage of the water entrained in the TSF results in the abatement of contact water flows after approximately 40 years.

Contact Water Pond Chemistry

During operations, contact water from facilities, and occasionally pit dewatering water, will be directed to site contact water collection ponds and directed to the water treatment plant (WTP). Inflow sources to each collection pond, and predicted analytes of concern, are provided in Table 12. Open pit dewatering water that is not directed to site contact water collection ponds will be pumped directly to the WTP. The WTP influent water quality was predicted based on water chemistries associated with each of the inflow sources listed in Table 12Table 12, mixed in their relative proportions based on the site wide water balance model, to estimate the mixed influent chemistry to the water treatment plant on a monthly timestep (SRK 2021a, entire).

Table 12. Contact water collection pond inflow sources included in model (USFS 2024, Table 3.5-6).

Contact Water Pond	Inflow Sources	Predicted Analytes with Concentrations above the Strictest Potentially Applied Standards
Hangar Flats Pond	Hangar Flats pit contact water TSF Buttress toe seepage and runoff Bradley Tailings contact water	Alkalinity, Antimony, Arsenic, Cadmium, Copper, Fluoride, Iron, Lead, Manganese, Mercury, Nickel, pH, Selenium, Silver, Sulfate, Thallium, and Zinc
SODA Pond	Hangar Flats pit contact water TSF Buttress toe seepage and runoff Bradley Tailings contact water	Alkalinity, Antimony, Arsenic, Cadmium, Copper, Chromium, Fluoride, Lead, Manganese, Mercury, Nickel, pH, Selenium, Silver, Sulfate, Thallium, and Zinc
Plant Ponds[1]	Pit Dewatering Stockpiles, including the Hangar Flats Stockpile Plant site runoff	Antimony, Arsenic, Cadmium, Chromium, Copper, Lead, Manganese, Mercury, Thallium, and Zinc
West End Pond	West End pit contact water West End In-Pit development rock backfill, stockpile seepage, and runoff	Alkalinity, Antimony, Arsenic, Cadmium, Chloride, Copper, Fluoride, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Sulfate, and Zinc
Midnight Pond	West End pond YPP contact water	Antimony, Arsenic, Copper, Manganese, Mercury, Nitrate/Nitrite, Lead, Sulfate, and Solids

Source: SRK (2021a, entire)

[1]Ponds at the Truck Shop and Plant Site are aggregated in the water chemistry model as a combined pond storage referred to as "Plant Ponds". The combined storage includes the North and South Truck Shop ponds and the North and Central Plant Site ponds.

Dewatering Water Chemistry

Forecasts for the water chemistries of the dewatering production for the Yellow Pine, Hangar Flats, and West End pits were developed based on the water in alluvial and bedrock monitoring wells in proximity to those locations. The relative dewatering components from the alluvium and bedrock groundwater were based on the groundwater flow model dewatering simulations (Brown and Caldwell 2021d, entire).

An aggregate dewatering chemistry was calculated from the individual source terms on an annual basis (SRK 2021a, Appendix D6). Predicted dewatering chemistry has consistently circumneutral pH with antimony and arsenic concentrations above the strictest potentially applied water quality standards. In some instances, maximum monthly predicted concentrations of manganese (Mine Years 3, 4, and 5) and mercury (Mine Year 3) were also above the strictest potentially applied water quality standards.

In early years, average predicted arsenic concentrations were between 0.12 milligrams per liter (mg/L) and 0.13 mg/L before decreasing to 0.088 mg/L in Mine Year 6. Later year predicted arsenic concentrations returned to their initial levels after Mine Year 8. Predicted antimony concentrations exhibited a similar trend with early time dewatering concentrations between 0.014 mg/L and 0.019 mg/L. In Mine Years 4 through 6, average antimony concentrations decreased below the 0.006 mg/L standard before returning to their initial concentrations after Mine Year 8.

TSF Embankment and Buttress

During the construction and early operations phases, Hangar Flats Pond will be located near the northeast toe of the TSF Buttress to provide contact water storage. Runoff and toe seepage from the TSF Buttress and remaining legacy materials in SODA will be conveyed to the Hangar Flats Pond using a series of runoff collection channels or berms, internal collections sumps, pumps, and pipelines as needed. The SODA Pond will be constructed south of the TSF Buttress to provide contact water storage for the remaining years of operations and closure, as the Hangar Flats Pond will be deconstructed as the Hangar Flats pit is mined below the valley bottom.

Operational and post-closure water quality predictions were developed for the TSF Buttress and adjacent TSF Embankment. The general modeling approach was to quantify: (1) solute concentrations in contact waters that will run off the surface of the facility or emerge from the base and intermediate lifts of the facility, either as toe seepage, pop-out seepage or as recharge to groundwater and (2) solute concentrations in groundwater underlying the facility. Further details regarding the TSF Buttress design and modeling can be found in Perpetua (2021c, Section 3.9) and SRK (2021a, Section 5), respectively.

At final buildout, the TSF Buttress and adjacent TSF Embankment will contain 142 million tons of material, comprising 85.5 million tons (60%) of non-potentially acid generating (PAG) development rock from the YPP, 22 million tons (16%) of non-PAG development rock from the West End pit, 14.3 million tons (10%) of non-PAG development rock from the Hangar Flats pit, 6.4 million tons (4%) of PAG development rock, 11.7 million tons (8%) of borrow material, 1.25 million tons (0.9%) of spent ore from the Hecla Heap, 0.85 million tons (0.6%) of spent ore from the SODA, and 0.2 million tons (0.1%) mine waste placed on the former Stibnite Mine Inc. on/off leach pads during the Stibnite Administrative Settlement and Order on Consent (ASAOC) action. Active 'blending' of the development rock during operations is not proposed. During operations, ore stockpiles 1, 2, 3 and 4 will be located on top of the TSF Buttress and are assumed to contribute to solute loading from the facility during the operational period only. These stockpiles are assumed to have been completely removed and processed prior to closure.

Representative leachate chemistries for the lithologies within the TSF Buttress and Embankment were obtained from humidity cell effluent data, scaled to field conditions. The details for the leachate chemistry calculation are described in SRK (2021b, p. 8). The primary source of contact water for material within the TSF Buttress and Embankment will be rainwater and snowmelt.

Any precipitation that falls on the TSF Buttress and Embankment will either run off or infiltrate the facility. Runoff waters are assumed to contact the outermost 0.3 meters (1 foot) of material within the facility. Any precipitation that infiltrates the facility will either recharge groundwater or report as toe seepage or pop-out seepage on the face of the facility (Perpetua 2021d, p. 4-7).

Precipitation that infiltrates the facility has the potential to recharge to groundwater. This water is assumed to interact with groundwater in the uppermost 32.8 ft (10 meters) of the aquifer beneath the footprint of the facility (SRK 2021a, p. 47). The aquifer below the facility consists entirely of alluvium. Any infiltration recharging to groundwater will migrate directly to the water table, and no allowance for solute attenuation has been accounted for along the flow path. The residence time in the aquifer of any precipitation that infiltrates the TSF Buttress and Embankment and recharges groundwater, was assumed to be short and on the order of one month to a few months at most (SRK 2021a, p. 47). The direction of groundwater flow beneath the TSF buttress and Embankment is toward the Hangar Flats pit area.

At closure, the TSF Embankment and Buttress will be regraded to promote positive drainage, and a low permeability geosynthetic cover will be placed over the entire facility, which will be designed to limit infiltration through the underlying development rock (Perpetua 2021d. p. 4-6). The geosynthetic cover will be overlain by an inert soil/rock layer and growth media and revegetated. Following cover placement, any toe/pop-out seepage from the facility will occur under the liner and is assumed to recharge groundwater.

Under this design and conceptualization, the predicted seepage volume from the TSF Buttress will increase during the operations phase until closure of the facility and installation of the geosynthetic liner. Following closure, there will no longer be any runoff or toe seepage from contact with the buttress materials. In the post-closure period, residual solution from the buttress materials will continue to infiltrate into the sub-surface and alluvial groundwater.

Predicted water chemistry associated with runoff from the TSF Buttress and Embankment will have circum-neutral pH with concentrations of antimony, arsenic, copper, manganese, mercury, and thallium above the strictest potentially applied water quality standards. Predicted water chemistry associated with toe seepage from the TSF Buttress and Embankment will have circum-neutral pH with concentrations of antimony, arsenic, cadmium, chromium, copper, fluoride, manganese, mercury, nickel, lead, selenium, silver, sulfate, thallium, zinc, and total dissolved solids (TDS) above the strictest potentially applied water quality standards.

Both the runoff and the toe seepage from the TSF Embankment and Buttress report to a contact water pond and then to the WTP. Sub-surface infiltration from the TSF Embankment and Buttress was modeled to mix with the alluvial groundwater under the facility footprint, resulting in a groundwater chemistry that has circum-neutral pH with antimony and arsenic concentrations above the strictest potentially applied water quality standards but lower than observed concentrations in the local monitoring well MWH-A04. After the end of operations, predicted groundwater analyte concentrations decrease slightly as TSF Embankment and Buttress seepage is collected on surface. Upon placement of the geosynthetic cover, seepage to the ground surface is inhibited and residual water within the TSF Embankment and Buttress infiltrates, contributing to slightly higher groundwater concentrations. Other constituent concentrations are below standards for groundwater. However, because the alluvial groundwater in the system contributes discharge to surface water flows, it is worth noting that predicted long-term mercury (10 mg/L) and copper concentrations (0.002 mg/L) are increased relative to existing conditions but remain below the most stringent potentially applicable criteria.

The mine-affected waters that report to the ground surface will be subject to consumptive use in ore processing with any water production above consumptive use subject to water treatment and discharge. To summarize, these mine-affected waters that will be subject to water treatment include dewatering production, waters collected in contact water ponds, stockpile runoff and toe seepage, TSF Buttress runoff and toe seepage, and post-closure TSF facility solutions. Waters infiltrating into the subsurface under the mine facilities will mix with alluvial groundwater and are not subject to water treatment except in instances where alluvial groundwater is subsequently pumped for mine dewatering.

The Site-Wide Water Balance model (Perpetua 2021d, pp. 6-9 - 6-10) provides a forecast for the volumes of water that will require water treatment for the operating and post closure time-periods. A principal driver for predicting water treatment rates will be uncertainty in future precipitation rates and their effect on contact water. A 120-year precipitation record was utilized to develop percentile estimates for meteoric inputs to the water balance. Initially, the volumes of water destined for water treatment will be less than 500 gpm because dewatering and seepage rates from newly constructed facilities will be ramping up at the same time that consumptive use demand for processing needs will be at its largest and consuming contact water as a supply. Over time, water treatment volumes will increase through about Mine Year 6 to approximately 2,000 gpm as dewatering production and seepage rates will constitute a higher percentage of diversion for process water in those years, displacing contact water as a source. Differences in actual versus predicted dewatering rates will have limited effect on water treatment needs because diversion from industrial supply wells or surface waters will be reduced to offset any increase in dewatering production (USFS 2023e, p. 112). Following Mine Year 6, predicted dewatering rates will decline removing most of the need for water treatment as water recycling will be needed to meet consumptive use demands, except during seasonal runoff periods when contact water volumes will increase. Any short-term volumes in excess of the water treatment capacity (i.e., following a large storm event) will result in water storage within the TSF or contact water ponds.

In the closure and post-closure periods, beginning in Mine Year 15, volume of mine-affected waters requiring water treatment will range seasonally up to approximately 1,000 gpm until geosynthetic cover installations (planned to commence in Mine Year 19) could be completed in Mine Year 23 to prevent mixing of surface water runoff and contact waters with consolidation water. Once the cover installations are in effect, volumes consisting of residual seepage and TSF consolidation water will continue to be treated but will decrease from approximately 200 gpm down to very minor, unmeasurable flow as the tailings solids consolidate and stop emitting water.

Predicted maximum analyte concentrations were developed for WTP influent on an annual basis for the construction, operations, and post-closure periods (Brown and Caldwell 2021e, entire; SRK 2021a, entire). In addition to influent flow rates, the maximum influent concentrations are relevant to the selection and design of the water treatment system and are summarized in Table 13**.**

Table 13. Predicted maximum concentrations in water treatment plant influent (USFS 2024, Table 3.5-10).

Parameter	Units	Construction	Operations	Post-Closure
pH (range)	-	6.9 – 7.6	8.1 – 8.5	8.0 – 8.4
Alkalinity	mg/L as $CaCO_3$	233	159	155
Silver	mg/L	0.005	0.0012	0.0055
Aluminum	mg/L	0.01	0.01	<0.01
Arsenic	mg/L	30.08	6.43	6.35
Boron	mg/L	4.89	2.34	0.53
Barium	mg/L	0.01	0.04	0.11
Beryllium	mg/L	0.001	0.001	0.001
Calcium	mg/L	14	22	422
Cadmium	mg/L	0.0032	0.0015	0.00035
Chloride	mg/L	40	34	58
Cobalt	mg/L	0.01	0.01	<0.01
Chromium	mg/L	0.01	0.03	<0.01
Fluoride	mg/L	4.8	4.0	5.6
Iron	mg/L	<0.01	0.12	<0.01
Mercury	mg/L	0.0003	0.0006	0.0151
Potassium	mg/L	103	41	113
Magnesium	mg/L	123	76	232
Manganese	mg/L	0.11	0.27	0.29
Molybdenum	mg/L	0.02	0.21	0.019
Sodium	mg/L	96	131	3,181
Nickel	mg/L	0.01	0.1	0.01

Parameter	Units	Construction	Operations	Post-Closure
Phosphorus	mg/L	4.1	1.7	0.25
Lead	mg/L	0.037	0.019	0.004
Antimony	mg/L	8.51	2.37	0.96
Selenium	mg/L	0.004	0.003	0.001
Sulfate	mg/L	331	323	7,508
Thallium	mg/L	0.0003	0.0001	0.0025
Vanadium	mg/L	0.01	0.01	0.01
Zinc	mg/L	0.198	0.241	0.055
Nitrate/Nitrite	mg/L as N	401	38	9
Ammonia	mg/L as N	<0.3	<0.3	<0.3
Cyanide, Total	mg/L	-	-	0.119
Cyanide, WAD	mg/L	-	-	0.073
TDS	mg/L	-	-	11,371

Source: Brown and Caldwell (2021e, entire)
[1]Treatment objectives are equivalent to the strictest potentially applied water quality standard
Key: WAD - weak acid dissociable, TDS – total dissolved solids

The differences in major ion composition of water treatment influent in the post-closure period are due to the routing of TSF water inventory and tailings consolidation water from the facility for treatment. To meet applicable discharge standards, the target post-treatment concentrations for analytes were identified for the water treatment plant design (Table 14).

Table 14. Target post-water treatment plant effluent analyte concentrations (USFS 2024, Table 35.-11).

Parameter	Units	Treatment Objective[1]
pH (range)	-	6.9 – 9.0
Silver	mg/L	0.0007
Arsenic	mg/L	0.01
Cadmium	mg/L	0.00033
Chromium (III)	mg/L	0.035
Chromium (IV)	mg/L	0.0106
Copper	mg/L	0.0025
Mercury	mg/L	0.000012
Nickel	mg/L	0.024
Lead	mg/L	0.0009
Antimony	mg/L	0.0052
Sulfate	mg/L	250
Thallium	mg/L	0.005
Zinc	mg/L	0.054
Nitrate/Nitrite	mg/L as N	10
Ammonia	mg/L as N	2.1
Cyanide, Total	mg/L	0.0052
Cyanide, WAD	mg/L	0.0039
TDS	mg/L	500

Source: Brown and Caldwell (2021e, p. 8-18, Table 8-18)
[1]Treatment objectives are equivalent to the strictest potentially applied water quality standard.

During colder months (October through April), the temperature of treated water is estimated to be 7.3 ^{o}C (Brown and Caldwell 2021e, p. 8-40). During the operational period Mine Years 4 through 6 when WTP discharge is between seven and 55% of the Meadow Creek flow, the discharge will increase stream temperature in Meadow Creek by 1 to 3 ^{o}C. During warmer months, retention times for contact water in ponds will be up to 34 days resulting in warmer water treatment plant feeds with the potential to increase Meadow Creek temperatures downstream of the treatment plant outfall by up to 2.5 ^{o}C. However, warmer water treatment plant discharge temperatures will be offset by the cooling effect of the piped diversion of Meadow Creek around the TSF with the net effect of water treatment on temperature of Meadow Creek expected to be less than 0.25 ^{o}C (Brown and Caldwell 2021e, p. 8-40).

Brown and Caldwell (2021e, entire) performed an assessment of the viability of potentially applicable water treatment technologies to the predicted maximum influent water chemistry and identified the following technologies to incorporate into the design for the construction, operational, and post-closure periods. Temporary treatment systems will be employed during the construction period until the WTP is constructed and commissioned. These temporary systems will utilize trailer-mounted or skid-mounted equipment packages containing membrane treatment or iron coprecipitation systems that can be set up with limited lead time.

The operational period water treatment plan flowsheet has a design capacity of 2,000 gpm. For the operational period water chemistry, a treatment process consisting of sodium hypochlorite oxidation, two-stage iron coprecipitation with ferric sulfate, and solids separation with contingent mercury precipitation via organic sulfide precipitant addition between iron precipitation stages was selected. Influent waters will be stored in lined storage ponds for flow equalization and pumped into the WTP. This operational water treatment generally targets dissolved nitrate, metals, and oxyanions in influent solution, primarily arsenic and antimony. Addition of the mercury-sequestering precipitant is included as a contingency for the design to account for uncertainties regarding the effectiveness of iron coprecipitation in reducing dissolved mercury and methylmercury concentrations to levels below applicable receiving stream standards. Residual solids from the treatment plant will be placed in the TSF.

Under an IPDES permit, the water treatment plant effluent will be directed to Meadow Creek at a location upstream of the Hangar Flats pit when flow augmentation is required (i.e., when Hangar Flats groundwater pumping results in decreased Meadow Creek baseflow) and otherwise to the EFSFSR for the remainder of operations. For predicting surface water chemistry incorporating the effects of treated effluent, the minimum of the predicted water treatment plant influent analyte concentrations or the target effluent concentrations was used. Constituents that do not have a target effluent concentration were assumed to be unaffected by the treatment process.

For the post-closure period, the water treatment process will need to be augmented to treat cyanide, sulfate, and TDS concentrations that will be derived from the remaining inventory of TSF process water and tailings consolidation seepage. The treatment process begins with chemical oxidation followed by iron coprecipitation to remove a significant fraction of dissolved metals. Organic sulfide precipitation of mercury will be provided. Softening will be performed via lime and soda ash to remove calcium and magnesium. Adjustment of pH will be provided in advance of ultrafiltration to remove carryover solids from the solids contact clarifier and prevent particulate fouling of the reverse osmosis (RO) membranes. The RO membrane treatment will separate the dissolved solids into a concentrated brine while the permeate water will be pH adjusted and re-mineralized prior to discharge to Meadow Creek via an IPDES-permitted outfall. Treatment plant residual solids will be placed in the TSF until its cover is completed, and thereafter dewatered and disposed of in a location constructed in the TSF above the cover.

The operations phase water treatment plant will treat mine-impacted water and discharge to the EFSFSR through reclamation of operational components through Mine Year 18. Prior to Mine Year 15, the reclamation and closure phase WTP will be constructed on top of the TSF Buttress where it will treat mine-impacted water through the completion of water treatment requirements estimated to be in Mine Year 40.

Sanitary Wastewater Treatment

The worker housing, administration building, warehouse, maintenance shops, and underground exploration surface facilities will produce sanitary wastewater. Wastewater from the administration building, warehouse, maintenance shops, and underground facility will be collected in tanks for transport to a sanitary wastewater treatment plant equipped with a septage receiving system located near the worker housing facility. The sanitary wastewater treatment plant will consist of a package plant containing a membrane bioreactor or equivalent system to treat wastewater to applicable discharge permit requirements. The volume of wastewater influent will depend on the number of personnel working on site and is expected to be approximately 50,000 gallons per day (gpd) during the construction period and 25,000 gpd during operations (Brown and Caldwell 2021e, p. 8-31). Sanitary wastewater treatment plant effluent will be discharged to the EFSFSR at an IPDES permitted location near the worker housing facility. Treatment residuals will be dewatered and transported to a permitted, off-site landfill for disposal.

IPDES Permits and Cyanidation Permit

The proposed action will need permits issued by the IDEQ to discharge treated water from the WTP and the sanitary wastewater treatment plant. Under the IPDES program, IDEQ will establish specific discharge limits for constituents of interest plus monitoring and reporting requirements for the system based on its regulatory criteria.

The proposed action will also need a Cyanidation Permit issued by IDEQ to allow the use of cyanide in its ore processing. Under this permit, IDEQ will institute permit obligations regarding the handling and containment of process solutions as well as responses to upset conditions. In addition, the permit will also contain requirements for the ultimate treatment and disposal of process water. The descriptions of handling TSF water in this report are consistent with the requirements of the Cyanidation Permit regulations. This analysis of water quality utilizes the predicted water chemistries for water treatment plant discharges as developed by SRK (2021a, entire) and Brown and Caldwell (2021e, entire).

The water treatment system during operations will need to adhere to surface water quality standards for regulated constituents, most notably arsenic and antimony. The discharge quality will meet IDEQ standards for all regulated constituents. The discharge rate will be between zero and 2,000 gpm (4.3 cfs) at a primary location at the process plant (near the confluence of Meadow Creek and EFSFSR) and a secondary location on Meadow Creek east of the Hangar Flats Pit area that will be used to supplement flows in Meadow Creek if needed. The outfalls will be installed to minimize sedimentation and maintain total suspended solid (TSS) within IDEQ accepted limits. Water treatment discharge is predicted to be 2.5 °C higher than ambient flow in Meadow Creek. This effect will be offset through the use of diversion pipes around the TSF, which maintain cooler water from upstream, resulting in stream flow 2.3 °C cooler in the EFSFSR below the treatment plant outfalls. Thus, coupled with the timing of water treatment needs with respect to the mining sequence and dewatering excess, treatment methods and capacity will be phased. During construction and early in operations, a modular, mobile, two-stage iron coprecipitation system will be utilized. Early in operations, this system will be replaced by a two-stage iron coprecipitation system located near the ore processing facility. Residuals (sludge) from the water treatment during construction will be stored in a small impoundment in the TSF footprint. During operations and closure, the residuals will be stored in the TSF. Due to contact water runoff seasonality, reuse, and equalization storage (i.e., ponds), average treatment rates are often significantly less than nominal treatment capacity, except during the Hangar Flats pit dewatering when a substantial proportion of treated water will be from relatively constant dewatering flows.

This is met with a staged water treatment strategy. The construction time period is paired with 300 gpm of peak capacity from package iron coprecipitation systems. The first three years of operations will require 1,000 gpm of total treatment capacity, using an iron coprecipitation system that will remain until closure. During peak simultaneous dewatering of the YPP and the Hangar Flats pit, an additional 1,000 gpm of modular water treatment capacity will be brought online for approximately three years, then treatment capacity will be scaled back to 1,000 gpm for the remainder of operations and early closure.

Prior to closure, a new closure WTP will be constructed to accommodate treatment of water from the TSF which will include iron coprecipitation and the application of reverse osmosis membrane treatment. After mine closure and final reclamation of the TSF Buttress and pit backfill surfaces, contact water treatment will no longer be required because installation of a geosynthetic liner, growth material cover, and revegetation will preclude contact of surface runoff with mined materials; but process water treatment for the TSF (Section 2.2.6.13) will continue longer, through approximately year 40. The closure treatment plant will be located on private land at the TSF Buttress as the TSF will ultimately be the only remaining water source requiring treatment.

Enhanced evaporation, using snowmaker style misters located over the lined TSF, collection ponds, or pits, will supplement the treatment system, to prevent surplus process water accumulation in the TSF and eliminate contact water inventory, if necessary, when environmental conditions are conducive to evaporation.

Surface Water Management

To manage surface water, existing streams that run through areas proposed for mining related disturbance will be diverted. Temporary diversions will be used within the action area to keep non-contact water separated from contact water. Contact water is water that flows into or through disturbed areas and mining facilities and could have the potential to pick up increased levels of sediment, metals, and other possible contaminants which cannot be discharged into surface water and groundwater without proper treatment. Non-contact water is meteoric water that does not contact disturbed areas or mining facilities.

Stream Diversions around Mining Features

Existing streams will be temporarily diverted around facilities, within constructed surface water channels. Diversion channel segments constructed in erodible materials will be lined with riprap to prevent erosion. Rock-cut channels will be constructed on steep slopes and in areas with shallow or at-surface bedrock, will have low erosion potential, and not require riprap lining.

Certain channel segments constructed over fill or excavated in permeable materials will be lined with a geosynthetic liner to prevent seepage. A geotextile or transition layer of sand/gravel followed by riprap will be placed over the liner for erosion protection. Certain diversion sections will be piped as dictated by terrain or the need to limit warming of water. Diversions will be sized for high flows in diverted creeks (i.e., approximately 7.4 cfs for Hennessy Creek, 1.4 cfs for West End Creek, and 700 cfs for the EFSFSR tunnel). The underground diversion for Hennessy Creek will be 18 to 24 in in diameter, while the underground diversion for West End Creek will be 8 to 12 in in diameter. The dimensions of the EFSFSR tunnel will be 15 ft high by 15 ft wide. These diversions will be in place through the mine operations period until replaced by the restored stream channels during the reclamation and closure period.

During mine operations, summer low flows in perennial diversion channels around the TSF impoundment and buttress (Meadow Creek), YPP (Hennessy Creek), and West End pit (West End Creek) will be piped underground as an environmental design feature to maintain cold stream temperatures. The 8- to 12-inch-diameter pipes, sized to convey August baseflow, will be installed under the diversion channels in the riprap channel lining or under the adjacent access road to carry low flows. Stream flow will enter pipes through inlets at the same locations stream and tributary inflows will be diverted into the constructed channel. Some diversions, such as portions of Hennessy and West End Creeks, and the EFSFSR tunnel, will be entirely underground, in which case conduits will be larger and sized for high flows.

Streams will be routed into the diversion channels by constructing a temporary flow barrier, such as a diversion berm or cofferdam, to redirect flows from the existing streams into the diversion channels. Additional protection, such as riprap or energy dissipation structures, may be needed at the channel entrances and exits to ensure velocities do not scour the existing streambed or bank. Where needed, trash racks or similar debris removal structures will be installed at the channel entrances to prevent large wood and other debris from entering the diversions.

To help ensure the stream diversions are completed in a manner protective of fish inhabiting the streams, plans have been developed for isolating channel segments, dewatering, and salvaging and relocating fish during dewatering or maintenance of natural stream channels and diversion channels, as described in the Fisheries and Aquatic Mitigation Plan (FMP; Brown and Caldwell, Rio ASE, and BioAnalysts 2021, pp. 5-1 - 5-37). Stream segments to be dewatered may be isolated using a variety of methods as appropriate for the site conditions. Sediment controls will be installed, where needed, to reduce stream turbidity and prevent sedimentation of the downstream receiving streams.

All temporary dewatering and diversion efforts for activities, such as stream repair, culvert maintenance, or temporary stream impacts from other mining activities, will have the proper fish exclusion screening, or other method, to minimize the risk of fish becoming entrained in the pump or diversion. Stream diversions around the TSF, TSF Buttress, Yellow Pine Pit, Process Plant site and Fiddle growth media stockpile will be assessed on a case-by-case basis for whether fish exclusion is necessary based on the diversion structure, channel dimensions, and likely fish presence. Further details on these potential exclusions are provided in the FMP (Brown and Caldwell, Rio ASE, and BioAnalysts 2021, pp. 5-3 to 5-4, 5-9 to 5-11).

EFSFSR Temporary Diversion Tunnel

Currently, the EFSFSR flows into and through the YPP lake. The cascade at the inflow to the pit lake currently blocks upstream fish passage. A tunnel will be built in Mine Year minus 1 to direct the EFSFSR around the west side of YPP to allow mining in the pit and fish passage during construction and operations (Figure 6. Fish passage tunnel (USFS 2024, Figure 3.5-12).). The tunnel will be approximately 0.9 mi long, 15 ft high, and 15 ft wide. The tunnel will include a fishway stream channel designed to provide for upstream and downstream passage of migratory and anadromous salmonid fish.

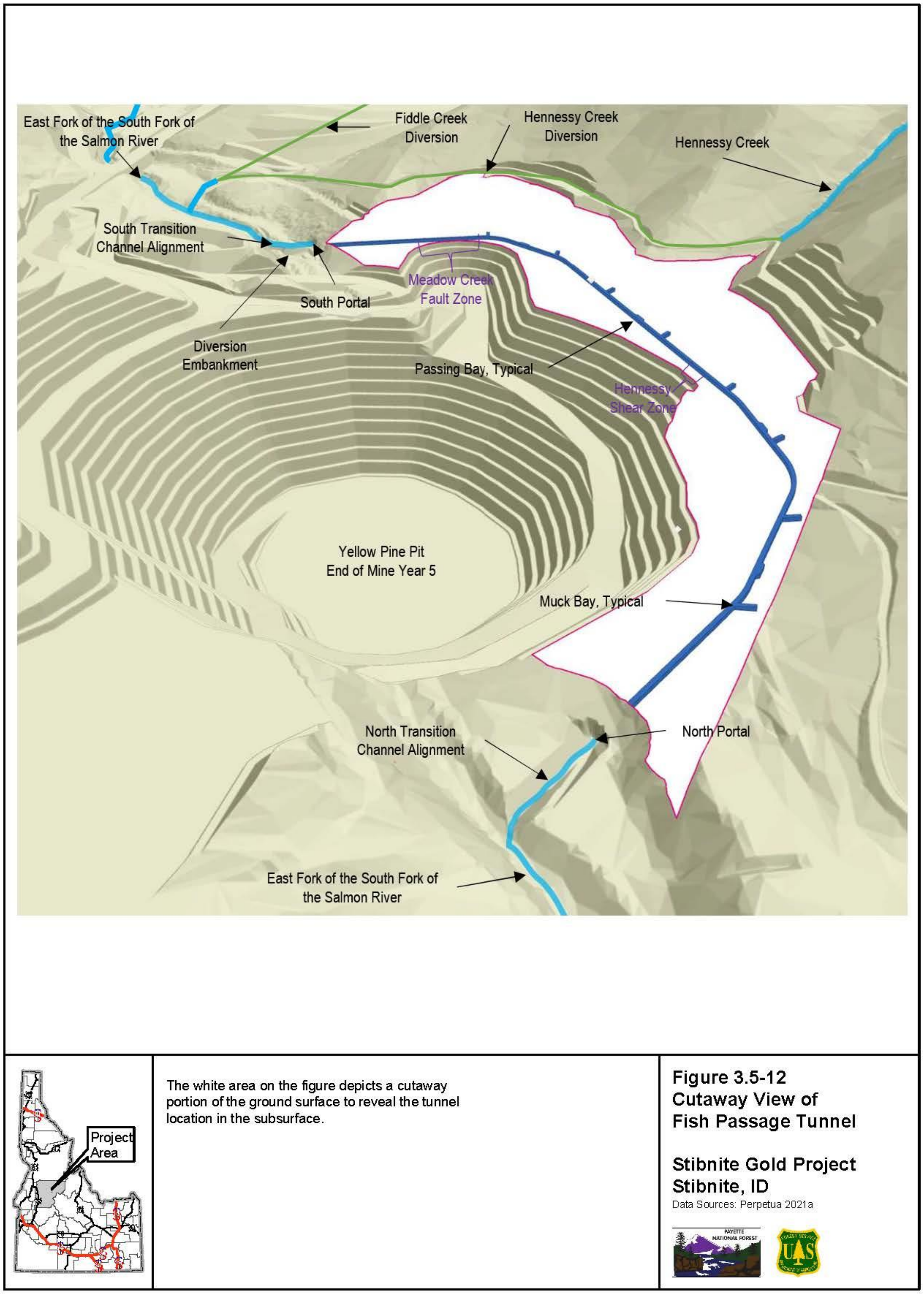

Figure 6. Fish passage tunnel (USFS 2024, Figure 3.5-12).

The tunnel will be designed so that fish can swim through its entire length in both directions (Brown and Caldwell, McMillen Jacobs, BioAnalysts 2021, entire). To encourage fish passage, low-energy lighting will be installed in the tunnel and set on timers to simulate daylight. A trash rack will be constructed near the upstream entrance to the tunnel to prevent large wood, boulders, and other debris from entering the tunnel and will be periodically cleaned. The spaces between the trash rack bars will be sized to allow listed fish passage. A surface water supply intake with fish screens will be installed upstream of the trash rack at a control weir to divert water from the EFSFSR for ore processing makeup when necessary. A parallel roadway will be constructed in the tunnel to allow equipment and personnel access for monitoring, inspection, and maintenance. The accessway will function as a floodway for high flows, greater than the normal flow range within the fishway.

The fishway will incorporate concrete weirs, designed to produce hydraulic conditions that could be successfully navigated by fish (McMillen Jacobs 2018, p. 32). The south portal (upstream end) of the tunnel will include a sediment collection and drop out area, a resting pool, trash rack, flow control weir, and picket panels. The north portal, located at the downstream end of the tunnel, will include an orientation pool for downstream migrating juvenile fish with an adult exclusion barrier to reduce potential predation, a separate adult fish holding/resting pool, rock weirs, and a transition zone. Specific details on the north and south portals, plus the overall design, function, operation, and maintenance of the diversion tunnel are thoroughly described in the Fishway Operations and Management Plan (Brown and Caldwell, McMillen Jacobs, and BioAnalysts 2021, entire).

Midnight Creek

Midnight Creek is a first order, perennial, non-fish-bearing stream. The Midnight Creek stream diversion will reroute approximately 0.3 mi of the lower portion of Midnight Creek to the south, away from where it currently enters the YPP lake. The rerouted creek will be piped under haul roads, so that it will enter the EFSFSR upstream of the proposed tunnel portal. The Midnight Creek diversion will manage flows in Midnight Creek during YPP operations and backfill activities. The creek will be restored when the newly developed EFSFSR alignment over the backfilled pit is complete and stabilized as described in Section 2.2.6.4.

Hennessy Creek

Hennessy Creek is a first order, perennial, non-fish-bearing stream. Hennessy Creek will be diverted south of YPP in a pipe along the public access road at the western edge of the pit. The diversion will include an impounding structure, overflow weir, and diversion cleanout basin. Diverted flows will be routed to Fiddle Creek downstream of the existing Stibnite Road culvert crossing, ultimately placing Hennessy Creek flows into the EFSFSR upstream of the south tunnel portal and disconnecting flow from the current unlined ditch passing alongside the Northwest Bradley dumps. Overflow, if any, will follow the existing stream channel into the YPP.

Fiddle Creek

Fiddle Creek is a second order, perennial, fish-bearing stream. Fiddle Creek will not be diverted. Rather, small stormwater diversions will route hillslope runoff around the Fiddle GMS, and a culvert will route Fiddle Creek under the GMS, GMS access road, and public access road.

West End Creek

West End Creek is a first order, non-perennial, non-fish-bearing stream. The approximately 1.5-mi-long West End Creek stream diversion will reroute West End Creek around the north side of the legacy West End DRSF and cross the upper benches of the West End pit. The diversion will consist of a lined channel along the upper legacy DRSF, and a pipe in the segments along a steep hillside above the West End pit, within the pit, and along the steep hillside alongside the lower legacy DRSF down to the outlet at the existing stream channel. The lined channel portion will be designed to convey flows from a minimum 25-year storm event plus 2 ft of freeboard.

Garnet Creek

Garnet Creek is a perennial, first order, non-fish-bearing stream. During construction, Garnet Creek will be re-routed downstream of the ore processing facility to a relocated confluence with the EFSFSR. The diverted length of Garnet Creek will be approximately 600 linear ft. Details of the Garnet Creek re-route are depicted in Brown and Caldwell (2021e, Appendix B, Drawing GSK-002). Above the early restoration reach, which passes through the processing plant site area, Garnet Creek will be routed along the upper processing plant site access road in a riprap channel, then cross under the ore processing facility roads in culverts, with environmental design features to reduce sediment loading to the stream, and to protect water quality. At closure, this segment of Garnet Creek will be restored, along with created wetlands at the plant site.

Meadow Creek

Meadow Creek is a perennial, third order, fish-bearing stream. Approximately 2 mi of Meadow Creek will be diverted around the south side of the TSF and TSF Buttress. The diversion will direct flows back into the existing SODA diversion upstream of the Hangar Flats pit. The new diversion will consist of a rock-cut channel in segments along the steep hillsides above the TSF and buttress, and an excavated channel in alluvium across tributary valley segments. Channel segments excavated in erodible or permeable materials will be lined with rock riprap or geosynthetic liner to prevent erosion and to minimize seepage. The Meadow Creek diversion channel around the TSF and TSF Buttress will be designed to convey flows from a minimum 100-year storm event with 1 foot of freeboard.

The stream also will be diverted around the Hangar Flats pit. The Meadow Creek channel will be moved away from the pit to the south/southeast and reconstructed as a permanent, sinuous channel and floodplain to allow potential for spawning habitat and establishment of riparian habitat within the floodplain. A liner will be installed under the stream/floodplain corridor to minimize water seepage into the Hangar Flats pit or the pit dewatering well system, and to avoid potential pit wall instability or loss of stream habitat as a result of stream dewatering. The Meadow Creek diversion channel/floodplain corridor around the Hangar Flats pit will be designed to convey flows from a minimum 100-year storm event with 3 ft of freeboard; as a natural channel design, the stream channel itself will be designed for bankfull flows (1.5-year recurrence). This diversion will be permanent and incorporates design aspects to resemble natural channels not applied to temporary diversions of the other creeks. This permanent design accounts for channel migration, flooding, riparian development, and biological habitat. Details of the Meadow Creek diversion appear in Brown and Caldwell (2021e, Appendix B), while details of its restoration appear in Tetra Tech (2023, Attachment D).

East Fork Meadow Creek

East Fork Meadow Creek (EFMC, aka Blowout Creek (BC)) is a first order, perennial, fish-bearing stream outside of the mine site. East Fork Meadow Creek was impacted by the failure of a water storage dam in 1965, creating a steep actively eroding channel that conveys EFMC. In its current condition, EFMC is a downcutting creek with conditions not suitable for fish occupancy. There are fish in the wetlands area upstream of EFMC that will be excluded from the EFMC restoration area by proper fish exclusion screening. The design for the EFMC repairs appears in the Rio ASE Stream Design Report (2021, Appendix D). The design entails three reaches: (1) the segment downstream from the wetlands and upstream from the downcutting creek area (design reach BC1), (2) the downcutting creek area (BC2), and (3) the approximately 400-foot segment between the downcutting area and the confluence with Meadow Creek (BC3). The failed area of EFMC in the actively eroding chute will be stabilized and repaired, and groundwater levels in the meadow upstream of the former dam site will be raised to restore wetland hydrology. A structure to control the grade of the creek will raise groundwater levels in the meadow, and a coarse rock drain will address ongoing erosion of the channel side slopes that currently deliver sediment directly to the creek, while facilitating construction of a permanent surface channel. This will be an environmental design feature and restoration effort, as the EFMC chute and upper meadow are unrelated to and unaffected by the proposed mine features. The restored stream channels in Blowout Creek (Tetra Tech 2023, Appendix D, Sheets 66-71) utilize placed streambed materials to maintain flows as surface water. These reaches have gradients greater than 14%, which will promote runoff as surface water. The EFMC restoration will affect 2,668 linear ft of stream below a 2,000 cubic yard structure placed as a rock grade control at the outlet of the wetlands area to the eroded channel. The rock grade control will be placed during the construction phase. For details on this construction, see the CMP (Tetra Tech 2023, Appendix D, Sheets 64-65). Upon exiting the rock drain (i.e., design reach BC2), flow will be conveyed by a restored stream channel to the confluence with Meadow Creek (see Tetra Tech 2023, Appendix D, Sheets 69-71). The lower portion of the EFMC alluvial fan will be an important borrow area for this and other restoration projects and is included in the action area disturbance. Therefore, the restored stream channel will be constructed approximately 100 ft north of the existing channel, which overlies sediments from the downcutting segment that will act as borrow materials for the restoration projects.

During construction and early mining, Grade control and water retention features will be constructed near the old reservoir water retention dam location to elevate the groundwater level and stream water surface sufficiently to restore wetland hydrology in the surrounding meadow. The retention structure will impound portions of the meadow channel, which will fill with sediment over time.

A coarse rock drain will be constructed within the chute downstream of the failed dam site to isolate the flow of EFMC from the actively eroding chute side slopes and to prevent further erosion of the gully bottom, facilitating subsequent restoration of a surface channel on top of the drain. The rock drain will also provide area for the collection and retention of side-slope erosion material rather than allowing that material to potentially contribute sediment to EFMC. As the rock drain fills with sediment, it will become closed off from the stream channel and flow will revert to the designed surface channel.

The existing alluvial fan in lower EFMC, located adjacent to Meadow Creek, will be partially removed, mostly during mine operations for borrow materials, and the area reclaimed. A surface diversion will be constructed at the margin of the lower alluvial fan to facilitate borrow excavation, and this stream reach subsequently restored.

Non-Contact Stormwater Diversions

Non-contact stormwater is meteoric water (i.e., precipitation) that does not contact tailings, open pits, the TSF, TSF Buttress, spent heap leached ore, and tailings from past mine operations, or any other mining related surfaces. The IDAPA 20.03.02 and 37,03.05 set stormwater design criteria (e.g., storm events for design sizing and freeboard requirements). Stormwater runoff from undisturbed areas upslope of mine features in the major drainages will be captured in stream diversion channels or in other channels that will direct runoff away from mine disturbed areas. Smaller-scale diversion channels or earthen berms will be used, where necessary, to divert stormwater around other mine infrastructure. Non-contact water will be managed with features to reduce erosion and sediment delivery to streams. Where sedimentation is a concern, non-contact water stormwater diversions will be routed to sediment catch basins where the water can evaporate, infiltrate, or discharge into the stream system after settling. Energy dissipation structures will be installed at the non-contact surface outfalls as needed.

Contact Water

Water that contacts mining disturbances and has the potential to impact water quality is termed contact water. Contact water includes, but is not limited to, runoff from mine facilities such as the TSF, TSF Buttress, stockpiles, mine pits, haul roads constructed of development rock, toe seepage of precipitation infiltrating through the stockpiles, and underground exploration water. The TSF Buttress and stockpiles are unlined facilities; therefore, water incident on the TSF Buttress and stockpiles that does not runoff will infiltrate into the buttress and then emerge as toe seepage or infiltrate into the subsurface and groundwater. The volume of runoff, toe seepage, and infiltration are accounted for in the site wide water balance (Perpetua 2021d, entire) with runoff and toe seepage collected as contact water, and the effects of the infiltration are accounted for in the assessment of groundwater chemistry. Collection of contact water will begin during the first year of on-site construction and will continue throughout operations and the closure and reclamation phases. Contact water will be captured in channels and sumps and routed to the ore processing facility, contact water storage ponds, water treatment plant, or enhanced evaporation systems. In unusually high runoff periods, collected water may be allowed to remain in the pits or the TSF temporarily, and excess contact water from outside of the pits may be routed to mine pits for temporary storage. Contact water storage ponds will be lined to minimize leakage. Water in the contact water storage ponds could be pumped to the mill for use, treated and discharged in accordance with applicable requirements, or evaporated. Contact water in the mine pits will be directed to in-pit sumps in the lowest part of the pit and piped to the mill for use, to other contact water storage ponds, to water treatment or evaporation, or into trucks for spraying for dust control within open pits and on stockpiles or TSF Buttress. Any contact water beneficially used in the ore processing or for dust control or stored for more than 24 hours then treated and discharged will require water rights permitting, including mitigation as outlined in the water right permit, through the IDWR prior to use.

Contact water that exceeds regulatory discharge standards set by IDEQ and cannot be used during operations will be disposed through a variety of methods including forced evaporation using sprayers located within the TSF or other managed areas or treated and discharged. Water will be treated to meet IPDES permit limits, and treated water will then be discharged through IPDES permitted outfalls to the EFSFSR or Meadow Creek.

Runoff from haul roads and access roads outside of pits, ore stockpiles, or development rock storage areas may be of sufficiently good quality to be eligible for coverage under the Multi-Sector General Permit (MSGP) for Stormwater Associated with Industrial Activities. Eligibility will depend upon the materials used for road construction and will be determined through coordination with IDEQ. Construction materials will be required to meet the 500 mg/kg arsenic concentration criteria associated with the protection of surface water from effects of metal leaching from the construction materials. The establishment of this criteria is detailed in the Development Rock Management Plan (Brown and Caldwell 2022, entire). Runoff covered under the MSGP will be managed with a variety of environmental design features and conventional stormwater control measures to ensure the protection of surface water quality.

Surface Water Outfalls

The specific number and exact locations of outfalls will be determined via IPDES permitting through IDEQ. All outfalls will be required to meet water quality limits for specific constituents, and some outfalls may have discharge volume limits where the permit specifies a loading limit. Not all outfalls will necessarily be active or be permitted in the same permit cycle (e.g., post closure outfall will not be active during operations).

Two IPDES surface water outfalls will be used to discharge treated contact water from active mine pits, the TSF Buttress, pit dewatering, legacy mine materials disturbed by new mining activities, and the plant site and truck shop. One outfall located near the plant site will discharge to the EFSFSR. A second outfall will discharge to Meadow Creek upstream from EFMC to augment streamflow during pit dewatering.

Water from the TSF and TSF Buttress underdrains may be discharged from two outfalls, depending on whether IPDES discharge limits are met without treatment of the underdrain water (otherwise, underdrain water will be routed to the plant site for use in processing, to the water treatment plant, or back to the TSF). Discharges from these two outfalls are expected to have a strong seasonal component, with some parts of the year seeing reduced flows, or even no discharge, as contact water is used for ore processing or other mine uses. The expected water treatment and discharge rates range between zero and 2,000 gpm, with the largest rates expected in Mine Years 5 and 6 when dewatering production is greatest and larger than the volume needed for use in the processing plant. Aside from those years, water treatment and discharge rates are zero during the summer months when water use is greatest and then range between 200 and 1,000 gpm in the winter months.

An outfall will be permitted on upper EFSFSR for the sanitary wastewater treatment facility at the worker housing facility. That outfall will be active through the operations period and during mine closure until the facility is decommissioned. An additional outfall is expected to be permitted in a future IPDES permit renewal for closure and post-closure discharge of treated TSF process water. That outfall will be on Meadow Creek upstream of EFMC near the TSF Buttress.

Additional permitted outfalls may be necessary during a portion of the operations period for contact water storage pond spillways that could discharge to surface water, although discharge will be very rare or non-existent, only occurring in the event of excessive precipitation or snowmelt. The need for additional outfalls associated with pond spillways and their location will be determined with IDEQ. Each outfall will be permitted through IDEQ and will be required to be monitored, meet discharge limits, and regulate the rate of discharge.

Draining the Yellow Pine Pit Lake

Draining the existing YPP lake will be initiated during construction. When the EFSFSR tunnel diversion is ready, stream flows will start being diverted into the tunnel during a period of low flow, most likely in the warmer months, and concurrent with salvaging fish (USFS 2024, Appendix B contains the fish salvage methodology) from the pit lake and diverted sections of the EFSFSR. As the EFSFSR water is diverted into the tunnel, the decreased EFSFSR flow into the pit lake will be expected to cause some fish to out-migrate, thereby lessening the number of fish requiring salvage and creating better conditions for salvaging fish. The period of fish salvage between the start of water diversion to full diversion into the EFSFSR tunnel is expected to be approximately one week.

Once fish salvage has occurred in the EFSFSR from the tunnel diversion downstream to the pit lake and most of the EFSFSR flow is being diverted into the tunnel, fish salvage in the lake will commence and take approximately one week to complete. The pit lake will drain naturally down to the elevation of the outlet of the lake, where the existing rock sill will control the water level, though some leakage and slow lowering via groundwater outflows may occur beyond that level. No erosion or downcutting of the outlet rock sill will be expected because it has endured the full range of EFSFSR flows over decades, and both inflow and outflow rates will be minimal during draining due to the river flow being diverted into the tunnel. The drain-down process will naturally convey lake water downstream to the EFSFSR.

After the natural drain down, water remaining in the pit lake or entering the pit from groundwater seepage or local stormwater runoff from pre-stripping operations on the highwalls above the pit lake will be managed as mine-impacted water. The water pumped from the pit lake will be used for construction purposes, transferred to the TSF (after it is lined and available) for future use in ore processing, or treated to meet permit limits before being discharged downstream in the EFSFSR via an IPDES permitted outfall.

Sediment remaining in the pit lake bottom will be removed beginning near the end of the final year of construction. Approximately 80 vertical ft of sediment lies on the pit bottom, and the pit walls are too steep to operate equipment without a ramp. Therefore, removal may be staged to coincide with successively lower benches as the pit is mined, and therefore may extend into the first year of operations. During this time, the pit will be used seasonally to capture and store contact water from the adjacent pit walls, and this water will be used or managed as stated above.

The sediment will be removed using an excavator or similar equipment and loaded into trucks and delivered to the TSF. Slurry/dredging methods are not anticipated but will be considered if the sediments are too wet to load or blend. The truck beds will have flashboards to minimize water leakage from the low-strength, saturated sediments. The loading area will drain back into the former pit lake, preventing off-site discharge of bleed water during loading. If necessary, wet material will be blended with loose dry material (e.g., development rock) from elsewhere on site to enable better loading, transport, and ultimate stability at the destination.

Ground Water Management

Groundwater will require management to allow mining in the pits and to direct seeps and springs from beneath mine facilities. Groundwater will also provide a portion of the water supply for the proposed action activities. Water supply aspects of the mine operations are described in the Water Use and Water Balance in Section 2.2.4.10. Any groundwater used within the action area will require permitting through IDWR prior to use. Depending on final use or disposal of groundwater, wells drilled on the site could be permitted as domestic use, industrial use, or dewatering wells.

Pit Dewatering

Lowering the water table in and surrounding the Yellow Pine, Hangar Flats, and West End pits during operations will increase pit wall stability and provide dry working conditions in the pit bottoms. Development of the Yellow Pine and Hangar Flats pits will require partial dewatering of the alluvium of portions of the EFSFSR and Meadow Creek valleys, respectively, to limit groundwater inflow to the pits and maintain stability of the pit slopes. Once the West End pit is mined below the level of West End Creek, the West End pit will also require dewatering.

Dewatering will be accomplished by drilling a series of alluvial and deeper bedrock wells near the pit perimeters to intercept and pump groundwater before the water reaches each pit. Alluvial groundwater at the Yellow Pine and Hangar Flats pits will be managed using a series of vertical wells. The West End pit is primarily in bedrock with only a thin layer of alluvium in the vicinity of the pit and no alluvial dewatering is planned for that pit. Pumps will be installed in each well and will run as necessary to draw down the groundwater and facilitate mining and backfilling operations. Horizontal drain holes in pit walls may also be considered for depressurizing remnant high pore pressure areas.

Groundwater pumped from pit dewatering will be considered to be contact water and will be managed through forced evaporation or active water treatment when the volume of pumped water exceeds the ore processing facility demand. Treated water will be discharged to either of two IPDES-permitted outfalls or either Meadow Creek or the outfall on the EFSFSR near the water treatment plant, depending on the need for streamflow support in Meadow Creek.

The pit dewatering wells will be permitted as industrial wells in conjunction with a water right application through IDWR. Groundwater not captured by the pit dewatering, and entering the pits as highwall seepage, will be directed to an in-pit sump in the lowest part of the pit where it will combine with stormwater and snowmelt runoff (i.e., contact water) from precipitation falling within the pit. The water will be used for dust control within the pits, and as needed, pumped to the ore processing facility for use as makeup water. In-pit water that cannot be used will be disposed of through forced evaporation or routed to the water treatment plant then discharged to the EFSFSR or Meadow Creek via IPDES permitted surface outfalls.

2.2.4.11 Sanitary Waste Handling Facilities

Sanitary waste handling facilities will be present at facilities and will be constructed and operated in accordance with Valley County, IDEQ, and Idaho Department of Health and Human Services standards. Sanitary wastewater will be treated using membrane bioreactor (MBR) or similar technology. Early in construction, the currently permitted MBR plant at the existing exploration camp will be used and treated effluent reused for flushing toilets and urinals (as allowed by the applicant's existing Reuse Permit M-228-02) or discharged to the existing drain field located in the process plant area, while the worker housing facility and its associated treatment plant is under construction. During operations and closure, sanitary wastewater from the worker housing facility, ore processing facility, and administration buildings will be treated at a new MBR or similar plant and discharged to the EFSFSR via a permitted IDPES outfall. Vaults or portable toilets will be used at off-site facilities and remote locations on site (TSF, pits, maintenance facility etc.), and serviced as needed using vacuum trucks. Treatment residuals will be hauled off site to a permitted sanitary landfill. Vault/portable toilet wastewater will be hauled to the on-site sanitary wastewater treatment plant for treatment.

2.2.4.12 On-site Composting Facilities and Solid Waste Collection and Disposal

On-site composting facilities will be permitted by IDEQ with oversight by the local Health District. Small scale composting associated with organic materials generated at the worker housing facility may be incorporated within the centralized GMS in the Fiddle Valley. These composting facilities will be fenced. Any larger composting facilities deemed necessary to support growth media quality or quantity improvements will be located off site.

All construction and demolition waste generated will be hauled off site for disposal at a permitted landfill; a landfill will not be constructed or maintained in the action area. Solid waste from the worker housing facility, shops, and other work areas that cannot be composted or recycled will be collected in wildlife-resistant receptacles and hauled off site for disposal in a municipal waste landfill.

Material that meets the classification of a "hazardous waste" will be collected and stored, per the Project Waste Management Plan at specially designed and operated secured satellite collection sites and a main storage site prior to shipment off-site to a Resource Conservation and Recovery Act certified hazardous waste disposal facility.

2.2.4.13 Mine Site Borrow Sources

Various types of earth and rock material will be used from borrow sources for construction, maintenance, closure, and reclamation activities. Most of these materials can be sourced in the action area from existing development rock dumps, legacy spent heap leach ore, and from development rock removed as part of proposed surface mining and underground exploration activities. These materials will be subject to physical and chemical testing to determine suitability for use.

Native earth materials will be required for some applications. Specific areas that have large quantities of high quality native alluvial and glacial granular borrow materials for use include:

- The alluvial and glacial soils in the Meadow Creek valley floor within the footprint of the TSF, TSF Buttress, Hangar Flats pit, and YPP;
- Sand, gravel, and cobbles in the lower EFMC alluvial fan; and
- Glacial soils in the Fiddle Creek valley walls within the footprint of the Fiddle GMS.

2.2.4.14 Materials, Supplies, Chemical Reagents, and Wastes

Numerous materials, supplies, and chemical reagents will be used, including fuel, explosives, and ore processing reagents. A Spill Prevention, Control and Countermeasure (SPCC) Plan will be developed prior to construction to establish procedures for responding to accidental spills and releases of petroleum products. In addition, a Hazardous Materials Handling and Emergency Response Plan will be developed prior to construction to address procedures for responding to accidental spills or releases of hazardous materials to minimize health risks and environmental effects.

Diesel Fuel, Gasoline, and Propane

Aboveground storage tanks will be used for fuels and other fluids, including gasoline, diesel fuel, lubricants, coolants, hydraulic fluids, and propane. Approximately 200,000 gallons of diesel fuel, 10,000 gallons of gasoline, and 30,000 gallons of propane will be stored in addition to a variety of materials, supplies, and reagents. The aboveground storage tanks will be installed on containments sized to contain 110% of the capacity of the tank. Refueling will occur on concrete-paved areas designed to contain refueling spills (i.e., berms around their perimeters). There will be no below ground fuel storage or piping used for refueling. Storage management will be outlined in the SPCC Plan. The storage tank facility for gasoline, diesel fuel, and propane will be located near the maintenance workshop with additional propane storage at the ore processing facility area, the underground portal area, and the worker housing facility.

Explosives Storage

Ammonium nitrate prill will be received in bulk in tanker trucks and transferred into storage silos. Other blasting supplies used for mine blasting operations will include blasting emulsion products, detonating cord, cast primers, and blasting caps. These products will be delivered in boxes or other approved containers on trucks. The explosives storage facility will include two silos containing ammonium nitrate on a concrete pad and two buildings, one for explosives and one for detonators. Components of bulk explosive material will be stored in separate and isolated containers, sized, and designed to meet Bureau of Alcohol, Tobacco, Firearms, and Explosives and MSHA requirements. The explosives storage facility will be fenced and securely gated. An explosives contractor will provide the products and manage the explosives storage facility.

Miscellaneous Oils, Solvents, and Lubricants

Various oils including motor oils, lubricants, antifreeze, and solvents will be shipped in on trucks. These will be stored in approved containers located within, or directly adjacent to, the maintenance shop and contained within secondary containments to prevent spills into the environment. All used petroleum products, waste antifreeze, and used solvents will be collected in approved containers, transported off site, and disposed or recycled.

Miscellaneous Consumables

Lime will be produced on site and stored in silos at the ore processing facility. Silos will be equipped with air emission controls. Sodium cyanide will be transported as dry cyanide briquettes to the action area. Nitric and sulfuric acid will be transported in tanks designed to prevent spills even in the event of rollovers. Nitric and sulfuric acids will be stored in specialized non-corrosive, polyethylene-lined tanks located within the ore processing facility and will have secondary containment.

Miscellaneous consumables will consist of various reagents used in the ore processing facility, along with wear parts for the crushing and grinding circuits. Liquids will be shipped in tank trucks designed for spill prevention and escorted by pilot cars manned and equipped to handle spills. All reagents will be transported and stored in suitable containers in designated reagent storage areas.

Waste Handling

Wastes generated from the proposed action include fluorescent bulbs, batteries, and empty aerosol containers, which will be managed in accordance with the appropriate regulatory standards. Materials that are not consumed will be recycled, to the extent practical, or disposed of in accordance with applicable regulations.

Used petroleum products will be stored on site in approved containers that will be separate from other trash and garbage products. Used petroleum products will be transported off site for recycling or disposal in an approved facility. Other legacy materials could be encountered during construction and operations. If encountered, these materials will be characterized to determine potential for re-processing, reuse, or on-site or off-site disposal.

2.2.4.15 Temporary Closure of Operations

No periods of temporary or seasonal closure are currently planned; however, a description of temporary closure is required for the cyanidation permit if applicable. In the event of temporary suspension of mining activities, the applicant will notify the Forest, U.S. Army Corps of Engineers (USACE), IDEQ, IDWR, IDL, and Valley County in writing with as much advanced warning as possible of the temporary stop of mining activities. This notification will include reasons for the shutdown and the estimated timeframe for resuming production. During any temporary shutdown, operational and environmental maintenance and monitoring activities will continue to be implemented to meet permit stipulations and requirements for environmental protection. This will include the reclamation success monitoring.

Dewatering of the open pits may continue during temporary closure due to the negative effects that pit lake formation or highwall saturation will have on highwall stability and renewed mine operations. Since ore processing may not be occurring, excess water from the various facilities will need to be managed. The operational plans required by the Cyanidation Permit and other plans developed as part of IDEQ permits will also describe specific activities and provide details on how process water will be managed during a temporary closure. Process water will continue to be managed per IDEQ requirements during any temporary closure including water collection and water treatment of excess water volumes beyond the capacity of the system to store and recycle.

A limited potential exists that unfinished facilities (such as haul roads, buttress, open pits, pit backfills, GMSs, etc.) will not have the same protective measures in place (e.g., stormwater collection systems or culverts) as will exist if the facility had been finished. Therefore, interim measures will be identified that will be taken to manage stormwater, sediment, dust, and other factors while the mining is temporarily stopped. Surface water diversion structures are proposed to be installed prior to construction of the TSF, open pits, and the TSF Buttress; hence, surface water will be diverted around these facilities regardless of the stage of their completion.

Environmental reports will be submitted according to schedules. Regardless of the operating status of the mine, appropriate monitoring will continue until compliance with permanent regulatory closure requirements is attained, unless modified by the required regulatory authorities.

2.2.5 Surface and Underground Exploration

Surface and underground exploration, including development drilling, will occur to evaluate potential mineralized areas outside of the proposed mining areas. New surface and underground exploration activities will be conducted during construction and operations. Any additional future expansion of mining activities will require supplemental permitting and approvals, including additional evaluation under NEPA and the Act.

2.2.5.1 Surface Exploration

A total of 65 acres of exploration drilling within the mine site is included in the proposed action (i.e., 25 acres of temporary roads and 40 acres of drill pads). Except for 11 planned locations, exact locations of the exploration drill pads have not been determined, although general areas for foreseeable exploration have been identified:

- Five areas surrounding the West End Pit.
- Two areas immediately east and west of the Yellow Pine Pit.
- An area adjacent to the Fiddle Creek growth media stockpile.
- Three areas near the former townsite and electrical transmission line corridor including the IPA and IPAB areas from the Golden Meadows Exploration Project (USFS 2016, p. A-3, Figure 1).
- Two areas immediately north and northeast of the Hangar Flats pit.
- An area immediately north of the process plant.
- An area approximately a quarter mi south of the process plant.
- Two areas north and east of the Scout Prospect decline.
- Two areas in the West Rabbit and East Rabbit areas from the Golden Meadows Exploration Project (USFS 2016, p. A-3, Figure 1).
- Nine areas in southeast of the Midnight Pit area, between the pit area and the existing radio communications tower one-half mi to the southeast including the Broken Hill, Ridgetop, Saddle, Upper Midnight, UM2, Doris K, Garnet, and West Garnet areas from the Golden Meadows Exploration Project (USFS 2016, p. A-3, Figure 1).

These areas will be used for exploration drill holes and for installation of monitoring wells associated with permit monitoring requirements. The drill areas are offset from flowing streams with no exploration areas along Sugar Creek.

For this exploration work, similar drilling methods, drilling equipment (i.e., helicopter-delivered drill rigs, truck, or crawler-mounted drill rigs), and environmental protection measures (USFS 2016, Attachment A, Section 1.12) that have been employed for exploration drilling in the past will be used. Some drill holes will extend to 1,500 ft or deeper, but the average drill hole will be approximately 800 ft long. Drill holes will be both vertical and angled, with some holes converted to monitoring wells when completed.

Reverse-circulation rotary or sonic drills will be used to drill pre-collars for core holes, drilling down to the depth desired for the start or core collection before mobilizing a core drill onto the hole. Pre-collared holes will have surface completions/seals and be capped when completed. Pre-collared holes will only be associated with road accessible drill sites.

Drilling crews consist of a drill operator plus one or two assistants. A geologist oversees drilling activities and compliance with permit requirements, environmental protection measures, and safety procedures. Drilling support equipment will include helicopters, water trucks, crew trucks, portable mud tanks, pipe trucks or skids, portable toilets, light plants, portable generators, motor graders, excavators, dozers, and product storage pallets. A helipad for exploration and medical evacuations adjacent to the administration offices and warehouse facilities will be maintained. Helicopter support for exploration activities will occur during daylight hours.

Where practicable, drill pads will be established in reclaimed roadbeds and temporary roads will be opened in the vicinity of authorized mine disturbance in order to access exploration targets. Each drill pad will have between one and five drill holes depending on its location and exploration needs. Placement of drill pads will be guided by exploration requirements, geotechnical studies, geochemical sampling, and groundwater monitoring needs. A rolling maximum of 5 acres of active temporary road disturbance (10,500 liner ft of road) and 8 acres of active drill pad disturbance (140 pads) within the total 65 acres will be utilized and road and pad disturbance will remain below that rolling maximum of disturbance. Disturbance reclamation will be conducted as soon as practicable following data collection, and at least three growing seasons will be needed to establish vegetation and determine reclamation success.

New drill pad disturbance will be kept to the minimum acreage necessary for safe access and working area for equipment and crews. Drill pad sizes will vary depending on the type of drilling work being conducted. Truck-mounted or crawler-mounted drill rigs typically require a 75- to 100-ft-long by 50- to 60-ft-wide working area (less than 0.15 acres). Drill pads supported by helicopter require working areas approximately 45-ft-long by 35-ft-wide working areas (less than 0.05 acres). The actual disturbance of each drill pad is dependent on the drill rig utilized, the number and orientation of drill holes on the pad, the steepness of the area topography, and the location of existing access roads.

Water and non-toxic approved drilling fluids will be utilized for all drilling activities. Drilling water will be obtained from currently approved sources and new approved sources subject to water rights and appropriations.

Sediment basins and traps (i.e., excavated sumps or portable tanks) will be used at each drill site to collect drill cuttings and to manage and circulate drilling fluids. Dimensions of road access drill sumps are 16-ft-long by 8-ft-wide by 8-ft-deep, with helicopter supported drill sumps approximately 12-ft-long by 6-ft-wide by 3-ft-deep. If needed to manage excess water produced from the exploration drill hole, larger or additional sumps will be installed. Sumps are installed with a shallow grade on at least one side to create a ramp for egress in the event that wildlife enter the sump. Upon completion of drilling, sumps will be backfilled and reclaimed.

Exploration drill holes will be abandoned by backfilling holes with drill cuttings, concrete, cement grout, or bentonite grout consistent with IDAPA 20.03.02.060.06(c). Dewatering and monitoring wells will be abandoned with surface completions/seals and be capped consistent with IDAPA 37.03.09 – Well Construction Standards Rules. Pre-collared holes will only be associated with track or truck mounted drilling equipment.

2.2.5.2 Underground Exploration

Underground exploration activities will occur at the newly discovered Scout Prospect, a 1-mi, downward-sloping tunnel (a decline). The decline will be used to reach the subsurface mineralized zone known as the Scout Prospect and will be accessed from a portal facility known as the Scout Portal, located south of the planned ore processing facility. Approximately 100,000 tons of rock will be excavated from the decline. Exploration drill holes will be installed at various locations in the decline. Selected drill cuttings or cores will be removed from underground for testing.

To construct the portal facility, the hillside will be cut into to develop a flat vertical slope using conventional underground drill and blast operations with mechanized equipment. Explosives will be used in the underground development process to construct the decline. The underground development rock could be used for surface pad construction, hauled to the ore stockpile area, or hauled for storage in the TSF Buttress.

Drilling is used in advance of the decline to ensure unexpected or unmanageable water pressures are not intersected. Water will be used in underground drilling or pumped from the collection point to the surface. Upon reaching the surface, the water will be piped to the ore processing facility to be used in the plant.

2.2.6 Lemhi Restoration Project

2.2.6.1 Overview

The proposed action will permanently impact wetlands and other Waters of the United States (WOTUS) subject to regulation under Section 404 of the Clean Water Act and requires a USACE permit. The Compensatory Stream and Wetland Mitigation Plan (CMP; (Tetra Tech 2023, entire), provides detailed descriptions of proposed restoration, establishment, enhancement, and preservation of aquatic resources to compensate for unavoidable impacts to WOTUS associated with activities that will be authorized by a USACE permit.

The selected off-site mitigation option to fully offset all predicted temporal loss of stream function in the Upper Salmon River subbasin includes side channel and floodplain reconnection completely on private land in the Upper Lemhi River watershed. This project would reconnect and/or create a series of interconnected perennial and non-perennial side channels and wetland complexes within a broad floodplain area that has been previously impacted by land use alterations, riparian vegetation clearing, levees, and grazing. The existing single-threaded channel would be bifurcated and obstructed using natural materials at multiple locations forcing flow into relic channels on the floodplain. This action would be augmented by complete channel excavation (primary channel approximately 5,721 linear feet), partial channel excavation (secondary channel – approximately 6,663 linear feet), and no additional excavation (tertiary channel – approximately 4,613 linear feet). The combination of predicted new primary and secondary channels in addition to improved instream habitat and channel conditions/dynamics is estimated to produce a total of 51,800 stream functional units plus any additional functional units generated by the creation of tertiary channels not accounted for in this calculation.

The primary goals of the Lemhi restoration project are to improve habitat for limiting life stages of ESA-listed fish species, i.e., pre-smolts (over-winter rearing), parr (summer rearing), adult (spawning and holding), and parr (high flow refugia) and to restore natural stream channel processes to maintain diverse habitat over time (Rio ASE 2023, entire). Improving stream habitat conditions are intended to help increase fish population abundance, productivity, and spatial structure. Specific Lemhi restoration targets are:

- Increased habitat quality and complexity (especially for juvenile life stages) by creating multi-threaded channels and connected off-channel habitat.
- Reduced width-to-depth ratio where the channel is over-widened to increase hydraulic complexity, floodplain connection, pool scour potential, shade, cover, and natural channel-forming processes.
- Increased frequency, duration, and area of floodplain connection to provide high flow refugia for rearing juveniles and to improve fine sediment distribution, groundwater recharge, floodwater storage, and nutrient cycling.
- Increased instream structure, hydraulic diversity, and more variable instream velocity,
- Increased pool quantity, frequency, and complexity.
- Surface/groundwater interchange to moderate instream temperature and provide areas of localized temperature refuge.
- Increased instream cover and interstitial space along margins for rearing life stages and for adult holding and cover leading up to and during spawning.
- Creation of a riparian corridor to increase shade, provide overhead cover, stabilize banks, provide instream structure, and increase woody debris recruitment potential.

Lemhi restoration elements targeting these objectives include:

- Develop a multi-threaded channel network of 12,426 feet perennial and non-perennial side channels and 4,965 feet of non-perennial tertiary channels through excavation of new channels and pilot channels to target flow into existing low areas. Tertiary channels are low depressions in the ground surface or relic channels disconnected from the mainstem that will largely exist or be constructed to convey surface water seasonally, and as such, will involve little to no excavation and/or treatment resulting in natural evolution with variable outcomes (i.e., some tertiary channels may develop into perennial side channels while the remainder become abandoned)
- Install large and small woody material to promote in-channel complexity, force hydraulic response (scour, deposition, split flow, floodplain connection, sediment sorting, and overall hydraulic diversity), and provide concealment cover for juvenile salmonids.
- Add floodplain roughness structures to provide high flow refugia, accommodate future channel dynamics, and promote lateral channel migration while maintaining a multi-threaded and sinuous channel character.

- Increase frequency of floodplain activation through channel constriction, blocking, and appropriate channel sizing of new channels and resizing of existing channel(s).
- Revegetation by means of planting native species within the riparian zone and transplanting local vegetation harvested near the Lemhi restoration project area; existing, mature riparian vegetation is limited within the Lemhi restoration vicinity and will be preserved and used as floodplain roughness and/or bank roughness where available and appropriate.

2.2.7 Closure and Reclamation

2.2.7.1 Overview

Closure and reclamation in the action area will include interim, concurrent, and final closure and reclamation in order to stabilize disturbances, mitigate/compensate wetland loss directly related to proposed action development, comply with applicable water quality standards, and achieve long-term post-mining land uses. Details on reclamation activities to be implemented, including appropriate seed mixes to be used, are described in the Reclamation and Closure Plan Stibnite Gold Project (Tetra Tech 2021, entire). Interim reclamation is intended to provide shorter-term stabilization to prevent erosion of disturbed areas and stockpiles that will be more fully and permanently reclaimed later.

Concurrent reclamation is designed to provide permanent, low-maintenance achievement of final reclamation goals on completed portions of the site prior to the overall completion of mining activities throughout the proposed action. Approximately 37% of the reclamation will be completed concurrent to mining and ore processing, and remaining reclamation activities will be completed during closure.

Final closure and reclamation will involve removing all structures and facilities. Reclamation of areas that will not have been concurrently reclaimed include the TSF and some backfill surfaces, recontouring and improving drainages, creation of wetlands, reconstructing various stream channels, decommissioning of the EFSFSR diversion tunnel, growth media placement, planting and revegetation on disturbance areas, and relocating Stibnite Road (FR 50-412) across the backfilled and closed Yellow Pine Pit area.

Final reclamation of certain facilities could continue beyond the five-year closure and reclamation period. The Burntlog Route will be needed until the TSF is fully reclaimed, after which the newly constructed portions of the road will be decommissioned and reclaimed (i.e., fully obliterated), and the currently existing portions of the road will be returned to their prior use.

Surface water flow diversion of portions of the EFSFSR, Garnet Creek, Meadow Creek, Midnight Creek, and Hennessy Creek will be reclaimed and incorporated into constructed wetlands (i.e., Garnet Creek) or restored stream channels across the reclaimed TSF (i.e., Meadow Creek) or YPP backfill.

Closure and reclamation activities are intended to achieve post-mining land uses of wildlife and fisheries habitat and dispersed recreation in the action area under current motorized access requirements and route designations. Dispersed recreation uses will be accessible by the relocated Stibnite Road (FR 50412) through the backfilled YPP that will facilitate recreational traffic and access to Thunder Mountain.

2.2.7.2 Decommissioning, Demolition, and Disposal of Facilities

Structures and facilities not necessary for post-closure water management (e.g., certain culverts and pipelines) will be dismantled or demolished. The materials from the dismantling or demolition of structures and facilities will be salvaged or disposed of in permitted off-site landfills. All reagents, petroleum products, solvents, and other hazardous or toxic materials will be removed from the site for reuse or will be disposed of according to applicable state and federal regulations. Concrete foundations will be broken or fractured as required to prevent excessive water retention and covered in-place with a minimum of 2 ft of cover material (consisting of a minimum of 1.5 ft of backfill and a minimum of 0.5 ft growth media) or will be broken up and buried in the TSF Buttress or pit backfill prior to installation of a geosynthetic liner cover. Soil and rock beneath fuel storage areas and chemical storage buildings will be tested for contamination and removed or disposed of appropriately if needed.

2.2.7.3 Underground Exploration and EFSFSR Tunnel

Underground facilities and support facilities, including the portals of the EFSFSR tunnel and Scout decline, will be decommissioned and closed. To prevent future access to underground workings, the underground portals (i.e., EFSFSR tunnel and Scout decline) will be closed using concrete block bulkheads, rockfills, or a combination of rockfill and low-permeability foam. The downstream (north) EFSFSR portal and the Scout decline will be closed with bulkheads inside the portals (where overhead cover was at least 3 times the tunnel height) or backfilled with clean rockfill starting inside the portals and working outward and up against the portal headwalls. Surface swales will be installed to direct surface water around the backfilled portal, and the exterior backfill, and surrounding disturbance will be graded to blend with adjacent topography, covered with growth media, and revegetated. At the EFSFSR upstream (south) portal, the control weir will be left in place, and the fishway weir notch raised with concrete, creating an approximately 4-foot-high sill to exclude river water or alluvial groundwater, and low-permeability geofoam or similar will be installed inside the portal after the initial backfill or bulkhead to prevent water entry. Then the portal area will be filled, regraded, and revegetated as described for the other openings.

2.2.7.4 Yellow Pine Pit

During mine years 5 through 11, the majority of the YPP backfill material (90%) will be West End pit development rock. The balance of YPP backfill will include development rock from the Hangars Flat pit (5%) and the YPP (5%). Backfill will be placed in lifts not exceeding 100 ft in vertical height with the large equipment, to include selective placement of the top lifts by direct dumping to better control the type of rock that will be placed near the surface. This placement method will limit subsidence of the backfill and the amount of regrading needed prior to placement of growth media (Tetra Tech 2021, pp. 4-16 to 4-17). This material will not be compacted beyond that which occurs during placement, subsequent routing of trucks, burial, and consolidation. Portions of the highwalls on the east and west sides of the pit will remain above the backfilled portion of the pit and will not be reclaimed. A sinuous channel will be constructed through the backfilled area for the reconstructed EFSFSR with an average valley gradient approximating the historical, pre-disturbance river gradient (Tetra Tech 2023, Appendix D). A low permeability geosynthetic liner will be incorporated into the cover over the entire surface of the backfilled YPP, including the re-constructed channel floodplain corridor to reduce the infiltration of meteoric water into backfill material, which could dewater the restored stream channel and result in additional metal leaching from the underlying backfill. Above the geosynthetic liner in the stream corridor, a layer of relatively fine material will be placed to protect the stream liner from puncture, followed by coarse rock armor to protect from exposure via stream scour, followed by floodplain alluvium at a minimum thickness equal to the maximum estimated scour depth of the proposed stream channel. Growth media will then be placed and the area revegetated. The lined corridor will be wide enough to accommodate future channel migration, evolution, and over-bank flooding. The cover system outside the stream/floodplain corridor will be similar to that described for the TSF Buttress (Section 2.2.6.6). Portions of Hennessy and Midnight Creeks will be restored over the backfilled area along with the reconstructed EFSFSR.

Hennessy Creek will cascade over the approximately 275 ft tall west highwall of the YPP to a restored 0.27 km section of low-gradient channel on the western edge of the reconstructed EFSFSR floodplain before joining the restored EFSFSR channel. Midnight Creek will be restored across the 0.23 km southeastern portion of the reconstructed EFSFSR floodplain. After closure of the EFSFSR tunnel, backfilling of the YPP, and restoration of the EFSFSR and Hennessy Creek across the backfill, the Hennessy Creek diversion will be decommissioned and the area reclaimed, along with the adjacent operations-phase public access road.

To accommodate migrating fish, including bull trout, step pools will be established within the constructed EFSFSR channel consistent with NOAA fish passage guidelines (NMFS 2022b, entire). The vertical relief (drop) between successive pools will not exceed published fish passage criteria. Detailed hydrologic and hydraulic analyses will inform the overall channel and floodplain design and construction, with channel bankfull width approximately 25 to 30 ft and average depth of approximately 2 ft. The lined Stibnite Lake, of similar size to the existing YPP lake, will be constructed within the lined corridor (Perpetua 2023, Attachment D, p. 9-14; Tetra Tech 2023, Attachment D)

Access through the site to Thunder Mountain Road (FR 50375) will utilize an access road through the backfilled area, replacing the segments of the Stibnite Road (FR 50412) that were removed by mining.

2.2.7.5 West End Pit

The West End pit area includes the West End pit, the Midnight pit, the sidehill pit, and the Development Rock from legacy mining activity. Reclamation will occur at the conclusion of mining operations. The West End pit will not be reclaimed. Instead, a pit lake about 400 ft deep will be allowed to form in the northern portion of the pit below the highwall, which will be about 800 ft above the pit lake surface. The West End pit lake will fill gradually up to 400-ft-deep, and lake levels will fluctuate seasonally and with longer-term climate variations; however, the lake will not completely fill with water or spill due to its limited catchment area.

To account for model uncertainty, lake levels will be monitored after closure, as specified in the Environmental Monitoring and Management Plan (Brown and Caldwell 2021b, entire), and a threshold water level will be established, sufficient to contain the predicted runoff volume from a high-snowpack year without discharge. If water levels approach the threshold, either or both surface water diversion and water treatment could be implemented to prevent the lake from spilling. If needed, a temporary treatment unit will be mobilized to the site to treat and discharge the pit lake water until the lake level falls below the threshold discharge level, thus preventing untreated discharge in potential subsequent wet weather years and enabling gradual and predictable water treatment rather than treatment at higher but variable and uncertain peak spring runoff rates.

The Midnight pit and the approximately 6-acre 100-foot-deep southeastern portion of the overall West End pit within the Midnight Creek catchment will be backfilled during operations with approximately 6 million tons of development rock from the West End pit. The backfill will be placed to achieve a mounded final reclamation surface to promote drainage away from the West End pit and prevent formation of a pit lake within Midnight pit. Portions of the backfill will be covered with growth media and revegetated and the remainder covered with talus like development rock to mimic a natural talus slope.

The floor of the sidehill pit southwest of the main West End pit will be graded to drain, covered with growth media, and revegetated. No backfilling will occur for the main West End pit. At closure, the remaining road into the pit and access to highwalls will be blocked with large boulders or earthen berms to deter motorized vehicle passage into the pit.

2.2.7.6 Tailings Storage Facility and TSF Buttress

Tailings reclamation is expected to be completed approximately 9 years after ore processing operations cease. After tailings consolidate sufficiently to use heavy equipment on top of the tailings (within 3 to 5 years after the end of deposition), cover material will be placed, wetlands will be constructed, Meadow Creek and its tributaries will be restored within appropriately sized lined floodplain corridors, growth media will be placed, and the area will be revegetated.

Once ore processing operations have ceased, the remaining supernatant water pool and ongoing accumulation of meteoric water and consolidation water will be removed through a combination of spray evaporators (similar to snowmaking misters) operated within the TSF boundary and an active water treatment that meets IPDES discharge limits, followed by discharge to the EFSFSR or Meadow Creek. Removal of the remaining supernatant water from the TSF will allow the surficial layers of the tailings to dry and gain strength, which will allow equipment to operate on the tailings surface for grading and the placement of the geosynthetic liner, overlain by unconsolidated overburden and growth media. Concave areas in the consolidated tailings surface will be filled to create suitable drainage conditions prior to liner and cover installation in the area designed to become restored stream channel. Cover placement and minor grading of tailings will begin within 3 to 5 years from the end of deposition, as portions of the TSF surface dry enough to allow equipment traffic, working inward from the facility perimeter. The cover material overlying the geosynthetic liner will be sourced from unconsolidated overburden or other appropriate material stored in a GMS on top of the adjacent TSF Buttress.

Appropriately designed meandering stream channels (Meadow Creek and tributaries) will be restored within a stream and floodplain corridor across the top of the lined TSF (Rio ASE 2021, p. 3-3, Figure 3-1). Pools and riffles will be constructed within the channel. Measures to create aquatic habitat will include side channels, oxbows, boulder clusters, root wads, and large woody debris. This will allow for the post-closure development of riparian habitat, convey water off the facility, and minimize potential interaction of surface water with the underlying tailings. Given the nature of the surface of the TSF, the constructed channel will have a shallow gradient.

Detailed hydrologic and hydraulic analyses will inform the overall channel and floodplain design, which will necessitate the construction of defined channels ranging from approximately 5 to 15 ft in bankfull width, with average bankfull depth reaching approximately 2 ft. A connected floodplain up to 200 ft wide will convey higher flows during a 100-year flood event.

Consolidation of the tailings will continue after cover placement and surface reclamation, at gradually declining rates, until approximately Mine Year 40. To prevent tailings consolidation water from mixing with surface water on the cover, potentially leading to water quality impacts if discharged to streams, the consolidation water will be collected for treatment, using shallow wells and gravel or geosynthetic drains. Initially, collected flows will be routed to a WTP for treatment and discharge. Treatment will no longer be required after approximately Mine Year 40, when operations cease and no water is being used that would require treatment, at which time the treatment facility will be decommissioned and the WTP site reclaimed.

Final slopes of the TSF Buttress will be variable, to blend with the surrounding terrain to the extent practicable, produce a permanent and stable landform, provide access for future maintenance on the TSF and buttress, and provide for non-erosive drainage across the reclaimed face of the buttress. Upon completion of final grading of the TSF Buttress, a low permeability geosynthetic cover will be placed over the facility, which will be designed to limit infiltration through the underlying development rock. The geosynthetic liner will be overlain by an inert soil/rock layer (non-PAG/metal leaching development rock, fill, or alluvium) and growth media and revegetated. Similar to that for the TSF, a channel and floodplain corridor will be established for Meadow Creek across the top of the lined buttress. The channel will have a low gradient and wide floodplain across the top of the buttress, then drop more steeply to the valley floor near the south abutment. The steep channel segment will consist of a boulder chute that will flow through multiple energy-dissipating basins (one mid-slope and one at the toe of the TSF Buttress) before being discharged to a restored Meadow Creek on the valley bottom.

2.2.7.7 Hangar Flats Pit

In mine years 6 and 7, Hangar Flats pit will be backfilled up to the valley bottom elevation or slightly higher with no pit lake anticipated. Following closure, the western pit highwall will remain exposed above the backfill area. The already-established Meadow Creek diversion channel and floodplain corridor will be retained around Hangar Flats pit as the final configuration, and the segment of Meadow Creek between the toe of the TSF Buttress and the entrance to the Hangar Flats pit diversion will be restored along with adjacent riparian wetlands. At closure, the entire surface of the backfilled Hangar Flats pit will be covered with a low permeability geosynthetic liner overlain with seed bank material to establish wetlands. Non-perennial drainages in adjacent upland areas will be routed to facilitate development of the wetland hydrology. Meadow Creek downstream of the Hangar Flats pit diversion, to the confluence with the EFSFSR, will be enhanced during mine operations with large woody debris, boulder cluster habitat structures, and riparian plantings.

2.2.7.8 Transmission Line and Electrical Infrastructure

The Johnson Creek and Stibnite substations will not be decommissioned immediately during mine closure. The transmission line between these substations will remain to provide power for post-closure water treatment. Once there is no longer a need for active water treatment, the 9-mi transmission line between the Johnson Creek and Stibnite substations will be decommissioned.

The substations, switchgear, and power line will be removed. The transmission line ROW and associated access roads will be recontoured to match surrounding topography and revegetated. As part of revegetation, the transmission line structure pads and access roads will be scarified and revegetated. Revegetation will not be required on affected lands, or portions thereof, where planting is not practicable or reasonable because the soil is composed of excessive amounts of sand, gravel, shale, stone, or other material to such an extent to prohibit plant growth. All existing transmission lines getting upgraded will remain on the landscape after mine closure and reclamation.

2.2.7.9 Burntlog Route

Once all final mine closure and reclamation work has been completed, the 21-ft-wide travel way of 19.8 mi of Burntlog Road (FR 447), 1.3 mi of Meadow Creek Lookout Road (FR 51290), and 2 mi along Thunder Mountain Road (FR 375) of the Burntlog Route will be reduced to their approximate pre-mining width. The public use status of these existing road segments will be unchanged from the current motor vehicle use map. Returning this 23 mi of existing road to pre-mining condition will entail grading or scarification along the outside edges of the road followed by seeding with the species listed in the Reclamation and Closure Plan (Tetra Tech 2021, p. 3-65, Table 3-12) or as approved by the Forest Service. Ditches, cross drains, culverts, safety berms, mile markers, guardrails, and signs on roads will be removed if these features are no longer needed. These roads will retain the flatter grades and gentler curves constructed for mine operations.

The approximately 15 mi of Burntlog Route that was newly constructed for the proposed action, connecting Burntlog Road (FR 447) to Meadow Creek Lookout Road (FR 51290) and Thunder Mountain Road (FR 50375), will be fully decommissioned. The road will be decommissioned by pulling back and re-contouring road cuts to slopes that are similar to, but not necessarily matching, pre-project conditions and will be consistent with the surrounding terrain as practicable. Surface water diversions, cross drains, culverts, safety berms, mile markers, guardrails, and signs will be removed. Soil nail walls, constructed of anchors bolted into the ground with a sprayed concrete surface, will remain to support slopes in areas with soft soils or weathered rock. Water bars or other erosion and sediment control structures, armored stream crossings, and stormwater crossings will be included where necessary. The reclaimed areas will be scarified, and 6 in of growth media will be placed in upland areas, followed by seeding and certified weed-free mulching on slopes over 30%. Revegetation will not be required where planting is not practicable or reasonable due to excessive amounts of sand, gravel, shale, stone, or other material to such an extent to prohibit plant growth.

2.2.7.10 Post Closure Public Access

As mentioned in Section 2.2.6.4, a service road will be established over the backfilled YPP to allow public access through the reclaimed site and connect Stibnite Road (FR 50412) to Thunder Mountain Road (FR 50375).

2.2.7.11 Off-site Facilities

Following mine closure and reclamation, the Burntlog Maintenance Facility buildings will be removed. The sewer system and septic tanks for the Burntlog Maintenance Facility will be decommissioned. All reagents, petroleum products, solvents, and other hazardous or toxic materials will be removed from the site and disposed of according to applicable state and federal regulations. Soil and rock beneath fuel storage areas and chemical storage buildings will be tested for contamination and treated if necessary. After demolition of the buildings and facilities, the site will be graded, revegetated, and drainage restored.

A “light industry” post-mining land use has been identified for the SGLF in which the facility could be maintained by a third party for future use, meaning the facility, located on private land, will not be reclaimed. A new conditional use permit (CUP) from Valley County will be required prior to use by any other entity. If there is no further use of the site after a two-year period, the structures will be removed and the site reclaimed (Valley County CUP No. 20-12 Stibnite Gold Project - Logistics Facility).

2.2.7.12 Contouring, Grading, Growth Medium Placement, and Seeding

Except for the Hangar Flats pit highwall above the valley bottom, the West End pit, and a portion of the YPP highwall, disturbed areas will be contoured and graded to blend into the surrounding topography and terrain. Compacted areas such as roads, ore stockpile areas, parking lots, fuel storage areas, and building sites will be prepared prior to placement of growth media and revegetation. Haul routes and access roads will be re-contoured to establish natural drainage patterns.

Growth media suitability criteria include U.S. Department of Agriculture (USDA) texture, percentage of organic matter, course fragment percentage and acidity (pH). Root zone material suitability guidelines include USDA texture, course fragment percentage, soil acidity (pH), electroconductivity, sodium adsorption ratio, Net Acid Generation pH, bulk density and arsenic, antimony, and mercury levels. Growth media material will be manufactured using screened fines from glacial till sources, available mulched vegetation, and off-site composted material from private lands (e.g., composted food waste from the worker housing facility). Off-site sources for composting feedstock materials will be in compliance with Forest Service requirements.

Planting, seeding, and mulching will be conducted in the fall and early winter to take advantage of snowpack and springtime moisture. Where cover crops are used in lieu of mulch, seeding will occur in the spring or fall followed by seeding of the permanent mixture. The forbs, grass species, seed amounts, and the trees and shrubs planned for planting on reclaimed areas are described in Tetra Tech (2021, p. 3-65, Table 3-12) and will be approved by the Forest.

2.2.7.13 Post Closure Water Treatment

Evaluation of post-closure water treatment is ongoing. Water treatment will be provided during the reclamation and closure and post-closure phases until waters requiring treatment are no longer being generated. Sources of water that could require treatment during closure and reclamation and through the post-closure period include TSF runoff and tailings consolidation water, plus any TSF Buttress toe seepage. Other development rock will be backfilled into the open pits and closed with synthetic geotextiles, growth media, surface grading, or revegetation to preclude contact between the development rock and surface runoff.

Consolidation water will be withdrawn from beneath the TSF geosynthetic cover using a combination of wells, wicks, or gravel drains, and routed to water treatment. Collected flows will be routed to the water treatment plant for treatment and discharge. Once it is determined that treatment is no longer required based upon agency approvals, the treatment facility will be decommissioned and the WTP site reclaimed. Water treatment will be provided during the reclamation and closure and post-closure phases until waters requiring treatment are no longer being generated. Life-of-mine water treatment of the TSF and other facilities is discussed in Section 2.2.4.10.

As described in Section 2.2.6.5, if spillage of surface water from the West End pit lake becomes imminent, a portable system will be brought to the site to treat and discharge pit lake water to maintain levels below the rim of the lake and prevent uncontrolled release of lake water.

2.2.7.14 Closure and Reclamation Traffic

Most closure and reclamation traffic will occur May through November. Mine traffic during closure and reclamation is anticipated to result in a total AADT of 27, with 15 from heavy vehicles and 12 from light vehicles.

2.2.8 Monitoring

Monitoring will be conducted by the mine operator and reviewed by the Forest and other regulatory agencies to ensure compliance with permits and regulations and to manage the impact of the proposed action on the environment. Air emissions, groundwater, surface water, aquatic, and other environmental parameters will be monitored during mine construction, operation, closure, and post-closure as described and specified in the Environmental Monitoring and Management Plan (EMMP; Brown and Caldwell 2021a, entire). Authorizations from federal and state agencies include monitoring requirements for resources (e.g., air emissions, surface water, and groundwater) during mine construction, operation, closure and reclamation, and post-closure.

Monitoring will be conducted following the completion of closure and reclamation of all facilities and disturbance areas to demonstrate compliance with permit requirements and to measure the success of reclamation and mitigation. Final monitoring requirements and timelines will be outlined in the final permit approval documents and the final EMMP.

The final EMMP will consist of multiple component plans, each of which will be finalized upon issuance of the related permit(s) and will contain monitoring and management requirements from each permit. In some cases, if environmental outcomes may be uncertain, the EMMP will include adaptive management planning that requires identification of performance measures, impact thresholds, and operational adjustment options, all intended to achieve and demonstrate compliance with applicable permitting and/or consistency with the environmental analysis (Section 2.4.1).

2.2.8.1 Environmental Monitoring

In an effort to capture actual or anticipated monitoring and management requirements for each of the required regulatory permits, an EMMP (Brown and Caldwell 2021b, entire) was drafted. The EMMP describes the component monitoring and management plans that will be developed and used to manage water resources, manage and monitor mine facilities, and monitor environmental and cultural resources. The EMMP includes environmental tasks and lists environmental permits, licenses, authorizations, and corresponding obligations. It also establishes commitments to environmental monitoring and management of mine facilities and environmental resources. The EMMP will provide direction to monitor operations and environmental commitments, document permit compliance, and reduce potential impacts to environmental resources. Key monitoring requirements of the EMMP are described below.

Water Resources Monitoring

Water resources monitoring includes five geographical areas within the action area. The areas represent portions of the proposed action with internally similar activities, hydrology, and potential water quality concerns:

- Northern operations area (YPP, West End Pit, Midnight Pit Backfill, EFSFSR diversion, and the confluence with Sugar Creek) where mining activities will expose mineralized rock materials and operations will modify groundwater levels and surface flows,
- Southern operations area (TSF, TSF Buttress, TSF surface diversions, Hangar Flats Pit, Meadow Creek, and East Fork Meadow Creek) where mining operations, development rock placement, and tailings storage will expose mineralize rock and tailings materials and operations will modify groundwater levels and surface flows,
- Ore processing area (processing plant, WTP, truck shop, support facilities, and the EFSFSR below the Meadow Creek confluence) where operations will receive, store, and utilize fuels and reagents (e.g., acids, cyanide) and water treatment discharge will occur,
- Worker housing area (employee housing, sanitary water treatment plant) where sanitary water treatment will occur, and
- Off-site facilities (SGLF and Burntlog Maintenance Facility) where operations will store and transfer fuels and reagents for delivery to the on-site areas.

Water resources monitoring will include measurements and analyses of samples at surface water locations and groundwater monitoring wells. Most monitoring locations are situated downstream or downgradient from proposed action components with the potential to contribute constituents to nearby water resources, with the remaining locations upstream or upgradient from proposed action components to characterize baseline conditions influent to the area. Measurements and analyte lists are based on the constituents potentially associated with the proposed action component and activities:

- Open pits and haulage areas are focused on potential contributions of sediment and nitrogen species associated with blasting operations,
- Tailings storage, stockpiles, and development rock storage areas are focused on the potential to contribute sediment, major ions (hardness), metals and cyanide associated with leaching of mined materials,
- The processing area is focused on the potential to contribute cyanide, metals, and major ions (hardness) associated with the cyanide ore processing,
- Treatment plant outfalls are focused on collection of monitoring data for compliance with water treatment objectives (i.e., major ions, hardness, metals, temperature, turbidity, and continuous flow measurement),
- The sanitary treatment plant outfall is focused on collection of monitoring data for compliance with sanitary treatment objectives (i.e., E. coli, biological oxygen demand, temperature, turbidity, and continuous flow measurement), and

- Multi-Sector and General Stormwater Permits stormwater discharge locations are focused on monitoring data for compliance with those permits (i.e., turbidity, temperature, and metals).

Instantaneous flow and temperature measurements will be collected at each surface water location for each sampling event, while water level and temperature measurements will be made at each groundwater well for each sampling event. The Forest will review monitoring results for comparison to Forest requirements, the approved mine plan, modeling forecasts, and water quality standards.

The Forest Service will also require the following measures regarding water resources monitoring and monitoring results:

Monitoring Measure - Water Resource Monitoring Plan Implementation: Because construction, operation, and closure has the potential to impact surface or groundwater resources, a focused Water Resources Monitoring Plan will be implemented. As the mine owner/operator, the applicant will be responsible for the implementation of the plan focused on confirming the predicted groundwater drawdown within allowance for model uncertainty and its relationship to discharges at proximal surface water resources. The plan will include surface water, groundwater, and meteorological monitoring requirements. Water quantity measurements will include diversion rates from groundwater pumping, water levels in groundwater monitoring wells and piezometers located within the mine site area, and flow rates of streams and springs at USGS monitoring stations, as well as spring locations characterized in the baseline program within the predicted 10-foot drawdown contour. Monitoring results will be provided to the Forest on a quarterly basis and summarized in an annual report. The applicant will be responsible for continued monitoring and reporting of changes in groundwater levels and surface water flows prior to, and during, operation and for a period of time in the post-reclamation period. The plan will be reviewed and approved by Forest and implemented prior to the commencement of mining. State authorizations may also have monitoring requirements, and these requirements along with monitoring already conducted or proposed could be applied to satisfy the needs of this mitigation measure.

Monitoring Measure - Groundwater Modeling Validation and Update: Since there is uncertainty in the numerical groundwater model developed for the proposed action, a work plan will be developed to revise the model and update it as necessary; model updates should occur no earlier than after one year of data being collected following the beginning of mine dewatering activities or whenever monitoring data demonstrates a change in conditions that will significantly influence prediction and recognition of potential mine impacts. The model update will be based on the actual observed changes in groundwater elevations and additional hydrogeologic or groundwater-related data collected during operation. The Forest's annual review of monitoring results combined with the updated groundwater modeling, if necessary, will provide early warning of potentially unanticipated, undesirable impacts to water resources to allow for implementation of appropriate measures.

Mitigation Measure – Groundwater Discharge to Surface Water: Impacts from groundwater discharge to surface water resources are predicted by the numerical groundwater flow model. However, if monitoring results indicate a different nature or extent of impacts that are outside of model uncertainty and associated with water management, additional compensatory mitigation will be implemented to mitigate for the effects of that reduced flow on the use of the affected surface water resource. Any additional compensatory mitigation will need to be performed in compliance with applicable regulations, including 404 CWA permitting and 401 Water Quality Certification.

Monitoring Measure - Water Resource Monitoring Plan Implementation: Because construction, operation, and closure have potential to impact surface or groundwater resources, a focused Water Resources Monitoring Plan will be developed by the applicant, who will be responsible for the implementation of the plan, incorporating the confirmation of predicted surface water and groundwater chemistry plus surface water temperature. The plan will include mined development rock and ore, surface water, groundwater, and meteorological monitoring requirements. Monitoring results will be provided to the Forest on a quarterly basis and summarized in an annual report. The applicant will be responsible for continued monitoring and reporting of surface and groundwater chemistry and temperature prior to, during, and after operations for a period of time in the post-reclamation period. The plan will be reviewed and approved by the Forest and implemented prior to the commencement of mining. State authorizations may also have monitoring requirements, and these requirements, along with monitoring already conducted or proposed, could be applied to satisfy the needs of this measure.

Monitoring Measure – Higher frequency water quality sampling and analyses: In scenarios where there is a demonstrated reason for concern that water sources and discharges around proposed action components could have rapidly changing analyte concentrations, water quality samples will be collected and analyzed more frequently than the regular monitoring program frequency for key parameters until monitoring parameters stabilize (e.g., weekly sampling compared to monthly or quarterly sampling). The higher frequency data collected, which may coincide with requirements under other state and federal permits, will be reviewed and compared to previously collected data, baseline concentrations, and other permit conditions. Higher frequency water quality sampling and analyses will be applied to:

- Discharges from the start-up or resumption of mine water treatment plants following an extended shut-down (pH, specific conductivity, weak acid dissociable [WAD] cyanide, organic carbon, arsenic, antimony, and mercury) until results meet IPDES permit limits or the results of monitoring are considered sufficient based on Forest review in consultation with applicable state regulatory agencies, and
- monitoring of spill indicators in affected receiving monitoring wells, contact water collection ponds, and surface waters (pH, specific conductivity, spilled material indicators) until the results of the monitoring are considered sufficient based on Forest review in consultation with applicable state regulatory agencies.

Mitigation Measure – Contingency plan for long-term power interruption: While IPDES permitting requires contingency planning for power interruption associated with discharging water treatment plants, other water management activities, not associated with discharges, are not required to have contingency plans under that permit. The applicant will develop and maintain water management contingency plans for a long-term power interruption of longer than 24 hours to prevent unauthorized discharge from the following water management facilities: contact water collection ponds, tailings storage facility, dewatering, process plant water containments, and any water pumping associated with a spill response.

Monitoring Measure - Updated Geochemical and Temperature Modeling: *Geochemical* modeling or temperature modeling will be updated as necessary (at the request of the Forest) if monitoring results obtained from the Water Resources Monitoring Plan or other data collection indicate a change in water quality conditions that will significantly influence prediction and recognition of potential mine impacts. The Forest's review of quarterly and annual monitoring results compared to predicted conditions will provide early warning of potentially unanticipated, undesirable impacts to water resources to allow for implementation of appropriate mitigation measures. Implementation of these measures will reduce or eliminate potential impacts to water quality.

Mitigation Measure - Contingent Stream Temperature Reduction Measures: Due to inherent limitations in modeling and forecasting stream flow temperatures over a multi-decade period, effectiveness of the actual performance of TSF consolidation, stream channel restoration, riparian plantings, and other temperature reduction measures implemented may differ from forecast. When shade is assumed to be 40% of design, predicted stream temperatures remain elevated in the TSF area and near existing conditions in downstream areas without realizing the benefit of the restored stream channel over the TSF on reducing stream temperatures below the existing condition. Without this temperature reduction, stream temperatures downstream of the YPP could also be greater than existing conditions.

Ditches and pipelines utilized to divert water around the TSF during operations are expected to result in maintaining cooler water temperatures for downstream reintroduction into the mainstream system. In addition, these diversions will not be affected by TSF consolidation or implementation of stream channel restoration. Therefore, these surface flow diversions will not be removed/reclaimed and continue to be utilized to divert flows in part of in whole until:

- TSF consolidation appropriate for stream channel restoration could be verified via consolidation monitoring and re-modeling for the as-built tailings facility,
- Stream restoration design and implementation could be re-assessed prior to construction by resurveying the as-built and partially consolidated TSF surface to determine whether design stream gradients could be achieved or whether the stream channel design will need adjustment to accommodate the gradients of the post-consolidation TSF surface, and
- Achievement of design shading effects of riparian plants on stream temperatures could be re-assessed prior to construction by measuring the success of establishing riparian plantings at locations outside the TSF footprint (e.g., Hangar Flats pit diversion corridor, TSF Buttress, across the YPP backfill or others) or a TSF-analogous test plot location utilizing the design cover materials and thicknesses.

Operational period maintenance practices for the diversions will remain in effect into the closure and post-closure period to prevent sedimentation and other factors from impairing the effective use of the diversions. Upon verification of the items above with any associated design adjustments, stream water temperature monitoring data in the constructed restored stream channel will be collected to confirm the performance of the temperature reduction measures. In an event where monitoring data indicated that acceptable stream temperatures will not be attained, the ditch and pipeline diversions will be re-commissioned and utilized to convey surface flows in part or in whole until an effective planting design will be developed and implemented.

***Mitigation Measure – Streamflow temperature adjustment**:* In the event that riparian shading does not provide sufficient shade to maintain Summer Maximum Weekly Maximum Temperature (MWMT) at or below those included in the closure plan, adaptive management in the areas of concern will be used to identify the issues and implement improvement measures. Depending on the degree and spatial extent of the mitigation needed, these measures could include supplemental plantings with larger, container plants along stream reaches, leaving low-flow diversion pipes in place for longer periods while vegetation is established, installation of temporary shade structures, storing and covering snowpack along reaches to allow melt water into the system, or retrofitting additional pond features for mixing day and night time flows to lower maximum daily stream temperatures.

For the USACE to issue a permit under Section 404 of the CWA and authorize dredge or fill placement in waters of the United States (WOTUS), all unavoidable impacts to jurisdictional WOTUS must be mitigated. Compensatory mitigation will be completed for impacts to wetlands through a combination of mitigation bank credits in the North Fork Payette subbasin and permittee-responsible on-site mitigation within the SFSR subbasin, plus some additional off-site mitigation outside the SFSR subbasin to account for temporal impacts (Tetra Tech 2023, pp. 2-2 to 2-3).

The proposed action includes activities that will result in permanent impacts to WOTUS including wetlands. Therefore, the applicant will need to have approval for a final Compensatory Mitigation Plan (CMP) prior to proposed action commencement and then implement and maintain the planned wetlands in coordination with the USACE, as part of their CWA 404 permit. Without this permit, work in WOTUS cannot legally commence. A CMP (Tetra Tech 2023, entire) that addresses compensation for lost wetland areas and functions, in addition to addressing mitigation proposed for impacted streams, many of which are also WOTUS, has been provided. The CMP addresses compensatory mitigation for permanent impacts that will be accomplished through a combination of mitigation bank credits and the creation of new wetlands, streams, and enhancing and reclaiming existing wetlands and streams in the general vicinity of the impact areas. The CMP also addresses compensatory mitigation to reduce the temporal loss of aquatic functions and potential risks associated with actions described in the CMP.

The CMP describes a plan to locate the compensatory wetland mitigation sites within the same subbasins as the associated wetland impact sites. Temporal lag between effects on stream functional units and their mitigation will be addressed via off-site stream improvements located in subbasins outside the action area. The proposed compensatory wetland mitigation within the action area subbasin will be located around the mine site area where the majority of wetland impacts will occur, with no mitigation sites proposed along the access roads and the transmission line routes. The current location and configuration of mitigation sites identified in the CMP were selected based on suitable hydrology and compatibility with watershed-scale features and on the likelihood that compensatory mitigation wetlands will be sustainable within five years. At the conclusion of the Forest NEPA process, final wetland impacts will be assessed, any agreed upon off-site compensatory mitigation projects will be finalized, and a final mitigation plan will be prepared, including a final assessment of functional units lost and created, and then the final credits/debits will be documented in the CWA Section 404 permit.

Monitoring associated with implementation of the CMP includes but is not limited to:

- Annual monitoring of stream restoration will be conducted during the low-flow period of the first five years following completion of the restoration actions with the understanding that attainment of performance standards may take a longer monitoring period.
- Following the fifth year of monitoring, a stream functional assessment for restoration design reaches will be completed for comparison to baseline stream functional assessments to determine whether restoration design reaches are functioning appropriately.
- Annual monitoring of wetland restoration areas will be conducted for the first five years following completion of restoration with the understanding that attainment of performance standards, primarily for palustrine forested (PFO) wetlands make take a longer monitoring period.
- Following the fifth year of monitoring, the MWAM will be used to conduct a functional assessment of restored wetlands and the results will be compared to the results of the functions and values assessments performed prior to project construction.
- Annual monitoring reports will be submitted for stream and wetland restoration monitoring results. The first annual monitoring report will include as-built drawings of each stream and wetland restoration project completed describing site condition, topography, and planted areas, site dimensions, and water supply/water control features. Any deviations from the design will be documented. Each annual report will present monitoring results organized into the following sections: Monitoring Requirements and Performance Standards, Summary Data, Maps and Plans, and Conclusions.

Performance standards for water resources include:

- comparison of water quality constituent concentrations to regulatory criteria,
- comparison of predicted water quality constituent concentrations to observed conditions with further action per the project mitigation measures,
- comparison of predicted project effects on groundwater levels and stream flows to observed conditions with further action per the project mitigation measures,
- comparison of predicted stream temperatures to observed conditions with further action per the mitigation measures, and
- functional assessment of restored streams and wetlands compared to CMP targets for functional replacement.

2.2.8.2 Dust Monitoring

In addition to air quality monitoring requirements associated with the IDEQ's Air Quality Permit to Construct, the Forest will require off-site dust monitoring to determine the effectiveness of dust control measures in protecting Forest vegetation and visual resources that include the following:

Monitoring Measure - Fence-Line Dust Control Monitoring Plan Implementation: Because dust emissions from the proposed action may impact air quality, a dust monitoring plan was developed by the applicant, who will be responsible for the implementation of the plan, including installation of dust monitors at two locations near the mine site. One location will be south of the mine site close to the Burntlog Route. The other location will be between the eastern mine site and wilderness areas. The plan will include dust and meteorological monitoring during operations and quarterly reports to the Forest Service; monitoring and reporting will occur during non-winter periods and be implemented prior to commencement of mining.

After five years of monitoring and every three years thereafter, the Forest and the applicant will review this plan to determine if sufficient information was acquired and the monitoring may be removed.

Mitigation Measure – Low-light Limitations on Dust-Emitting Activities: Blasting events that generate dust aside from the regular excavation, haulage, dumping, crushing, and grinding activities will not occur during sunrise and sunset time periods. Performance standards for dust monitoring include comparison of predicted dust emissions to observed conditions with further action per the mitigation measures.

2.2.8.3 Reclamation Monitoring

Prior to reclamation monitoring and maintenance programs, the Forest and IDL will agree to specific quantitative and qualitative reclamation monitoring plans and standards. Reclamation monitoring will begin during concurrent reclamation at facilities. Quantitative and qualitative monitoring of reclamation success will begin the first growing season after concurrent or final reclamation is completed and will continue until success criteria are satisfied. The Reclamation and Closure Plan (Tetra Tech 2021, entire) presents the quantitative and qualitative reclamation monitoring that will be conducted and the performance standards that will be used (with Forest and IDL approval) to determine when maintenance activities are necessary or reclamation is complete. These monitoring requirements are summarized below.

Erosion and Sediment Control Monitoring

Soil stability will be estimated for all reclaimed areas using qualitative descriptors examining soil movement, surface rock, pedestaling, flow patterns, and rilling/gullying. A reclamation specialist will observe each reclaimed area and assign qualitative descriptors. Soil stability monitoring will be completed twice annually for erosion control purposes, once in the spring and once in the fall during the period when reclamation activities are being implemented. Once reclamation activities are completed, soil stability observations will be made as part of performance monitoring after three years and will recur every three years until stabilization objectives have been met. For performance monitoring, the observations will be made at the same time the vegetation success observations are made. The monitoring results will be used to aid in determining the cause of any failures that are encountered and to locate problem areas before erosion becomes widespread enough to affect reclamation success.

Slope Stability Monitoring

Slope stability will be monitored during the erosion observations. Qualified staff will look for signs of slope movement, cut slope and rock face failures, and other indications of slope instability. The location and dimensions of significant surface cracks and fill slope bulges will be monitored. This information will be used to determine if surface cracks are the result of differential settling of fill material or slope instability. The appropriate regulatory agency will be notified, and corrective plans will be developed.

Reclamation Maintenance Procedures

To maintain normal conditions for reclaimed areas per their designs or if the performance of reclaimed areas is not satisfactory, appropriate maintenance activities will be implemented. Maintenance activities may include one or more of the following:

- Sediment removal from sediment basins, stormwater drainage channels, and diversions as necessary to maintain their design capacity;
- Diverting surface water away from reclaimed areas where erosion jeopardizes attainment of reclamation standards;
- Stabilizing rills, gullies, and other erosion features or slope failures that have exposed development rock;
- Noxious weed and invasive plant species control (per Forest approved methods and the 2020 Programmatic Activities biological opinion); and
- Re-seeding or re-applying reclamation treatments in areas where it is determined through monitoring and agency consultation that reclamation will not meet standards.

Annual Report

The applicant will submit an annual report to the Forest and the other federal and state agencies that are responsible for issuing authorizations applicable to reclamation for the preceding calendar year. The annual report will contain descriptions of the reclamation activities completed during the previous year, a summary of areas reclaimed, a discussion of the results of the reclamation monitoring conducted, and corrective actions implemented.

Performance standards for reclamation include:

- physical stability of reclaimed facilities free from erosion features that will affect revegetation and risks for mass slope failures,
- comparison of predicted revegetation of riparian shade areas to observed conditions and the shading effects on stream temperatures with further action per the project mitigation measures, and
- achievement of 70% of the pre-existing vegetation cover for general revegetation areas (i.e., areas not associated with the establishment of riparian shading to achieve target stream temperatures).

2.3 Term of the Action

The proposed action will take place over approximately 20 to 25 years, not including the long-term, post-closure environmental monitoring or potential long-term water treatment. The proposed action start date is unknown at this time as it is subject to Federal and State decisions plus the resolution of any objections, protests, or litigation that would stay the start of construction.

The phases of the proposed action include: (1) construction (approximately 3 years; Mine Years -3 through -1); (2) mining and ore processing operations (approximately 15 years; Mine Years 1 through 15); (3) surface and underground exploration (approximately 17 years, beginning during construction and continuing concurrent with operations; Mine Years -2 through 15); and (4) closure and reclamation (Mine Year 16+). Most activities in the closure and reclamation period will be completed within five years. However, closure water management and water treatment are expected to continue for as long as 25 years (Mine Years 16 through 40; (Perpetua 2021c, p. 3-78). The environmental monitoring phase will continue for as long as needed to demonstrate that the site has been fully reclaimed. Figure 7 provides an illustration of the timing of construction and operations activities and the initiation of the closure phase.

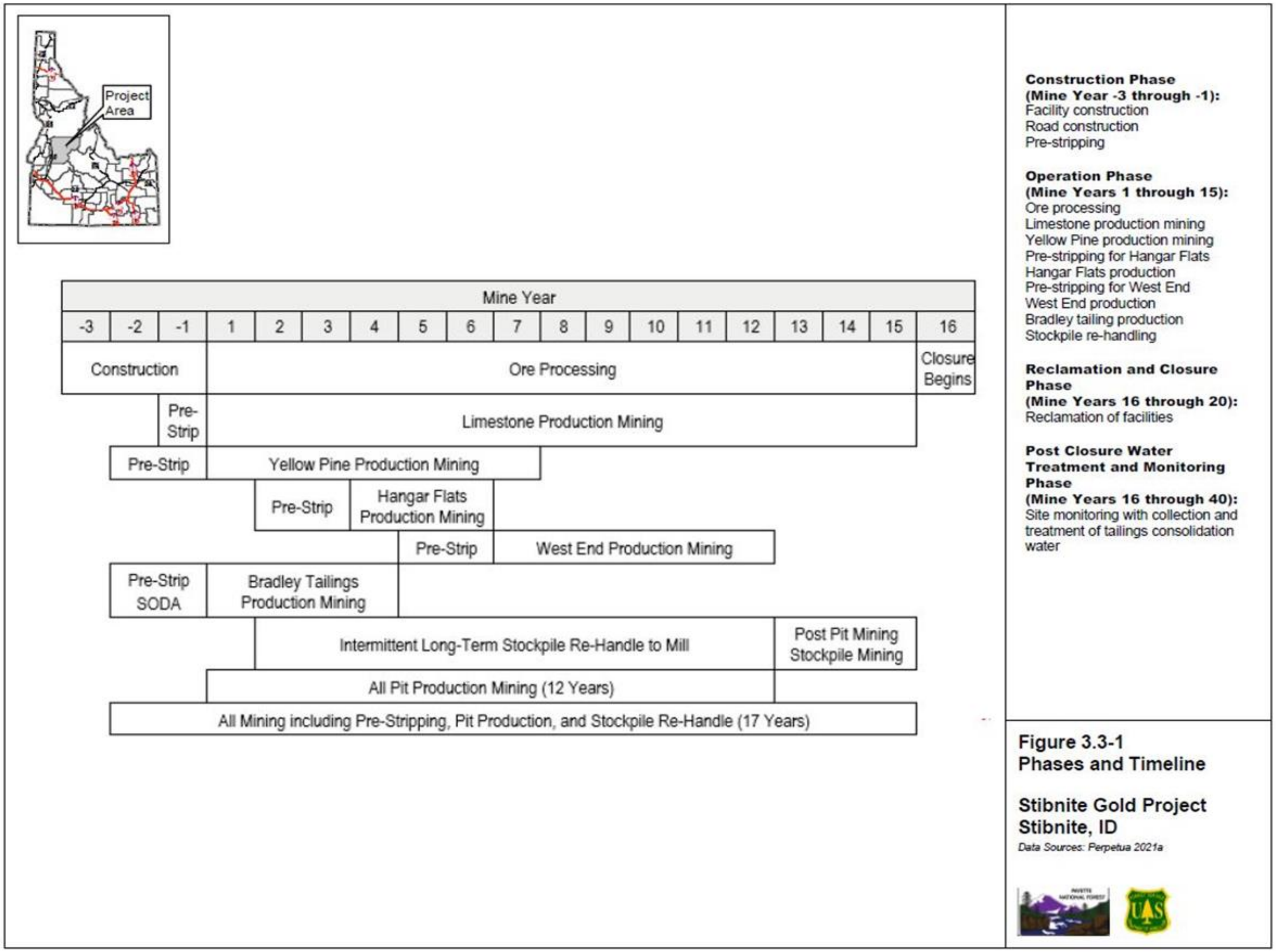

Figure 7. Proposed action phases and timeline (USFS 2024, Figure 3.3-1).

2.4 Proposed Conservation Measures

The Forest has identified specific measures to reduce the degree of impact from the proposed action to bull trout, bull trout critical habitat, North American wolverine, and whitebark pine. The Service considers these measures essential to limit impacts to bull trout, bull trout critical habitat, North American wolverine, and whitebark pine. If any of these measures are not implemented, there may be effects of the action that were not considered in this Opinion and reinitiation of consultation may be required.

The proposed action must comply with all laws and regulations that apply to the proposed activities with prominent requirements relative to the affects analysis and guidelines in the Payette Forest Plan and Boise Forest Plan and (USFS 2003, entire; 2010, entire) that are designed to reduce or prevent impacts resulting from proposed management activities are incorporated into the proposed action by reference. In addition, best management practices outlined in the Best Management Practices for Mining in Idaho (IDL 1992, entire) will be implemented where appropriate and applicable for operations to minimize site disturbance from mining and drilling activities. Based on the application of permits and regulatory compliance requirements to the proposed action, regulatory requirements, standards and guidelines, best management practices, and permit conditions will be followed.

In the design of the proposed action, many of the environmental impacts that may be caused by the proposed action have been considered. This led to an evaluation of project design features and operational characteristics that may avoid or minimize potential environmental impacts of the proposed action and are referred to as environmental design features (EDFs).

A full list of EDFs, regulatory and Forest Plan requirements, and other measures are found in the Assessment (USFS 2024, Appendix B, Table 3.9-1, Table 3.9-2, Table 3.9-3). The EDFs include, but are not limited to:

- To address stream temperature, riparian planting widths along restored and enhanced stream reaches will be 18 feet wide on each stream bank where possible.
- During mine operations, summer low flows in perennial diversion channels around the TSF impoundment and buttress (Meadow Creek), YPP (Hennessy Creek and EFSFSR tunnel), and West End pit (West End Creek) will be piped underground to maintain cold stream temperatures.
- In fish-bearing waters, intake hoses shall be screened with the most appropriate mesh size (generally 3/32 of an inch), or in compliance with NMFS guidelines.
- Required setbacks for blasting are set to meet maximum overpressure and maximum peak particle velocity and that a 239-ft blasting setback on 20-ft benches and 419 ft on 40-ft benches from the closest point the blast field to stream and lake habitats should be protective.
- To protect fish, a standard procedure for channel segment isolation, dewatering, fish salvage, and fish relocation to appropriate receiving streams during dewatering or maintenance of natural stream and diversion channels, will be based on the USFWS Recommended Fish Exclusion, Capture, Handling, and Electroshocking Protocols and

Standards (USFWS 2012b, entire) and NMFS (2000, entire) Guidelines for Electrofishing Waters Containing Salmonids Listed Under the Endangered Species Act.

- Adjustments will be made on a temporary basis to construction and operations based on a Canada lynx or wolverine sighting location.
- Winter recreation use in high-elevation habitats characteristic of wolverine denning habitat will be monitored periodically. Where practicable, monitoring will be done in cooperation with State fish and game agencies.
- Sound dampening and muffling equipment will be utilized to minimize noise from equipment and facilities. When possible, high noise activities will be scheduled at the same time. Equipment will be monitored and maintained to reduce noise related impacts.
- If a wolverine is observed within or near the action area, the Forest and the Service will be notified immediately, and coordination will occur regarding modifications to construction and operation activities to avoid potential disruption of wolverine denning activities.
- Off road use and construction of new or temporary roads in wolverine habitat will be limited.
- New or temporary roads will be marked off limits to non-authorized motorized access to reduce traffic and increased access in wolverine habitat.
- For exploratory drilling activities, from January 15 to May 15, a 1-mile no-disturbance buffer will be implemented around denning habitat as modeled using the persistent snow cover layer described in (Copeland et al. 2010, entire).
- Pre-construction surveys will be conducted within whitebark pine modeled suitable habitat that overlaps proposed action components and along the entirety of the Burntlog Route. Surveys will also be conducted in unsurveyed areas (e.g., not included in Tetra Tech's 2019 survey effort) and in occupied habitat to identify whitebark pine individuals within the disturbance footprint and estimate the number of individuals within 300 feet of the planned disturbance footprint. Surveys will make note of mature (greater than 4-inch diameter at breast height [DBH]) and cone-producing "plus" trees.
- In areas known to be occupied by whitebark pine, dust management strategies will avoid the use of dust suppressants known to have negative effects on conifers. Water or conifer-safe dust suppression chemicals will be used to control dust (if necessary) in these areas.
- To protect from accidental removal or damage, all identifiable whitebark pine trees, particularly mature, healthy trees in a disturbance area will be marked either individually or collectively by stand perimeter marking and buffered by 33 feet, in a manner that does not cause damage to the tree or introduce disease, regardless of their age class (seedling, sapling, and mature trees).

2.4.1 Agency Requirements

An Interested Agency Review Board (Board) will be formed to provide oversight for the proposed action's environmental-related activities including adaptive management. The Board will consist of all permitting agencies including IDEQ, IDWR, NMFS, USFWS, EPA, Valley County, and the Forest.

Member agencies on the Board will have access to proposed action design reports, proposed action as-built drawings, monitoring reports, model updates required by mitigation measures, and any environmental action plans. These agencies can also provide input where appropriate on proposed action documentation. Specific construction stage documentation subject to Board review upon their completion include construction design of the water treatment plants, tailings storage facility, processing plant facility components, the Burntlog Route, the fish tunnel, and the EFSFSR water intake; the final Stormwater Pollution Prevention Plan; the final CMP; monitoring and mitigation plans under the EMMP (including adaptive management); and engineering as-builts for completed facilities.

2.4.2 Stibnite Gold Mitigation Plan

The EDFs are impact avoidance and minimization up front or as part of operations. The potential impacts of the proposed action remaining after applying the avoidance and minimization measures were addressed on a resource basis by further specific resource mitigation plans including: Stibnite Gold EMMP (Brown and Caldwell 2021b, entire); Fisheries and Aquatic Resources Mitigation Plan (Brown and Caldwell, Rio ASE, and BioAnalysts 2021, entire); Fishway Operations and Management Plan (Brown and Caldwell, McMillen Jacobs, and BioAnalysts 2021, entire), Compensatory Mitigation Plan (Tetra Tech 2023, entire); Snow Avalanche Hazard Assessment for Access Roads (DAC 2021, entire); Development Rock Management Plan (Brown and Caldwell 2022, entire); Environmental Legacy Management Plan (Perpetua 2021a, entire); Reclamation Closure Plan (Tetra Tech 2021, entire); Transportation Management Plan (Perpetua 2022a, entire); Water Management Plan (Brown and Caldwell 2021e, entire); Water Resources Monitoring Plan (Brown and Caldwell 2021d, entire); and 404 permit application including a draft CMP (Perpetua 2023, entire).

All Forest and USACE requirements and mitigation commitments are in the current draft EMMP (Brown and Caldwell 2021b, entire). This EMMP consists of a program framework and appendices containing component monitoring and management plans. The EMMP will guide monitoring, document permit compliance, implement impact reduction procedures, and address adaptive management thresholds and responses where impacts and mitigation effectiveness carry substantial uncertainty.

2.4.2.1 Fisheries and Aquatic Resources Mitigation Plan (FMP)

The FMP (Brown and Caldwell, Rio ASE, and BioAnalysts 2021, entire) describes the measures to minimize adverse impacts on fisheries and aquatic resources, with particular attention to ESA-listed fish species and their designated critical habitat. The FMP actions will begin during construction and continue throughout mine operations and into closure and reclamation. The FMP includes water quality protection; fish protection, salvage, and relocation during diversions and dewatering activities; a process of protection and salvage for draining of the YPP; measures to avoid impacts during blasting; monitoring streamflow; restoring passage in stream channels with fish passage impediments; and monitoring of fish and aquatic biota.

2.4.2.2 Fishway Operations and Management Plan

A fishway is proposed for safe upstream and downstream passage of anadromous and migratory fish in the EFSFSR during construction and mine operations, to be part of the tunnel that diverts the EFSFSR around the YPP. The fishway operations and management plan (FOMP; Brown and Caldwell, McMillen Jacobs, and BioAnalysts 2021, entire) outlines the operation of the fishway and monitoring for effective fish passage, as well as an adaptive approach to provide for fish trap and haul operations as an alternative, using the same facilities consistent with the 2022 NOAA guidelines for fish passage (NMFS 2022b, entire). Fish protection measures for the EFSFSR tunnel and YPP dewatering are outlined as well, such as a temporary fish barrier downstream of the YPP during tunnel construction, carefully sequenced dewatering of the YPP, and start of fishway operations.

Measures to avoid and minimize impacts to fish habitat are detailed in the FMP and FOMP and include, but are not limited to, the following measures:

- Water quality protection: Measures designed on managing contact and non-contact water to maintain and improve water quality while supplying sufficient water for mining and ore processing. Diversions, ditches, and other mine facilities will be lined and/or water collected and treated to protect water quality. Riparian corridors will be restored and enhanced, and certain diversions piped, to reduce stream temperatures. Water treatment will continue during both operations and the post-closure phase.
- Fish protection, salvage, and relocation during dewatering and diversions: Measures for screening or excluding of fish from diversion channels, water withdrawals, low-flow pipes, and the YPP dewatering to exclude and protect fish. During diversions and dewatering activities in fish bearing streams, fish handling and salvage protection measures have been identified to safely isolate, collect, handle, and transport the fish.
- Instream work windows have been established to protect spawning and incubation. The instream work window is from May 1 to August 1, providing no incubating eggs (i.e., redds) within the construction area. If incubating eggs are present, the work window will be from June 15 to August 1. September 15 to April 30 could be an alternate work window that will avoid spawning adults and minimize impacts to juveniles if there is no documented spawning and, therefore, no incubation occurring in the affected stream section.
- Trap and haul protocols at the fishway (if needed): The primary goal is operating and maintaining the EFSFSR fishway during construction and operations and later in the mine life by restoring the EFSFSR stream channel over the backfilled YPP to provide permanent, volitional upstream and downstream fish passage and access to important stream habitats of the upper EFSFSR and portions of Meadow Creek. If fish are not able to use the fishway during any period, trap and haul procedures have been developed to safely collect, handle, and move fish upstream of the fishway.
- Avoidance measures during blasting activities: Measures to largely avoid or minimize the potential effects from blasting activities using appropriate setback distances from aquatic habitats to limit blast-related air overpressure and ground vibrations to harmless levels. Other additional blasting techniques can also be used to reduce these levels, and BMPs

and site-specific modification of methods can further minimize or prevent damage to fish and the aquatic environment.

- Monitoring streamflow: Activities for maintaining, to the extent practicable, appropriate streamflows and streamflow monitoring in natural or restored channels where fish are present.
- Stream restoration and enhancement: Design elements for stream restoration and enhancement based on natural channel design principles intended to restore permanent fish passage at YPP, improve fish habitat site-wide for spawning and rearing salmonids, and provide a net ecological benefit relative to current conditions.
- Restoring passage in stream channels: Removing existing passage barriers within the mine site to allow for fish movement between streams and areas of the mine site where access is currently blocked or impeded within the proposed action footprint as well as along the Burntlog Route.
- Monitoring fish and aquatic biota: Provide the data necessary to evaluate how the various mitigation and protection measures are implemented and to assess the status and trends and ongoing effectiveness.
- When diverting and restoring stream channels, cofferdams will isolate portions of the stream channel slated for restoration within the existing ordinary high-water mark to keep water and fish out of the new channel until construction is completed. Once the new channel is completed (including prewashing the substrate), water will be slowly reintroduced into the new channel (one-third of the flow initially), with seine block nets keeping fish from entering the new channel. Seine block nets will be placed in the upstream end of the original channel, which will then be electrofished to remove all fish before all flow can be rerouted into the new channel. Any fish captured will be moved upstream of the seine block net. Once the original channel is cleared, two-thirds of the flow will be released into the new channel, and then ultimately all flow will be released into the new channel and the seine block net to the new channel removed. The original channel will be permanently blocked from the new channel and then filled with clean native alluvium as the new floodplain. Steps for isolating the stream channel include:
    - Temporary cofferdams will be placed between the actively flowing river surface water and all active work areas. Temporary cofferdams may be placed at additional locations to achieve required water quality standards, or to simplify construction determined by the contractor.
    - Fill material for bulk bags or ‘super sacks”, if used, will be clean, washed, and rounded material similar in gradation to existing channel substrate, and not contain fines. Material must be approved before use.
    - Cofferdams and diversion dams will be built in a manner to meet turbidity limits as defined in the project specifications. Use of gravel and soil to build a pushup type cofferdam or flow diversion dam are acceptable at all locations not connected to surface water flow but will not be allowed in the actively flowing channel.

- When reintroducing water to dewatered areas and newly constructed channels, a staged rewatering plan will be applied. The following will be applied to all rewatering efforts:
    - Turbidity monitoring protocol will be applied to rewatering effort.
    - The area will be pre-washed before rewatering. Turbid wash water will be detained and pumped to the floodplain or sediment capture areas rather than discharging to fish-bearing channels.
    - Seine nets will be installed at upstream end to prevent fish from moving from downstream until 2/3 of the total flow is restored to the channel.
    - Starting in early morning, 1/3 of new channel flow will be introduced over a period of 1 to 2 hours.
    - The second third of flow will be introduced over the next 1 to 2 hours and fish salvage of bypass channel will begin if fish are present.
    - Upstream seine nets will be removed once 2/3 flow in rewatered channel and downstream turbidity is within acceptable range (less than 40 nephelometric turbidity unit (NTU) or less than 10% of the background condition).
    - The final third of flow will be introduced once fish salvage efforts are complete, and downstream turbidity verified to be within acceptable range.
    - A plug will be installed to block flow into old channel.
    - The same steps will be followed when rewatering the mainstem.
- Turbidity monitoring will include:
    - Turbidity reading, location, and time will be recorded for background reading approximately 100 ft upstream from the project area using a recently calibrated turbidimeter or via visual observation.
    - The turbidity reading, location, and time will be recorded at the measure compliance location point.
        - 50 ft downstream for streams less than 30 ft wide
        - 100 ft downstream for streams between 30 and 100 ft wide
        - 200 ft downstream for streams greater than 100 ft wide
    - Turbidity will be measured (background location and compliance point) ever 4 hours while work is being implemented.
    - If exceedances occur for more than two consecutive monitoring intervals (after 8 hours), the activity will stop until the turbidity level returns to background. The Offices of Species Conservation will be notified for all exceedances and corrective actions at project completion.
    - If turbidity controls (cofferdams, wattles, fencing, etc.) are determined ineffective, crews will be mobilized to modify, as necessary. Occurrences will be documented in the project daily reports.

3. Analytical Framework

3.1 Jeopardy Determination

In accordance with our regulations (50 CFR 402.02, 402.14(g)), the jeopardy analysis in this Opinion relies on the following four components:

1. The *Status of the Species* evaluates the species' current rangewide condition relative to its reproduction, numbers, and distribution; the factors responsible for that condition; its survival and recovery needs; and explains if the species' current rangewide population retains sufficient abundance, distribution, and diversity to persist and retains the potential for recovery (Endangered Species Consultation Handbook, March 1998, pp. 4-33 to 4-37).

2. The *Environmental Baseline* section evaluates the past and current condition of the species in the action area relative to its reproduction, numbers, and distribution absent the effects of the proposed action; including the anticipated condition contemporaneous to the term of the proposed action; the factors responsible for that condition; and the relationship of the action area to the survival and recovery of the species.

3. The *Effects of the Action* section evaluates all consequences to the species that are reasonably certain to be caused by the proposed action, including the consequences of other activities that are caused by the proposed action (i.e., the consequences would not occur but for the proposed action and are reasonably certain to occur) and how those consequences are likely to influence the survival and recovery of the species.

4. The *Cumulative Effects* section evaluates the consequences of future State or private activities, not including Federal activities, reasonably certain to occur in the action area of the Federal action subject to consultation, on the species and its habitat, and how those effects are likely to influence the survival and recovery of the species.

In accordance with policy and regulation, the jeopardy determination is made by formulating the Service's opinion as to whether the proposed Federal action, including its consequences, taken together with the status of the species, environmental baseline, and cumulative effects, reasonably would be expected to reduce appreciably the likelihood of both the survival and recovery of the species in the wild by reducing the reproduction, numbers, or distribution of that species.

Interim recovery units were defined in the final listing rule for bull trout for use in completing jeopardy analyses (64 FR 58910, November 1, 1999). Subsequently, six recovery units (RUs) for the bull trout were defined in the final Recovery Plan for the Coterminous United States Population of Bull Trout (USFWS 2015a, entire). Pursuant to Service policy (USFWS 2006, *in litt.*), when a proposed Federal action impairs or precludes the capacity of a RU from providing both the survival and recovery function assigned to it, that action may represent jeopardy to the species. When using this type of analysis, the biological opinion describes how the proposed action affects not only the capability of the RU, but the relationship of the RU to both the survival and recovery of the listed species as a whole.

3.2 Destruction/Adverse Modification Determination

In accordance with regulations and regional implementation guidance, the destruction or adverse modification analysis in this biological opinion relies on the following four components:

1. The *Status of Critical Habitat* section evaluates the rangewide condition of the critical habitat (CH) in terms essential habitat features, primary constituent elements, or physical and biological features that provide for the conservation of the listed species; the factors responsible for that condition; and the intended value of the CH for the conservation of the listed species.

2. The *Environmental Baseline* section analyzes the past and current condition of the CH in the action area absent the effects of the proposed action; including the anticipated condition of the species and its CH contemporaneous to the term of the proposed action; the factors responsible for that condition; and the conservation value of the CH in the action area for the conservation of the species.

3. The *Effects of the Action* section evaluates all consequences to CH that are reasonably certain to be caused by the proposed action (i.e., the consequences would not occur but for the proposed action and are reasonably certain to occur) and how those consequences are likely to influence the conservation value of the affected CH for the species in the action area.

4. The *Cumulative Effects* section evaluates the effects to CH of future State or private activities, not including Federal activities, reasonably certain to occur in the action area of the Federal action subject to consultation, and how those effects are likely to influence the conservation value of the affected CH for the species in the action area.

In accordance with regulation, the destruction or adverse modification determination is made by formulating the Service's opinion as to whether the proposed Federal action, taken together with the status of the critical habitat, environmental baseline, and cumulative effects, reasonably would be expected to result in a direct or indirect alteration that appreciably diminishes the value of CH for the conservation of the species.

4. BULL TROUT

4.1 Status of Bull Trout

This section presents information about the regulatory, biological, and ecological status of bull trout at a range-wide scale that provides context for evaluating the significance of probable effects caused by the proposed action.

The bull trout was listed as a threatened species in the coterminous United States in 1999 (64 FR 58910-58933; USFWS 1999). Throughout its range, bull trout are threatened by the combined effects of habitat degradation, fragmentation, and alterations associated with dewatering, road construction and maintenance, mining, inappropriate livestock grazing, blockage of migratory corridors by dams or other diversion structures, poor water quality, incidental angler harvest, entrainment, and introduced non-native species. Livestock grazing can coexist with bull trout conservation when implemented and managed to meet upland and riparian health goals. When upland and riparian health is degraded and the causal factors include livestock grazing we may refer to it as inappropriate livestock grazing. Throughout this document when we denote livestock grazing in association with threats to bull trout, we are referring to inappropriate livestock grazing. Since the listing of bull trout, there has been very little change in the general distribution of bull trout in the coterminous United States, and we are not aware that any known, occupied bull trout core areas have been extirpated (USFWS 2015a, p. iii).

The 2015 recovery plan for bull trout identifies six proposed RUs within the listed range of the species (USFWS 2015a, entire). Each of the RUs are further organized into multiple bull trout core areas, which are mapped as non-overlapping watershed-based polygons, and each core area includes one or more local populations. Within the coterminous United States we currently recognize 109 occupied core areas, which comprise 600 or more local populations of bull trout (USFWS 2015a, entire). Core areas are functionally similar to bull trout metapopulations, in that bull trout within a core area are much more likely to interact, both spatially and temporally, than are bull trout from separate core areas.

The Service has also identified a number of marine or mainstem riverine habitat areas outside of bull trout core areas that provide foraging, migration, and overwintering (FMO) habitat that may be shared by bull trout originating from multiple core areas. These shared FMO areas support the viability of bull trout populations by contributing to successful overwintering survival and dispersal among core areas (USFWS 2015a, entire).

For a detailed account of bull trout biology, life history, threats, demography, and conservation needs, refer to Appendix A: Status of the Species.

4.2 Environmental Baseline of the Action Area

The term “environmental baseline” is defined in the regulations implementing the Act as “the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The impacts to listed species or designated critical habitat from Federal agency activities or existing Federal agency facilities that are not within the agency’s discretion to modify are part of the environmental baseline” (50 CFR 402.02).

4.2.1 Status of Bull Trout in the Action Area

Upper Snake Recovery Unit

The action area is in the Upper Snake Recovery Unit (RU), which is located in central Idaho, northern Nevada, and eastern Oregon. The Upper Snake RU is divided into seven geographic regions: Salmon River, Boise River, Payette River, Little Lost River, Malheur River, Jarbidge River, and Weiser River (USFWS 2015b, p. E-1). This RU contains 22 core areas and 206 local populations (USFWS 2015b p. E-1). The current condition of the bull trout in this RU reflects the adverse effects of climate change, dams, mining, forest management practices, nonnative species, and agriculture (e.g., water diversions, grazing; USFWS 2015b, pp. E-12 to E-18). Conservation measures implemented for this RU include in-stream habitat restoration, in-stream flow requirements, screening of irrigation diversions, and riparian restoration (USFWS 2015b, pp. E-19 to E-20).

The proposed action is located in the Salmon River geographic region. Over 70% of occupied habitat in the Upper Snake RU occurs in the Salmon River basin, as well as 123 of the 206 local populations and 10 of the 22 core areas. Connectivity within Salmon River basin core areas is mostly intact except for the Pahsimeroi River and portions of the Lemhi River where diversions and subsurface flows impact bull trout migration by reducing or eliminating flows in the mainstem river. The Upper Salmon River, Lake Creek, and Opal Lake core areas contain adfluvial populations of bull trout, while most of the remaining core areas contain fluvial populations; the Pahsimeroi contains only resident populations of bull trout. Most core areas appear to have increasing or stable trends, but trends are not known in the Pahsimeroi, Lake Creek, or Opal Lake core areas (USFWS 2015b, p. E-2).

South Fork Salmon River Core Area

The South Fork Salmon River core area occurs in Valley and Idaho counties and enters the mainstem Salmon River east of French Creek and extends south to its headwaters upstream of Warm Lake. The ridges that form the eastern boundary of this relatively narrow, north-south oriented area lie in the headwaters of the Middle Fork Salmon River and Big Creek. The western boundary is the divide between the upper North Fork Payette River and the South Fork Salmon River. The core area is 338,100 acres, and the Forest manages 99% of the land (USFWS 2015b, p. E-89).

In the South Fork Salmon River core area, bull trout are currently known to use spawning and rearing (SR) habitat in streams comprising 27 local populations, including the Upper East Fork South Fork Salmon River (EFSFSR) local population that encompasses the mine site. The Service (2015b, p. E-15, Table E-3) identified no primary threats in the South Fork Salmon River core area; however, other threats include connectivity impairment, habitat degradation, and brook trout (USFWS 2015b, p. E-89). The IDFG data indicate an increasing population trend for this core area (Meyer et al. 2014, p. 207, Table 2).

Lemhi River Core Area

The Lemhi River core area is in Lemhi County. This core area includes the Lemhi River and is bordered by the rugged Bitterroot Range of the Beaverhead Mountains to the north and east and the Lemhi Mountain Range to the west. The core area is 808,670 acres with federally-managed land divided equally between the Forest (40%) and the Bureau of Land Management (39%); 19% is privately managed (USFWS 2015b, p. E-93).

Bull trout are currently known to use SR habitat in at least six streams or stream complexes (i.e., local populations). These local populations include Hayden Creek, Pattee Creek, Upper Lemhi River, Geertson Creek, Kenny Creek, and Bohannon Creek. Most bull trout are found in isolated resident populations, but the mainstem Lemhi River contains fluvial bull trout. Connectivity between the tributaries and the Lemhi River is reduced because of migration barriers. Hayden Creek has year-round connectivity to the Lemhi River and contains a fluvial population (USFWS 2015b, p. E-93). The Service (2015b, p. E-93) identified no primary threats in the Lemhi River core area; however, other threats include connectivity impairment and habitat degradation. The IDFG data indicate an increasing population trend for this core area (Meyer et al. 2014, p. 207, Table 2).

Action Area

The action area includes the Stibnite mine operations (i.e., the Stibnite project area, defined as the watersheds impacted by the proposed mine operations [Figure 1]), and the Lemhi River restoration project (Lemhi restoration project area). Because bull trout do not occur in Big Creek and Hargrave Creek, the proposed culvert replacements in these creeks are not included in the action area.

The action area includes streams that support bull trout in the South Fork Salmon River core area (Figure 1). The majority of effects from the proposed action will occur in the subwatersheds associated with streams along the Burntlog Route, Johnson Creek Route, and within the mine site area, as shown in Figure 1.

Bull trout are currently known to use spawning and rearing habitat in at least 27 streams or stream complexes (local populations) within the SFSR core area, including Burntlog Creek, Trapper Creek/Lake, Riordan Lake, Upper EFSFSR, Sugar Creek, Tamarack Creek, and Profile Creek (USFWS 2015b, p. E-89), and these local populations are the ones that may be affected. Tamarack Creek and Profile Creek will not be impacted by the proposed action because they are not located within the Stibnite project area.

<u>Stibnite Project Area</u>

Burnt Log Creek, Trapper Creek, and Riordan Creek/Lake

Johnson Creek from its confluence with the EFSFSR upstream 28.7 mi to Rock Creek provides feeding, migration, and overwintering (FMO) habitat. Burntlog Creek from its confluence with Johnson Creek upstream 14.1 mi to its headwaters provides SR habitat. Trapper Creek from its confluence with Johnson Creek upstream 9.0 mi to its headwaters provides SR habitat. Riordan Creek from its confluence with Johnson Creek upstream 2.7 mi to potential passage barriers contains FMO habitat; Riordan Creek from the potential barriers upstream 2.0 mi to Riordan Lake outlet provides spawning and rearing habitat; Riordan Lake (73.1 acres) contains FMO habitat; and Riordan Creek from Riordan Lake inlet upstream 4.1 mi to its headwaters provides SR habitat (USFWS 2010, pp. 681–682).

There are bull trout eDNA detections in Burntlog Creek and its tributaries, Trapper Creek, Riordan Creek, and Johnson Creek, although no estimate has been made of population size in these waters. Data from field collections by the BNF have shown that up to 200 bull trout have been observed at any given site, but most samples showed less than 20 individuals. Multiple life stages of bull trout have been observed in these local population watersheds (USFS 2024, p. Appendix C-1).

Upper EFSFSR

Bull trout occur throughout the EFSFSR and above, below, and in YPP. The upper EFSFSR subwatershed is considered a priority subwatershed to the Forest's Aquatic Conservation Strategy (ACS). The ACS is intended to provide guidance towards long-term maintenance and restoration of characteristics found in healthy, functioning watersheds, riparian areas, and associated fish habitat (USFS 2024, p. 248). Burns et al. (2005, pp. 21–23) summarized the assessment of bull trout across the Forest and concluded this species has high viability in the EFSFSR because of high connectivity among stream areas, the availability of suitable habitat, and the presence of fluvial and adfluvial migrants.

Previous work has documented upstream migrations of bull trout into the EFSFSR and some of its tributaries during early summer, spawning during August through September, then downstream migrations to the lower EFSFSR, South Fork Salmon River, or Salmon River where fish remain until the start of migration in early summer the following year. This fluvial life history appears to be the dominant pattern in bull trout in the EFSFSR. Hogen and Scarnecchia (2006, p. 376) reported that 50 of 62 bull trout radio-tagged in the EFSFSR and immediate surrounding waters demonstrated this fluvial life history pattern. They also report that all tagged fish demonstrating migration-related movements traveled into the EFSFSR, and not into Johnson Creek (a major tributary to the EFSFSR), confirming the importance of the EFSFSR for bull trout in the action area (Hogen and Scarnecchia 2006, pp. 380, 385).

Although most of bull trout in the EFSFSR appear to have a fluvial life history pattern, YPP supports at least a small population of bull trout that demonstrate an adfluvial life-history pattern. Hogen and Scarnecchia (2006, p. 376) reported that 5 of the 62 radio-tagged fish (8.1%) were initially located in the lake, migrated downstream in June, traveled into and spawned within tributaries to the EFSFSR in late summer, and then returned to YPP in the fall where they remained through the winter. The YPP cascade barrier blocks upstream passage of fluvial bull trout. Bull trout in the EFSFSR upstream from the YPP cascade barrier are resident fish.

Mark-recapture studies were undertaken at the YPP lake in 2018 and 2019 to evaluate movements of salmonids and to estimate population abundances (Brown and Caldwell 2019, entire; 2020, entire). Abundance estimates for bull trout in 2018 were made in May at 57 individuals; July at 104 individuals; and September at 82 individuals. The 2019 abundance estimates were made in July at 104 individuals; August at 45 individuals; and September at 47 individuals (Brown and Caldwell 2020b, p. 4-2, Table 4-4).

In the Upper EFSFSR local population, spawning and early rearing habitat is found in the EFSFSR and Meadow Creek. The MWH (2017, p. Appendix 6) reports that snorkel surveys conducted at the locations shown in Figure 8 (MWH 2017, Figure 3-6) and summarized in Table *15* show that bull trout were observed in the EFSFSR below YPP and in upper Meadow Creek, but not in the reaches above the YPP. However, the Rangewide Bull Trout eDNA Project (Young et al. 2017, entire) collected positive eDNA samples in the EFSFSR above YPP from the confluence with Fiddle Creek upstream to above the confluence with Meadow Creek and in Meadow Creek as well (Figure 9; Young et al. 2017, entire). Also, USFS (2024, p. 296) reports that all life stages are present in the EFSFSR both above and below the YPP, indicating that successful reproduction is occurring in these areas. Because bull trout were not observed during snorkel surveys in the EFSFSR above the YPP, there are no density estimates for these reaches.

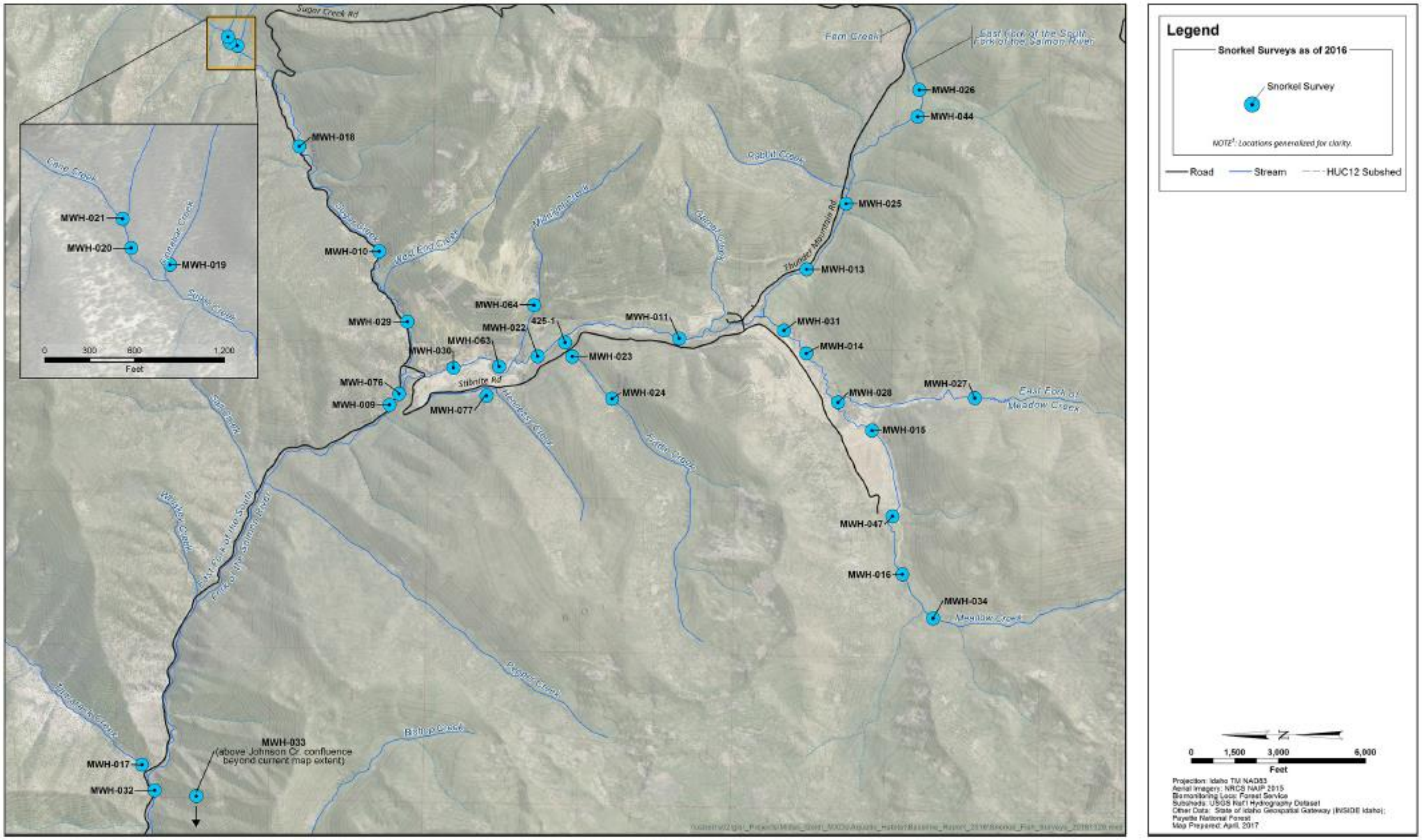

Figure 8. Snorkel survey sites established during all survey years (MHW 2017, Figure 3-6).

Table 15. Snorkel survey results for bull trout from 2012 to 2014 in the action area (adapted from MHW 2017, Appendix 6).

MWHSite ID#		**MeadowCreek**			**EF Meadow Creek**	**EFSFSR**				
		031	**014**	**015**	**028**	**013**	**011**	**022**	**030**	**009**
Bull Trout	2012	1	NS	6	0	0	0	0	7	4
	2013	NS	0	0	0	0	0	0	5	NS
	2014	NS	0	0	0	0	0	0	8	22

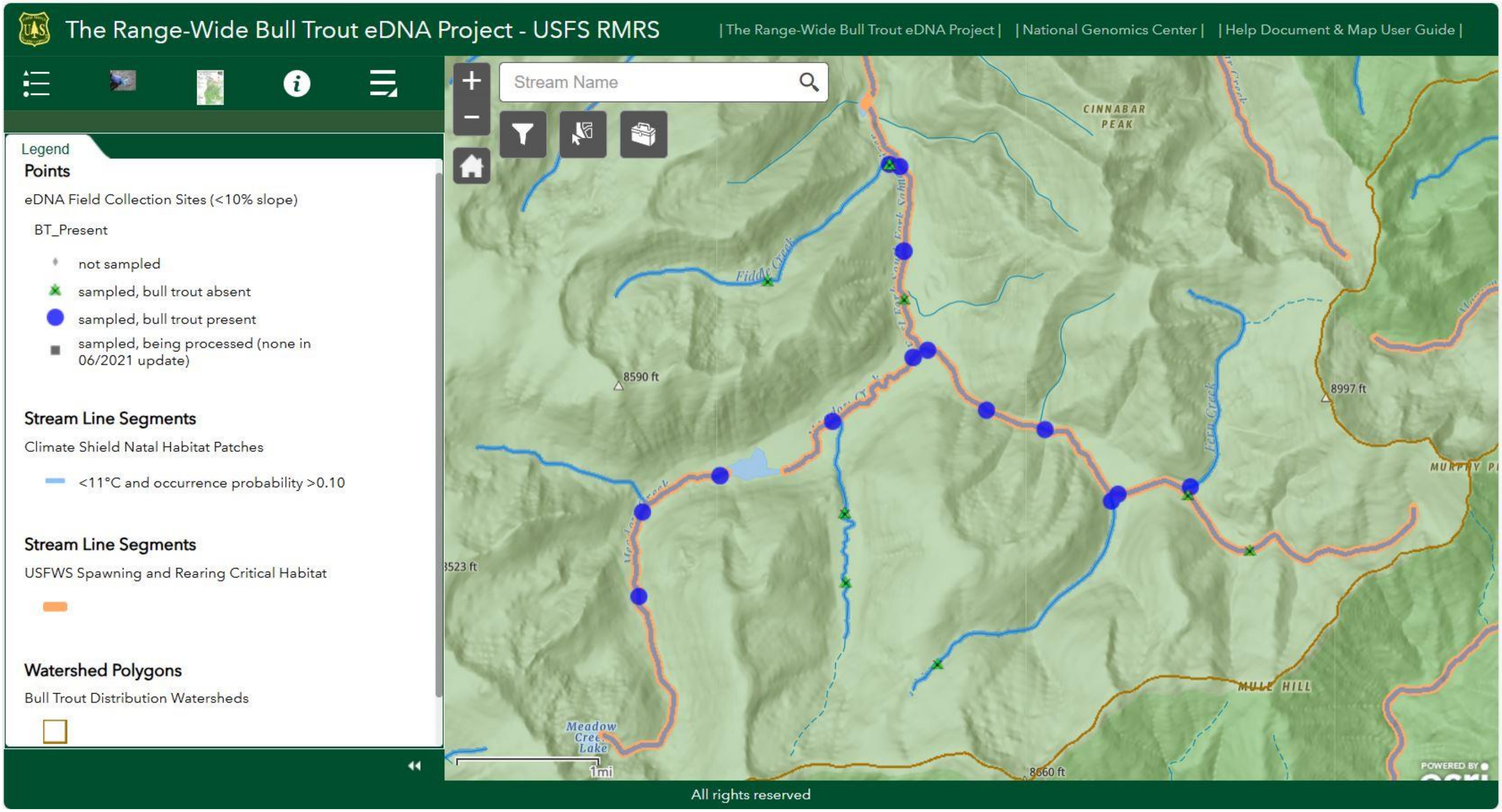

Figure 9. Bull trout eDNA detections in the EFSFSR above the YPP (Young et al. 2017, entire).

Sugar Creek

Sugar Creek from its confluence with East Fork South Fork Salmon River upstream 7.1 mi to its headwaters provides SR habitat for bull trout, as does an unnamed tributary and Cinnabar and Cane Creeks (USFWS 2010, p. 681). Bull trout densities in these streams are shown in Table 16.

Table 16. Adjusted bull trout areal and linear densities at snorkel survey sites within Sugar Creek and tributaries from 2012 to 2015 (USFS 2024, Table 4.1-6).

Site ID (Downstream to Upstream)	Stream	Year(s) Sampled	Mean Site Length (m) / Width (m)	Mean Density (fish/m^2) / Mean Linear Density (fish/m)
MWH-029	Sugar Creek	2012-2014	97 / 5.5	0.029 / 0.162
MWH-010	Sugar Creek	2012-2014	97 / 5.5	0.048 / 0.260
MWH-018	Sugar Creek	2012-2015	95.2 / 5.1	0.046 / 0.234
MWH-020	Sugar Creek	2012-2013	95.5 / 3.6	0.080 / 0.238
MWH-019	Cinnabar Creek	2012-2015	93 / 2.8	0.095 / 0.236
MWH-021	Cane Creek	2012-2013	55.5 / 3.0	0.107 / 0.316

Lemhi Restoration Project Area

The Lemhi restoration project area includes the Lemhi River about 12 mi downstream from Leodore, Idaho, along State Route 28, including the river and its riparian area from the top of the restoration site to approximately 100 m downstream (Figure 2). The area covers the river, the riparian area, and the floodplain areas on the north side of the Lemhi River (IDEQ ID17060204SL024_05).

Lemhi River from its confluence with the Salmon River upstream 57.1 mi to the confluence of Texas Creek and Eighteenmile Creek provides FMO habitat (USFWS 2010, pp. 767–768). The restoration project is located approximately 8 mi upstream from the confluence of Hayden Creek, which contains the Hayden Creek local population.

The IDFG collected fish density data approximately 8 km upstream from the proposed restoration site between 2015 and 2020. Very few bull trout were captured in their sampling (less than 100 fish/km), but because their sampling occurred during the late spring, surveyors did not expect to observe a large number of bull trout. However, had sampling occurred later in the summer, IDFG stated they likely would have encountered more bull trout as they migrated towards their spawning grounds (Meyer 2023, as cited in USFS 2024, p. 301).

4.2.2 Factors Affecting Bull Trout in the Action Area

Mining has been a major factor affecting bull trout in the action area. Two major periods of mineral exploration, development, and operations have occurred in the Stibnite Mining District

(District) over the past century that have left substantial environmental impacts that remain today (Midas Gold 2016b, p. ES-6). The action area for the proposed action is located within a portion of the District (Midas Gold 2016, p. ES-1).

The first period of activity commenced in the mid-1920s and continued into the 1950s; it involved the mining of gold, silver, antimony, and tungsten mineralized materials by both underground and, later, open pit-mining methods. During World War II, this District is estimated to have produced more than 90% of the Nation's antimony and 65% of the Nation's tungsten; materials that were used in munitions, steelmaking, fire retardants and for other purposes. Mining of these strategic minerals was considered so critical that the federal government subsidized the mining activity, managed site operations, and military time could be served at the mine site. Strategic metal mining operations at the District continued through much of the Korean War. Antimony-gold-tungsten mining and milling ceased in 1952 near the end of the Korean War (Midas Gold 2016b, p. ES-6).

The second period of major activity in the District started with exploration activities in 1974 and was followed by open pit mining and seasonal on-off heap leaching and one-time heap leaching from 1982 to 1997, with ore provided by multiple operators from a number of locations, and processed in adjacent heap leaching facilities (Midas Gold 2016b, p. ES-7).

The mining, milling, and processing activities created numerous legacy impacts including underground mine workings, multiple open pits, development rock dumps, tailings deposits, heap leach pads, spent heap leach ore piles, a mill and smelter site, three town sites, camp sites, a ruptured water dam (with its associated erosion and downstream sedimentation), haul roads, an abandoned water diversion tunnel, an airstrip, and other disturbances. Extensive forest fires in the area have compounded the human-created impacts and have increased soil erosion and impacted water quality (Midas Gold 2016b, p. ES-7).

Past mining activity has severely impacted both the main stem of Meadow Creek and its East Fork tributary. The East Fork of Meadow Creek, locally known as "Blowout Creek," is today one of the largest sources of sediment for this part of the Salmon River. "Blowout Creek" got its name from a water dam that failed in the 1965 with a washout that scarified an erosional channel and drained the meadow and the productive wetlands above. The erosional and dewatering effects continue today, with sediment delivered downstream with every spring melt and every summer rainstorm, with the finer sediments choking the spawning grounds of the Salmon River (Midas Gold 2016b, p. ES-7).

The EFSFSR currently runs though the YPP. First mined in 1938, and abandoned in the late 1950s, the pit has since filled with river water and formed a lake. While recreationists currently camp on the old mine benches within the open pit and catch fish in the un-reclaimed pit lake, anadromous and local fish populations have not been able to migrate upstream from this point since 1938 because the steep gradient of the EFSFSR inflow to the YPP creates a physical passage barrier (Midas Gold 2016b, p. ES-7).

Sediment delivery, chemical contamination, and changes to natural stream flow patterns have characterized the Stibnite mining area for the last 100 years. Since 1992, with the listing of Chinook salmon, actions on Federal lands have been assessed for effects to listed fish and some effects have been mitigated. Recent activities have focused on continued clean-up of Federal lands in the Stibnite mining area (USFS 2007a, p. 11)**.**

Baseline conditions include the legacy of the century-old Stibnite and Cinnabar mining areas; however, recent reclamation and previous Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) efforts have addressed sources of effects to fish and fish habitat. Mine reclamation activities have reduced potential erosion and sediment delivery by reducing sediment sources, restoring hydrologic function, and vegetating disturbed sites. Actions have also removed hazardous materials toxic to aquatic organisms. The CERCLA actions have relocated part of Meadow Creek, reduced the risk of catastrophic failure of the Meadow Creek diversion channel, reduced mobilization of toxic tailings into Meadow Creek, reduced erosion of spent ore into Meadow Creek, eliminated the potential for diesel to enter Cinnabar Creek (tributary to Sugar Creek), and reduced the migration of tailings into Cinnabar Creek (USFS 2007a, p. 11).

As described in the Assessment (USFS 2024, p. 8), in January 2021, Perpetua and affiliates entered into an Administrative Settlement Agreement and Order on Consent (ASAOC) with the EPA and the Forest under CERCLA to conduct cleanup of certain conditions at the Stibnite mine site. These areas are mostly outside of and not included in the proposed mining project. With the signing of the 2021 ASAOC, the parties plan to address certain legacy mining impacts under CERCLA that would not otherwise be addressed by the proposed action outside the CERCLA footprint. The ASAOC includes three primary phases. Phase 1 includes several "time critical removal actions" (TCRAs) consisting of stream diversion ditches designed to avoid contact of water with sources of contamination and removal of approximately 325,000 tons of development rock and tailings from locations in Meadow Creek or EFSFSR that are currently impacting water quality. Phase 1 also includes baseline studies of conditions at five historic mine adits where mine water is discharging. Implementation of removal actions to address the adits is optional under the ASAOC. The purpose of these studies is to collect information to inform potential future CERCLA removal actions at these locations. In addition, a Clean Water Act evaluation and a cultural resource survey were completed to support Phase 1 activities, and the Service completed a biological opinion on the action (USFWS 2022, entire). Phase 1 activities will be accomplished regardless of the status and potential approval of the proposed action and is scheduled to be completed between 2021 and 2025 (USFS 2024, p.8).

When all work in Phase 1 is completed, and if approvals and permits have not been obtained for the proposed action, optional Bridge Phase activities may be performed as described in the ASAOC. These activities may include additional water diversions, capping or covering of mine waste in place, and targeted removal of additional mine waste materials to improve water quality. The Bridge Phase would be completed within a year of the agencies' acceptance of the work plan for this phase. Optional Phases 2 and 3 would be conducted if elected and approved by the agencies (USFS 2024, p. 9).

Water quality in the action area remains impaired. The IDEQ 2022 Integrated Report lists the 1st and 2nd order reaches of the EFSFSR (including Meadow Creek) as impaired (303d list) due to elevated levels of arsenic and elevated stream temperature, while the 3rd order reach of the EFSFSR downstream of Meadow Creek is impaired due to elevated levels of antimony and arsenic and elevated stream temperature. Sugar Creek is listed due to elevated levels of mercury and arsenic (IDEQ 2022, pp. 338–342).

4.2.2.1 Bull Trout Habitat Conditions

Baseline conditions of key Watershed Condition Indicators (WCIs) that are most likely to be affected by the proposed action include: Water Temperature, Sediment/Turbidity, Chemical Contaminants/Nutrients, Physical Barriers, and Change in Peak/Base Flows (USFS 2024, p. 248). The entire environmental baseline matrix is shown in USFS (2024, Tables C-1 and C-2).

Water Temperature

Cold water temperatures play an important role in determining bull trout habitat quality, as these fish are primarily found in colder streams, and spawning habitats are generally characterized by temperatures that drop below 43 °F (9 °C) in the fall (Fraley and Shepard 1989, p. 137; Pratt 1992, p. 5; Rieman and McIntyre 1993, p. 2). Constant temperatures above 61 °F (16 °C) are not tolerated by bull trout (Poole et al. 2001, p. 5), but they may migrate through these higher temperature habitats by utilizing areas of thermal refuge, such as a confluence with a cold-water tributary, deep pools, or locations with surface and groundwater exchanges. For water temperature to be functioning appropriately (FA; i.e., the desired condition) the 7-day average maximum temperature in a reach should meet the following criteria for each life history stage:

- Incubation: 35.6-41.0 °F / 2-5 °C
- Rearing: 39.2-53.6 °F / 4-12 °C
- Spawning: 39.2-48.2 °F / 4-9 °C

Temperatures should not exceed 59.0 °F (15 °C) in areas used by adults during migration in order to avoid creating thermal passage barriers for bull trout.

Stibnite Project Area

Burntlog Creek, Trapper Creek, and Riordan Creek/Lake

Nearly every local population watershed in the SFSR (including Burntlog, Trapper, and Riordan Creeks) was impacted by large catastrophic wildfire in 2007. In addition to the Cascade Complex Fire (320,000 acres), the Loon-Zena Fire burned over 200,000 acres in the South Fork Salmon River subbasin north of the BNF boundary (USFS 2024, Appendix C, Table C-1).

Stream temperatures are thought to have increased relative to pre-fire conditions due to the large areas of fire-killed trees within RCAs. However, the 7-day average of the daily maximum temperature (June-October) in the lower reaches of Trapper Creek, Burntlog Creek, and Riordan Creek collected in 15-minute increments using a TidBit temperature logger (MWH 2017, Appendix 3; Stantec 2018, entire, 2019, entire, 2020, entire) were:

- 2015: Trapper Creek 10.3 ºC; Lower Burntlog Creek 12.5 ºC
- 2016: Trapper Creek 9.4 ºC
- 2017: Trapper Creek: 8.9 ºC
- 2018: Trapper Creek 9.2 ºC; Riordan Creek 9.7 ºC; Lower Burntlog Creek 11.3 ºC
- 2019: Trapper Creek 9.0 ºC; Riordan Creek 10.9 ºC; Lower Burntlog Creek 10.9 ºC

It will be many decades before the coniferous overstory provides shade similar to the level that existed prior to the wildfire. The presence of numerous springs and groundwater sources in smaller streams will provide some cooling benefit until vegetation is reestablished.

Water temperatures tend to fall within the functioning appropriately thresholds for most of the time as shown in the 2015-2019 data, though these thresholds are periodically exceeded (USFS 2024, Appendix C, Table C-1).

Upper EFSFSR and Sugar Creek

Daily water temperatures (measured in 15-minute increments) in the EFSFSR, Meadow Creek, and EFMC have been monitored since 2012 (MWH 2017, Section 5.1.5, p. 5-35; Stantec 2020, Appendix 2). These daily temperatures with bull trout life history temperature thresholds (Table 17) are in Figure 10 and show temperatures frequently exceed spawning, incubation/emergence, and even at times, rearing thermal threshold for bull trout.

Table 17. Bull trout temperature thresholds and modeled length of stream that meet water temperature thresholds in July and September (USFS 2024, Table 4.1-17).

Life Stage / Season[1]	**Range of Optimal Temperature Thresholds (°C)**	**Total Stream Length Above YPP/ Below YPP (km)**	**Stream Length Within Optimal Temperature Threshold (km)**		
			Above YPP	**Below YPP**	**Total**
Adult Spawning August – September	4-9	24.20 / 2.01	0	0	0 (0%)[2]
Incubation/ Emergence[1] August – April	2-5	24.20 / 2.01	0	0	0
Juvenile Rearing Year-round[3]	4-12	24.20 / 2.01	5.02	0	5.02 (19.2%)[2]

Source: EPA (2003, entire), USFS 2003
[1] Analysis based on Fall (September) maximum weekly maximum temperatures.
[2] Percent of stream length is based on the modeled occupancy potential habitat.
[3] Analysis based Summer (July) MWMT.

The EFSFSR from 0.89 km downstream from the confluence with Sugar Creek to around 5 km upstream from the confluence with Meadow Creek, including Fiddle Creek (total of 12.94 km), and around 13.27 km of Meadow Creek and EFMC were evaluated for temperature thresholds. Overall, there are 26.21 km of available habitat, none of its temperatures are within optimal thresholds for spawning, and incubation/emergence, and less than 20% is suitable for rearing (Table 17).

Figure 10 and Stantec (2024, Appendix C, Table C-2), show that in the EFSFSR, temperature for spawning is functioning at unacceptable risk (FUR) both below and above the YPP, while both incubation and rearing temperatures are FA. Meadow Creek spawning temperature is also FUR, while incubation temperature is functioning at risk (FR) and rearing temperature is FA. Sugar

Creek temperature for spawning is FUR while both incubation and rearing temperatures are FA (USFS 2024, Appendix C, Table C-2).

It is important to note that the length of potential habitat for bull trout incubation is based on September maximum weekly maximum temperatures (MWMT); however, there are diurnal variations and hyporheic conditions that protect the eggs and alevins reducing mortality rates. While much of the length of stream above and below the YPP do not meet the thermal threshold, there are all life stages of bull trout present, which means successful reproduction is occurring. Therefore, while fall MWMT may show zero miles of suitable spawning and incubation habitat, this may not be a true representation of the conditions in the river. Additionally, if temperatures are above the thresholds, fish may avoid areas within streams by finding thermal refuges.

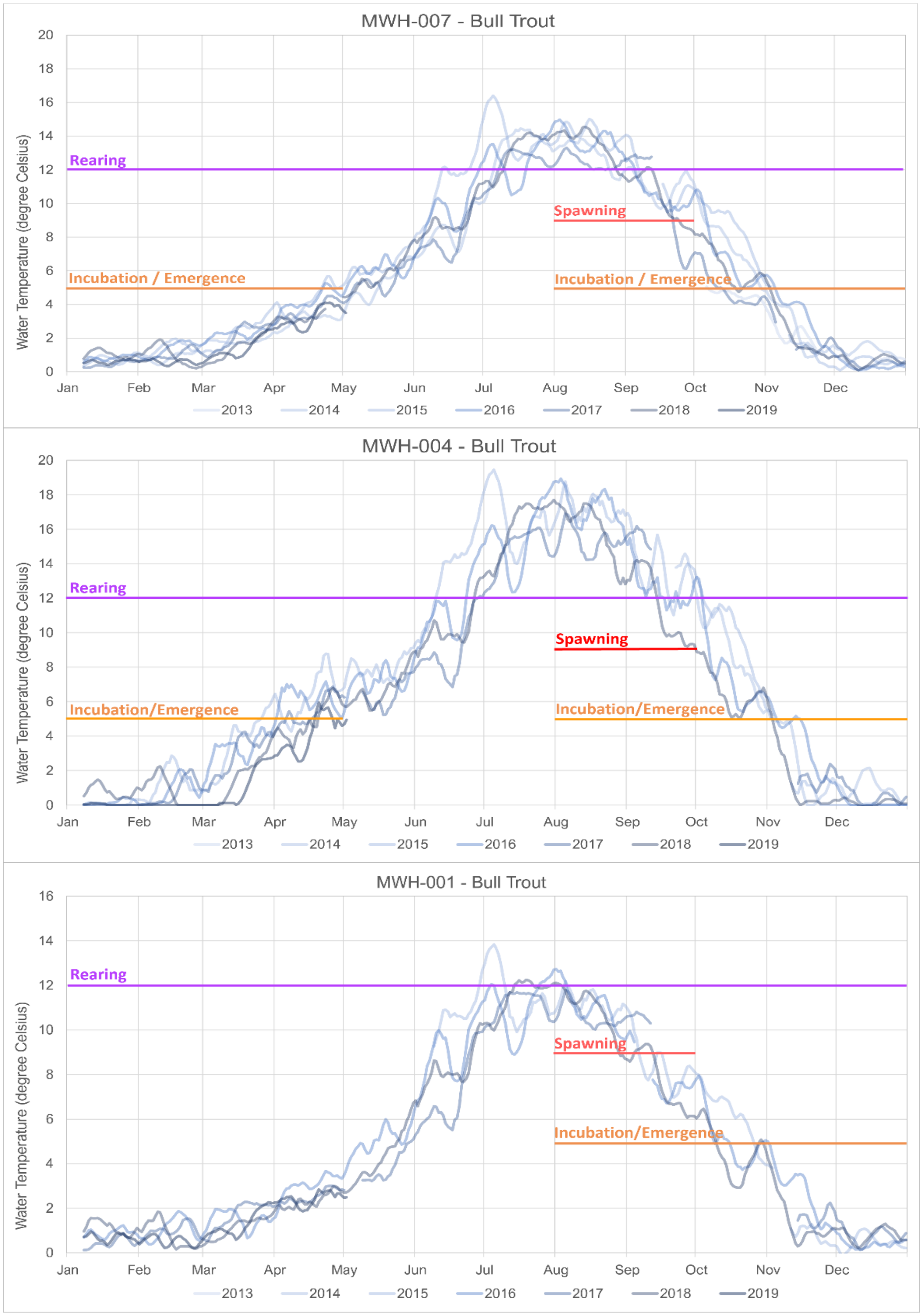

Figure 10. 7-day average of the daily maximum water temperatures in the EFSFSR upstream from Sugar Creek (upper figure) in the Middle Meadow Creek (middle figure) and in the EFSFSR upstream from Meadow Creek (lower figure) with bull trout temperature thresholds (USFS 2024, Figure 4.1-11).

Lemhi Restoration Project Area

Water temperature data from USGS gage 13305000 near Lemhi, Idaho (between the proposed restoration project and Hayden Creek) show mean monthly water temperatures ranged from a low of 7.6 °C in April to a high of 14.3 °C in August (Table 18). Given that bull trout use the mainstem Lemhi River for FMO habitat and mean monthly temperatures are below the 16 °C tolerance threshold (Poole et al. 2001, p. 5), the water temperature indicator is FA. In addition, the Lemhi River in the vicinity of the restoration project is fully supporting its cold water aquatic life beneficial use designation (IDEQ 2022, accessed June 10, 2024).

Table 18. Mean monthly water temperature in the Lemhi River near Lemhi, Idaho.

00010, Temperature, water, degrees Celsius,												
YEAR	Monthly mean in deg C (Calculation Period: 1998-04-01 -> 2005-08-31) Period-of-record for statistical calculation restricted by user											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1998				7.59	8.87	9.67	13.81	14.24	12.46			
2001						11.66	14.31	14.93	12.37			
2005					8.67	9.38	13.68	13.88				
Mean of monthly Temperature, water				7.6	8.8	10.2	13.9	14.3	12.4			

Sediment

Bjornn et al. (1977, p. 1) classified interstitial sediments as particles that are less than 6.35 millimeters. Salmonid survival and production are reduced as fine sediment increases, producing multiple negative impacts on salmonids at several life history stages. Increases in fine sediment entombs incubating eggs in redds, reduces egg survival by reducing oxygen flow, alters the food web, reduces pool volumes for adult and juvenile salmonids, and reduces the availability of rearing space for juveniles, rendering them more susceptible to predation (Bjornn et al. 1977, entire; Suttle et al. 2004, entire). High levels of fine sediment can cause an overall loss of productivity and diversity within a stream. Bjornn et al. (1977, p. 40) found that when the percentage of fine sediment exceeds 20 to 30% in spawning riffles, survival and emergence of salmonid embryos begins to decline.

Using modeling based on an extensive literature review, Jensen et al. (2009, p. 356) found that egg to fry survival for salmon and steelhead shows a negative curvilinear relationship to the percent of sediment in stream that is less than 0.85 mm in diameter; survival sharply decreased and leveled out at less than 10% when fines were greater than 25%. The current condition of the interstitial sediment deposition indicator is determined using free matrix and cobble embeddedness monitoring, which measure the degree to which salmonid spawning substrate (i.e., substrate particles ranging from approximately 45 to 300 mm) are surrounded or covered by fine sediment.

The rearing capacity of salmonid habitat decreases as embeddedness levels increase. For example, Suttle et al. (2004, p. 969) found that growth and survival of juvenile steelhead declined with a measure of increasing substrate embeddedness. The substrate monitoring sites are spread out across the fish analysis area (Figure 11) and are measured annually, so the data are best interpreted as a measure of annual, watershed scale conditions and trends, rather than site-specific effects from point sources of sediment. Generally high embeddedness relative to reference conditions could indicate degraded conditions in a watershed, while low embeddedness indicate favorable conditions in a watershed.

Stibnite Project Area

Nelson and Burns (2005), Nelson et al. (2006), and Zurstadt et al. (2016; as cited in USFS 2024, p. 3-11), describe a method to rate the interstitial sediment deposition indicator. The rating system is used in this analysis to describe the current condition of the interstitial sediment deposition indicator in the analysis area.

Burntlog Creek, Trapper Creek, and Riordan Creek/Lake

Aquatic baseline studies in Burntlog and Trapper creeks show over 5-year average embeddedness levels at 8 and 4% (FA). Free matrix and surface fines measurements in Burntlog, and Trapper creeks have WCIs that are FA. Free matrix in Riordan Creek are FA, however, surface fines are FUR (Stantec 2020, p. 16, Table 2).

The Sediment WCI is expected to be FUR due to impacts from the Cascade Complex wildfire in the temporary to short-term timeframes. In comparison to the pre-fire condition, soil erosion will increase due to the loss of vegetation consumed by the Cascade Complex wildfire and, to a much lesser degree, the fire-induced hydrophobic soil conditions. Sediment delivery to streams increased as a result of increased surface erosion, decreased surface roughness, and increased water runoff. Much of this sediment is stored in the tributary channels and delivered to main channels over time. The total volume of sediment stored behind obstructions will vary between subwatersheds and years in response to changes in bankfull channel width and annual peak flow rates (Megahan 1982, entire).

Upper EFSFSR and Sugar Creek

The current existence, use, and maintenance of the Stibnite Road, Quartz Creek Road, and historical mining disturbance in the Stibnite area continue to be a source of existing and potential anthropogenic sediment to the EFSFSR. Because they occur in the same geology and have experienced similar weather and management activity, analysis area tributaries that lack data are expected to have embeddedness levels comparable with those measured in other tributaries.

The floods of 2008 and landslides in 2018 and 2019 deposited sediment into the EFSFSR and the sediment accumulations behind log jams and debris fans that were created are evident. However, it also may be that the influx of diverse particle sizes and large woody debris (LWD) were more beneficial than deleterious because the system was deficient in LWD, and spawning sites were limited downstream of the town of Yellow Pine.

Within the action area, cobble embeddedness and interstitial sediment deposition (measured through free matrix surveys) immediately upstream from the Meadow Creek confluence (MWH-013, Figure 11), in lower Meadow Creek (MWH-014, Figure 11), and in the EFSFSR immediately downstream from the Sugar Creek confluence (MWH-009, Figure 11) are FA (Stantec 2018, entire, 2019, entire, 2020, entire). More information on baseline conditions for interstitial sediment is found in USFS 2024, Appendix C. Multi-year cobble embeddedness in

Sugar Creek are reported to be 13% and FA (Stantec 2020, p. 16, Table 2). The free matrix and surface fine indicators are FUR.

Lemhi Restoration Project Area

The headwater streams of the Lemhi River are considered sediment supply zones, affected by weathering and erosion of the bordering slopes. Sediment has accumulated in the alluvial fan, creating terraces along the valley margins. As a result, the Lemhi River exhibits a pronounced deposition zone. Sediment input from land use practices in the Lemhi River basin continue to affect the mainstem Lemhi River. Several segments of the Lemhi subbasin have Total Maximum Daily Loads (TMDL) approved for sediment targets in the Lemhi tributaries, though the Lemhi River TMDL is for fecal coliform bacteria and not sediment (IDHW 1999, p. 35, Section 3.1).

Turbidity

After sediment is delivered to a stream channel, larger particles are deposited onto the streambed relatively quickly, while finer particles such as silt and clay remain in suspension for long periods of time, causing prolonged turbidity. Sediment is a significant stressor to salmonids and can affect them in both direct and indirect ways. Bull trout are highly susceptible to sediment inputs and require low turbidity and suspended sediment levels for spawning, incubation, and juvenile rearing (Muck 2010, entire). The Service knows of no positive effects to salmonids from increased sediment, while the potential negative impacts of increased suspended sediment on bull trout and other salmonids have been well documented (Bakke 2002, p. 1; Newcombe and MacDonald 1991, pp. 72–73; Newcombe and Jensen 1996, pp. 700–715; Bash et al. 2001, p. 24).

Increased sediment and suspended solids have the potential to affect primary production and benthic invertebrate abundance, due to reductions in photosynthesis within murky waters. Thus, food availability for fish may be reduced as sediment levels increase (Cordone and Kelley 1961, pp. 189–190; Lloyd 1987, p. 35; Henley et al. 2000, pp. 129–133). Sediment can also reduce the health of in-stream plants, thereby reducing cover for fish and making them more vulnerable to predation (Waters 1995, pp. 111–116). Pools, which are a physical and biological feature of bull trout critical habitat, can be filled by sediment and degraded or lost (Megahan 1982, p. 114).

Increases in suspended sediment have been shown to affect salmonid behavior in several ways. Social and feeding behavior can be disrupted by increased levels of suspended sediment (Berg and Northcote 1985, p. 1410). Turbidity can cause lethal, sublethal, and behavioral effects in juvenile and adult salmonids depending on the duration and intensity (Newcombe and Jensen 1996, pp. 700–715). Fish may avoid high concentrations of suspended sediments altogether (Hicks et al. 1991, pp. 483–485). Even small elevations in suspended sediment may reduce feeding efficiency and growth rates of some salmonids (Sigler et al. 1984, p. 142).

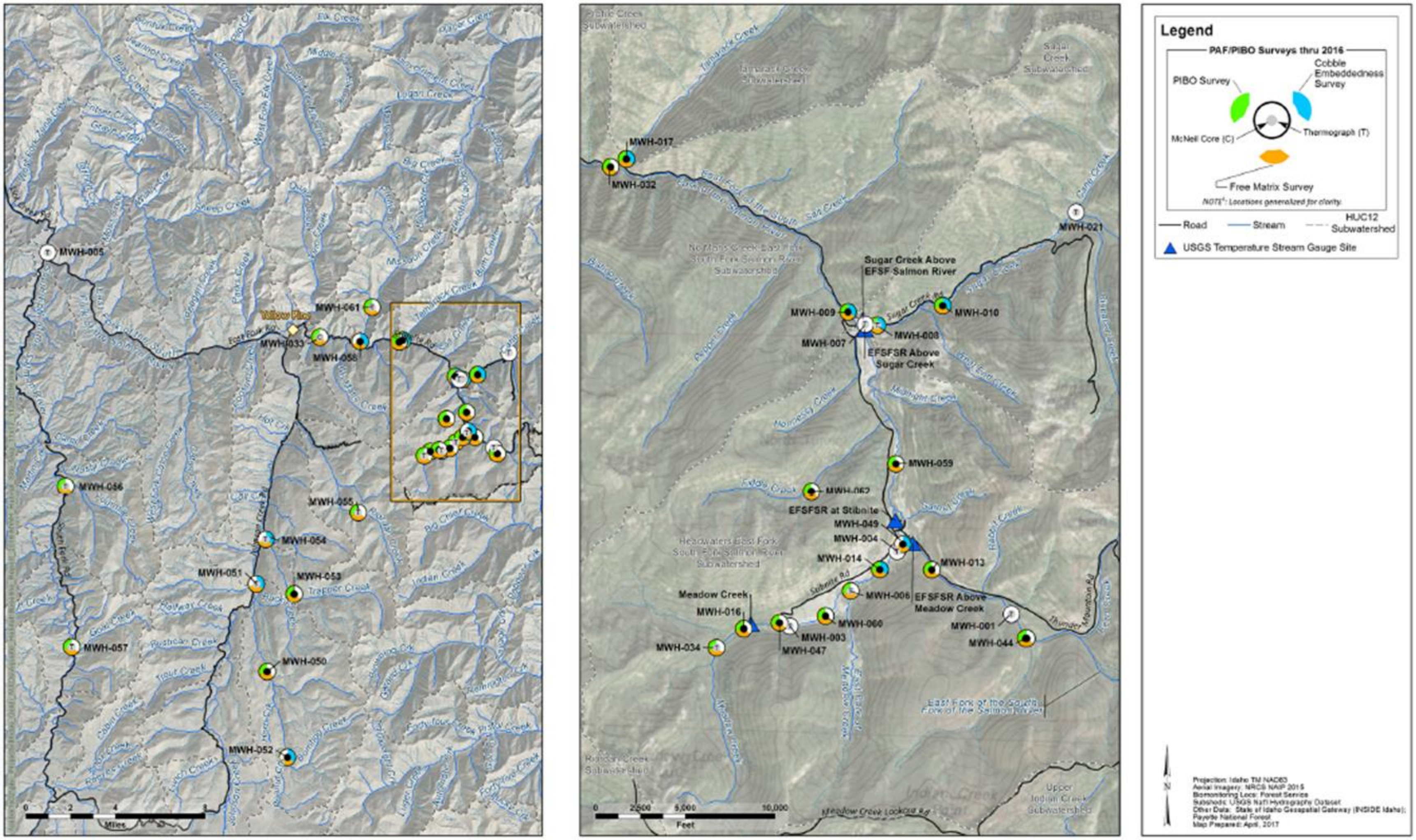

Figure 11. Stibnite aquatic habitat survey locations and survey activity, 2012-2016 (MWH 2017, Figure 3-1).

Stibnite Project Area

Burntlog Creek, Trapper Creek, and Riordan Creek/Lake

There is no WCI identified for turbidity alone, but it is connected to the metric for sediment, specifically surface fines. Surface fines in Burntlog Creek are FA at two sites (MWH 050 and 051) and FR at MWH 052. In Trapper Creek, surface fines are FA at MWH 053 and 054, and FUR at MWH 055. In Riordan Creek, surface fines are FUR at MWH 055 (Stantec 2018, p. 17, Table 3).

Upper EFSFSR and Sugar Creek

According to IDEQ, turbidity in Idaho should not be greater than 50 nephelometric units (NTU) instantaneous or 25 NTU for more than 10 consecutive days above baseline background (Rowe et al. 2003, p. 12). Turbidity monitoring in the Stibnite area showed lower Meadow Creek, just upstream from the confluence with the EFSFSR, having monthly average NTUs ranging from 1.2 to 24, with the highest measurements occurring in April, May, and December; 6 months were below 3 NTUs. The EFSFSR near the confluence with Meadow Creek showed monthly average NTUs ranging between 1.3 and 8.9; nine months were below 3 NTUs. The EFSFSR near the Fiddle Creek confluence showed monthly average NTUs ranging from 1.7 to 15 and seven months were at or near 3 NTUs (HDR 2017, entire). As noted above, there is no WCI identified for turbidity alone, but it is connected to surface fines. Based on the aquatics baseline monitoring, surface fines are considered FA (USFS 2024, Appendix C).

Turbidity monitoring in the uppermost reach Sugar Creek showed NTUs ranging from 0.0 to 19.2, NTUs for Sugar Creek above West End Creek ranged from 0.0 to 19.3, and NTUs for Sugar Creek above EFSFSR ranged from 0.0 to 21.6 (HDR 2017, pp. 4-98 to 4-118). Surface fines are considered FA in Sugar Creek above West End Creek. In Sugar Creek just upstream of the confluence of the EFSFSR, surface fines were FUR in 2016, FR in 2015, and FA in 2013 and 2014 (MWH 2017, p. 5-15, Figure 5-3).

Lemhi Restoration Project Area

Excessive bank erosion and runoff from agricultural lands, roads, all-terrain vehicle trails, and mining operations have increased fine sediment inputs to the Lemhi River channel. Dense riparian vegetation had historically stabilized banks composed of fine sand and silt, which are now eroding and contributing sediment to the river on an annual basis. Cattle grazing has disturbed the surface of the floodplain and compacted the soils, both of which lead to more fine sediment runoff. Roads have been located adjacent to many of the tributaries, where they have altered the riparian vegetation composition, compacted soils, and provide conduits for concentrated sheet flows during snowmelt and thunderstorms. Mining operations have included placer mining and exploratory trenches, especially in the foothills and headwater areas along the Beaverhead Mountains from Gilmore to Salmon. The cumulative effects of these impacts have likely increased fine-sediment inputs entering the Lemhi River system, resulting in elevated fine sediment levels and siltation (Rio ASE and Biomark 2021, p. 12). As noted previously, fine sediment and surface fines are associated with turbidity, and given the high levels of sediment in the Lemhi system, the surface fines indicator is expected to be FR.

Chemical Contaminants

Stibnite Project Area

Burntlog Creek, Trapper Creek, and Riordan Creek/Lake

Burntlog Creek, Trapper Creek, and Riordan Creek/Lake are fully supporting their designated beneficial uses (i.e., cold water aquatic life, primary contact recreation, and salmonid spawning) (IDEQ 2022, accessed June 10, 2024). The chemical contaminant indicator is FA.

Upper EFSFSR and Sugar Creek

Water quality in the mine site area, particularly in the EFSFSR and in Sugar Creek have chemical constituents, particularly arsenic, antimony, copper, and mercury, that exceed acceptable thresholds (USFS 2023e, Section 7). Copper only exceeds acceptable thresholds in Sugar Creek but is well below the acceptable threshold in the other mine site area streams. Antimony and arsenic exceed the thresholds in all but Fiddle Creek. Mercury exceeds the thresholds in the EFSFSR and in Sugar Creek. Table 19 provides a summary of the average measured concentrations of these chemical constituents. The USFS (2024, Figure 4.1-3) provides the monitoring locations corresponding with the nodes shown in Table 19. These chemical constituents have the potential to affect the growth and survival of bull trout at their current concentrations.

Past mining at the mine site area has led to increased heavy metals concentrations in sediments and fish tissues. Both sediment and macroinvertebrate samples were collected in August 2016 to assess the concentration of metals at the mine site. Results showed all streams had sediments with elevated antimony and arsenic. Except for two sites on Meadow Creek and Tamarack Creek, mercury exceeded the freshwater sediment screening benchmark. Macroinvertebrate samples showed arsenic levels that exceeded the benchmark in both the EFSFSR and Meadow Creek (MWH 2017, p. 5-45).

Fish tissues were collected in 2015 to assess the concentration of metals as well. Concentrations of cadmium, silver, and thallium were not detected above the method detection limit (MDL) in fish tissue at any of the sites. In addition, concentrations of chromium, lead, and nickel were only detected above the MDL at a few sites, and even then, at very low concentrations. All other metals, including antimony, mercury, and arsenic, were detected at concentrations above the MDL at all sites. Except for mercury, maximum metal concentrations were seen in fish collected in EF Meadow Creek and the EFSFSR. However, there was no clear correlation among all metals relative to any sample site (i.e., no one site was elevated for all metals). Concentrations of mercury, antimony, and arsenic did trend higher in YPP, in the EFSFSR at MWH-011 (Figure 12), and upstream from the Meadow Creek confluence (MWH-026, Figure 12) sites. However, concentrations of mercury, antimony, and arsenic were below literature-derived effects thresholds at all sites, except MWH-018 (Sugar Creek, Figure 12). The concentration at MWH-018 was 0.202 milligram/kilogram wet weight, which is essentially at the minimal effects threshold considered in NMFS 2014 (as cited in MWH 2017, p. 5-50). The concentration of aluminum in one fish at MWH-027 (EF Meadow Creek, Figure 12) was 16.171, which is above the lowest observed effects concentration (LOEC) reported in USEPA 2015 (as cited in MWH 2017, p. 5-50). However, the other two fish sampled from EF Meadow Creek had concentrations well below the LOEC (MWH 2017, p. 5-50, Table 5-15).

Table 19. Average constituent concentrations at monitoring locations (USFS 2024, Table 4.1-4).

Constituent of Concern		Aluminum[1]	Copper[2]	Antimony[3]	Arsenic[4]	Mercury[5]
Analysis Criteria		**0.05 mg/L**	**2.4 µg/L**	**5.2 µg/L**	**10 µg/L**	**0.002 µg/L (total mercury)**
Node	**Stream**	**Average Measured Baseline (µg/L)**				
YP-T-27	Meadow Creek	1.2	0.3	6.1	35	0.0015
YP-T-22	Meadow Creek	1.2	0.3	8.1	34	0.0017
YP-SR-10	EFSFSR	9.4	0.2	12	25	0.0025
YP-SR-8	EFSFSR	9.4	0.3	17	28	0.0024
YP-SR-6	EFSFSR	9.8	0.2	19	31	0.0024
YP-SR-4	EFSFSR	12	0.3	31	63	0.0024
YP-SR-2	EFSFSR	14	0.2	22	45	0.0057
YP-T-11	Fiddle Creek	16	0.2	0.6	2	0.0018
YP-T-1	Sugar Creek	9.0	8.56[6]	34	13	0.159

Source: Midas Gold (2019, Table 4-8); (SRK 2021a, entire)

Analysis criteria pertain to fish species. Aluminum, arsenic, and mercury criteria are based on total concentrations while copper and antimony are based on dissolved concentrations.

[1] Aluminum: Lowest predicted for the action area based on Recommended Aquatic Life Criteria (EPA 2018a, entire); The same water quality data as in the Biotic Ligand Model were used (Brown and Caldwell 2020, entire).

[2] Copper criteria were derived using the Biotic Ligand Model per guidance contained in IDEQ (2017, entire). A conservative chronic copper standard was estimated by applying the lowest of the 10th percentile chronic criteria based on regional classifications for the Salmon River Basin, Idaho Batholith, and third order streams. Per the Stibnite Gold Project Water Quality Management Plan (Brown and Caldwell 2020a, entire) , preliminary calculations using the Biotic Ligand Model and site-specific data have produced similar values (i.e., 2.6 ug/L chronic and 4.2 ug/L acute criteria for the mine WTP outfall and 1.5 ug/L chronic and 2.5 ug/L acute criteria for the working housing treatment plant outfall) to the standard derived using these regional classifications (i.e., conservative guidance of 2.5 ug/L chronic and 4.0 ug/L acute criteria for third order streams and 2.4 ug/L chronic and 3.9 ug/L acute criteria for the Salmon River Basin).

[3] Antimony does not have a specified NMFS or USFWS criteria and is based on EPA's human health chronic criterion for consumption of water and organisms of 0.0056 milligram/L.

[4] Arsenic: NMFS (2014, p. 275) and USFWS (2015d, p. 260) both determined jeopardy for the chronic criterion proposed by EPA for Idaho Water Quality Standards (0.150 mg/L [150 µg/L]). NMFS (2014, p. 281) and USFWS (2015d, p. 271) directed EPA to promulgate or approve new aquatic life criterion, and in the interim directed EPA to ensure the 10 µg/L recreational use standard is applied in all Water Quality Based Effluent Limitations (WQBELs) and Reasonable Potential to Exceed Calculations using the human health criteria and the current methodology for developing WQBELs to protect human health. .

[5] Mercury: NMFS (2014) directed EPA to promulgate or approve a new criterion. The fish tissue criterion that IDEQ adopted in 2005 is to be implemented in the interim. USFWS (2015d, p. 279) directed EPA to use the 2001 EPA/2005 Idaho human health fish tissue criterion of 0.3 mg/kg wet weight for WQBELs and reasonable potential to exceed criterion calculations using the current methodology for developing WQBELs to protect human health.

[6] Of the 38 dissolved copper values reported for YP-T-1, only one value was higher than 0.00261 mg/L; therefore, it is likely that this single anomalous value of 0.342 mg/L was the result of a sampling, analytical, or data management error as all other observations were less than 0.00261 mg/L.

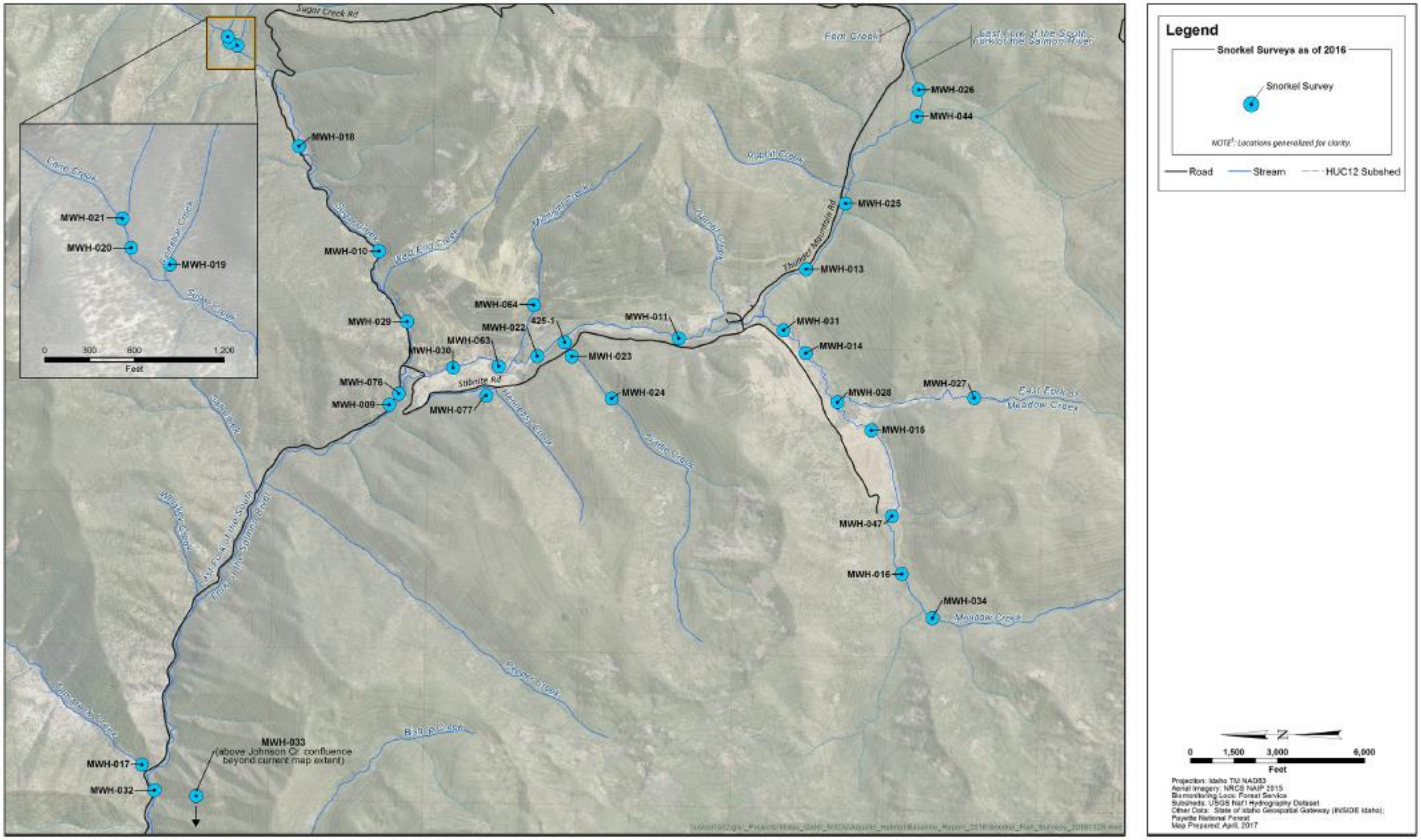

Figure 12. Snorkel and tissue collection sites during all survey years (MWH 2017, Figure 3-6).

The upper EFSFSR (1st and 2nd order) is listed under 303(d) by IDEQ for arsenic and the 3rd order reach below the confluence with Meadow Creek is 303(d) listed for arsenic and antimony, and the 4th order reach below Sugar Creek is 303(d) listed for arsenic and mercury. The 3rd order reach of Sugar Creek below Cane Creek is 303(d) listed for arsenic and mercury (IDEQ 2022, pp. 340–342); therefore, the baseline for the chemical contaminants indicator is considered FUR. For more information on Contaminants see USFS 2024, pp. 256-263.

Lemhi Restoration Project Area

The Lemhi River is categorized as a Category 4a water, which is defined as those waterbodies impaired for one or more standards for one or more beneficial uses but has an EPA-approved TMDL. The Lemhi River in the restoration reach is primarily impaired by bacteria (*Escherichia coli*) for primary recreation based on the 1999 Lemhi River Watershed TMDL (IDHW 1999, Section 3.1, p. 35). Pathogens are likely a result of agricultural runoff where livestock occur. Other potential contaminants include roadway runoff, agricultural runoff containing pesticides and fertilizers, and household or commercial cleaning or other waste products.

Physical Barriers

Stibnite Project Area

Burntlog Creek, Trapper Creek, and Riordan Creek/Lake

There are three road-stream crossings in the Upper Johnson Creek subwatershed. Results from the 2003-2004 culvert inventory indicate that none are barriers. Cascade barrier to fish passage exist in lower Trapper Creek, approximately 1,200 m from the confluence. Approximately 1,500 m of Riordan Creek has gradients around 8 to 10%. In the headwaters of Burntlog, Trapper, and Riordan Creeks, the Burntlog Road crossings primarily have culverts, most of which are not passable at most, if not all flows. There are a few bridge crossings that have box culverts that are likely passable at most flows. Depending on the particular stream and road crossing, the physical barrier indicator is FA or FUR (USFS 2024, Appendix C, Table C-1).

Upper EFSFSR and Sugar Creek

Barriers to fish passage can impact the natural movement (e.g., migration) of fish species and fish population dynamics by reducing, or completely blocking, potential habitat during certain life stages. Barriers can impact fish habitat connectivity and disrupt the natural movement of fish and block important habitat for fish during all life cycles, including spawning and rearing. Fish passage barriers were identified and described within the mine site (BioAnalysts 2021, entire). BioAnalysts (2021, pp. 13–14, Table 3) identified fish passage barriers, with five artificial barriers and one natural barrier in fish-bearing streams (Figure 13). The status of these barriers was identified as either complete, meaning no fish species can pass at any time of year, or partial, meaning some or all fish may pass at moderate or high flows, but not at low flows. Artificial barriers can be attributed to various actions, for example, construction of culverts and stream alteration (BioAnalysts 2021, p. 2). Table 20 presents the amount of total potential habitat upstream from each barrier for bull trout; those that do not have potential habitat for bull trout upstream from the barrier are not included in the table.

BioAnalysts (2021, pp. 13–14, Table 3) identified major barriers to fish movement in the mine site area including the high gradient cascade in the EFSFSR upstream from the YPP lake, EFSFSR box culvert, and the high gradient cascade in Meadow Creek upstream from the confluence with the EFMC (at the downstream end of the engineered channel). The high gradient cascade in the EFSFSR upstream from the YPP lake is a complete barrier to natural fish passage. The other two major barriers, the EFSFSR box culvert and Meadow Creek barriers, are flow-dependent partial barriers that can block seasonal migration, and only hinder migration of fish that reside in or were stocked upstream from the YPP lake cascade lake barrier (i.e., translocated Chinook salmon). For these reasons the physical barriers indicator is FUR (USFS 2024, Appendix C, Table C-2).

Table 20. Existing fish passage barriers for bull trout and potential habitat under baseline conditions (adapted from USFS 2024, Table 4.1-3).

Barriers	Status	Potential Habitat Upstream from Barrier (km)
EFSFSR above YPP (02) Artificial – Gradient	Complete	32.82[1] 19.54[2]
EFSFSR (203) Artificial – Box Culvert	Partial	26.43[1] 16.66[2]
Fiddle Creek (04) Artificial - Gradient	Complete	3.50[1] 0[2]
Fiddle Creek (200) Artificial – Gradient	Complete	3.46[1] 0[2]
Meadow Creek (05) Artificial – Gradient	Partial	8.23[1] 6.62[2]
East Fork Meadow Creek (06) Natural – Gradient	Partial	2.22[1] 0[2]

[1] Results based on Occupancy Probability for bull trout.
[2] Results based on usable Critical Habitat for bull trout.

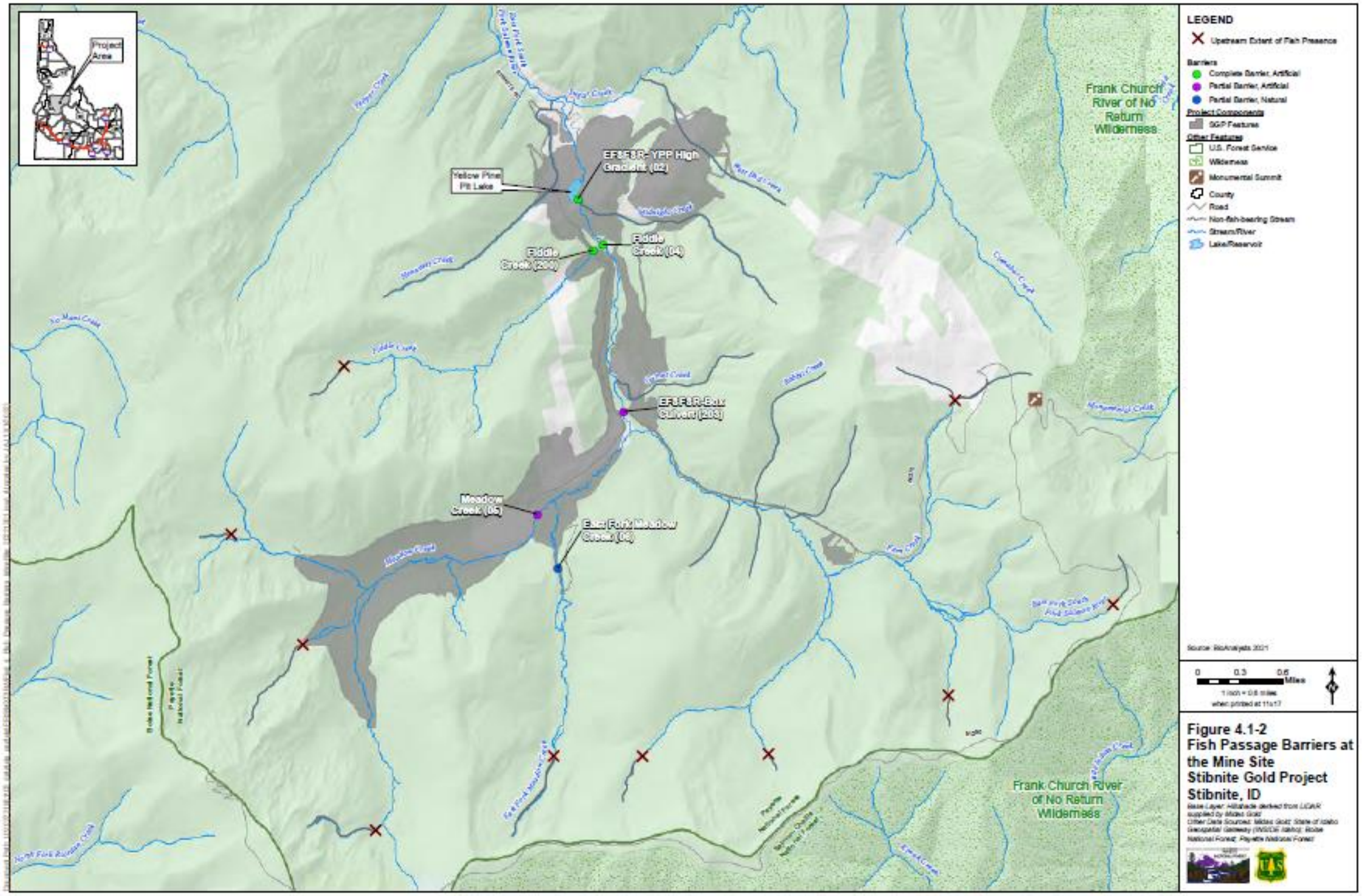

Figure 13. Fish passage barriers at the mine site (USFS 2024, Figure 4.1-2).

Lemhi Restoration Project Area

There are no structural fish passage barriers in the Lemhi restoration project area. Upper Lemhi River rehabilitation activities have included irrigation diversion consolidation screening and improvements for fish passage barrier removals for habitat access and tributary flow reconnection. Inadequate flows have resulted in passage barriers to salmonids.

Change in Peak/Base Flows

The desired condition for this indicator is present when a "watershed hydrograph indicates peak flow, base flow, and flow timing characteristics comparable to an undisturbed watershed of a similar size, geomorphology, and climatology" (USFS 2024, Appendix C, Table C-2).

Changes in or disruptions of watershed processes likely to influence characteristics of stream channels are also likely to influence the dynamics and persistence of bull trout populations. Bull trout have been more strongly associated with pristine or only lightly disturbed basins (Brown 1992; Clancy 1993; Cross and Everest 1995; Dambacher and others, in press; Huntington 1995; Ratliff and Howell 1992, as cited in USFWS 1998).

Patterns of stream flow and the frequency of extreme flow events that influence substrates are anticipated to be important factors in population dynamics (Rieman and McIntyre 1993, as cited in USFWS 1998, p. 17). With overwinter incubation and a close tie to the substrate, embryos and juveniles may be particularly vulnerable to flooding and channel scour associated with the rain-on-snow events common in some parts of the range within the belt geography of northern Idaho and northwestern Montana (Rieman and Mcintyre 1993, as cited in USFWS 1998, p. 18). Channel dewatering tied to low flows and bed aggradation has also blocked access for spawning fish resulting in year class failures (Weaver 1992, as cited in USFWS 1998, p. 18).

Stibnite Project Area

Burntlog Creek, Trapper Creek, and Riordan Creek/Lake

The USFS 2024 (Appendix C, Table C-1) reports that the condition of the Peak/Base flows indicator is unknown in these watersheds. But the Assessment also notes that due to the effects of the Cascade Complex Fire and Buck Fire in 2020, equivalent clearcut area (ECA) has increased in Burntlog and Trapper Creeks and have likely resulted in "large responses in water yield and peak flows" (Watertight Solutions 2007, p. 5).

Upper EFSFSR and Sugar Creek

The USFS 2024 (Appendix, Table C-2) reports that this indicator is FR due to roads, the YPP, and other historical diversions in the mining area that have affected flow timing in the Upper EFSFSR, Profile Creek, and along the mainstem EFSFSR.

Lemhi Restoration Project Area

The upper Lemhi River has a complex hydrology, with interactions of snowmelt surface flows, groundwater gains and losses, and an extensive network of irrigation diversions and returns. Peak flows occur from snowmelt runoff, typically in May and June (Rio ASE and Biomark 2021, p. 8). Groundwater discharge and recharge is an important factor affecting the year-round water budget, caused by an extensive alluvial aquifer. Irrigation diversions combined have legal rights totaling 205 cfs, with most diversions made between late April and early October (Rio ASE and Biomark 2021, p. 8). Figure 14 shows the effects of irrigation on baseflows.

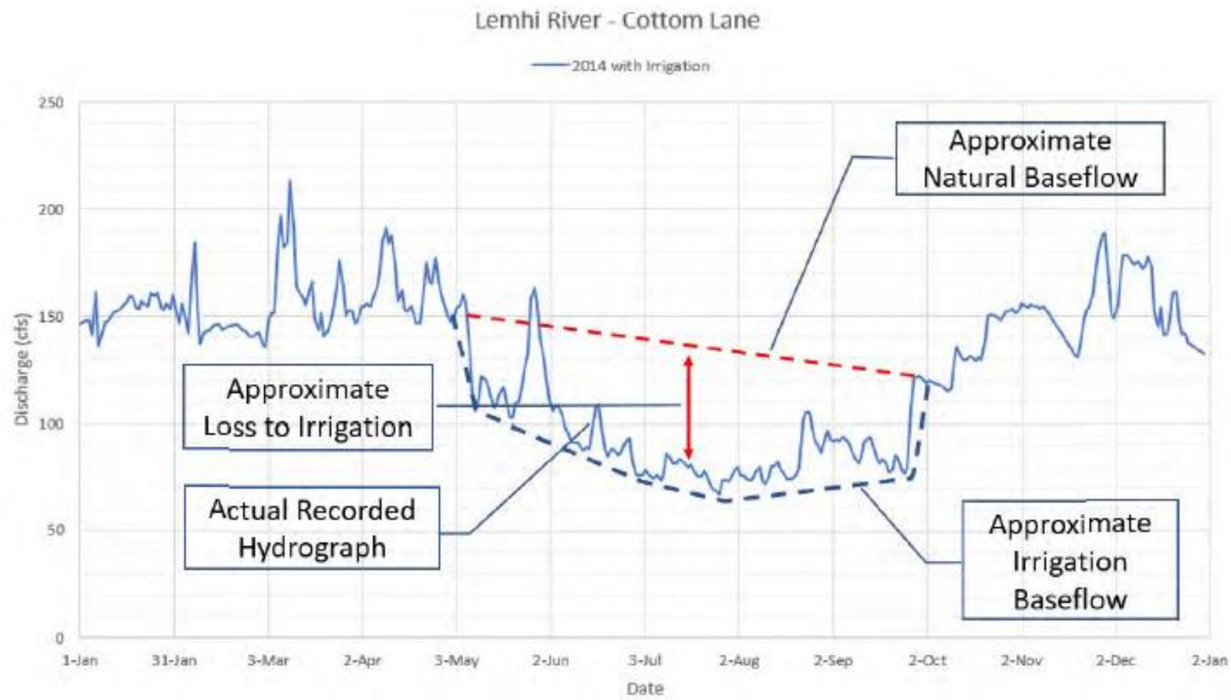

Figure 14. Annual hydrograph of the Lemhi River at Cottom Lane and estimated irrigation diversion magnitude (Rio ASE and Biomark 2021, Figure 4).

Since June 2022, flows have been recorded at USGS gage stations at Big Timber Creek near Leodore (USGS gage 13304050) and in the Lemhi River near McFarland (USGS gage 1330470), just downstream from the restoration site. Flows in Big Timber Creek had short-term peak flows just over 200 cfs in June 2022, and peak flows around 130 cfs in June 2023. Flows rapidly drop from the peak flows in early July. Flows begin to increase in March.

Flows in the Lemhi River at the USGS gage at McFarland show that, between August 10, 2022, and July 24, 2023, low flows occurred in August and September (between 45 and 60 cfs). Peak flows were as high as 298 cfs in April and 249 cfs in June. The average flow for the 11 months of available data is 122 cfs.

Water management improvements have been made for several decades, including improving flow conditions in tributary streams. Despite these improvements, the upper Lemhi River still requires a more normative hydrologic regime to promote habitat formation and improve fish access, particularly in light of future climate change effects (Rio ASE and Biomark 2021, p. 8). For these reasons the peak/base flows indicator is FR.

Climate Change

Per the definitions utilized by the NOAA Fisheries WCR Guidance to Improve the Resilience of Fish Passage Facilities to Climate Change (NMFS 2022a, entire), the proposed action is long-term with a lifespan of more than 20 years with four ESA-listed fish species present (Chinook salmon, steelhead, bull trout, and westslope cutthroat trout). The proposed action includes potential risk pathways for fish passage including water diversion for consumptive use in accordance with water rights, construction of a fishway, installation of culverts and bridges for stream crossings, and the potential use of trap and haul as a secondary approach for fish passage in the event that primary approaches are not meeting targets. In addition, mine closure and site restoration activities include stream restoration through the mine area with fish passage in a designed channel.

The proposed action water balances and temperature forecasts utilized for the development of the mine and closure designs employ sensitivity analyses to examine the potential range of future site conditions. These forecasts develop ranges for water diversion for consumptive use, contact water management, water treatment, restored stream channel flows, and riparian shading of restored stream segments. These ranges were incorporated into the component designs to allow for variability in stream flows (both high and low flows) and air temperature conditions. Idaho requirements for sizing channels and ponds were also applied so that the facilities will be engineered and constructed to contain high flow storm events with sufficient capacity and freeboard.

Because the operating lifetime of the proposed action will be approximately 15 years following a three-year construction period, effects of climate change during the operating lifetime will be limited by that duration. Therefore, there is less potential for climate change to affect proposed action operational components than components associated with mine closure and restoration. As such, the climate change risks associated with the post-closure components of the proposed action were prioritized and incorporated into the designs of the restored stream channels and their associated riparian shading so that the stream channels will respond to variable climatic conditions in a manner similar to natural drainages. Unlike the restored stream channels, water diversion for consumptive use and trap and haul practices will not continue past the operational period. Furthermore, access roads and stream crossings constructed for the proposed action will be removed during mine reclamation and closure.

The proposed action is located with the Columbia River watershed. As such, application of the NOAA Fisheries guidelines calls for use of the Bureau of Reclamation’s West-Wide Climate and Hydrology Assessment (BOR 2021, entire) for forecasting future trends in stream flow and temperature as affected by climate change. Within the Columbia River watershed, the assessment makes the following forecasts from the present through 2100:

- warming air temperatures by five degrees Fahrenheit with a range of +/- 5 degrees based on the 10th and 90th percentiles of forecasts used,
- consistent total annual precipitation within a range of +/-30%,
- decreasing April 1st snow water equivalents by 25% within a range of +/-45%,
- consistent total annual runoff within a range of +/-45%,

- increasing December-March runoff by 10% within a range of +/-65%,
- decreasing April-July runoff by 10% within a range of +/- 75%,
- a six month increase in mean drought durations, and
- an increase in the mean Palmer Drought Severity Index from 1.4 to 1.7.

Based on this assessment, the effects of climate change will primarily manifest as the following risk pathways identified in the NOAA Fisheries guidelines: drier dry extremes, decreased minimum flows, runoff starting earlier in the year, increased water temperature, and increased wildfire effects, which will significantly decrease the quality of bull trout habitat over time.

These forecasts are qualitatively consistent with Department of Agriculture climate change assessments for the area (Halofsky et al. 2018, entire). Action area flow data collected from USGS gauge 13313000 on Johnson Creek between 1929 and 2017 is also consistent with runoff earlier in the year when comparing recent periods (1988-2017 and 2012-2017) to earlier periods (1959-1988) and the overall record (1929-2017; USFS 2024, Figure 3.5-21).

4.2.3 Consultations Affecting Bull Trout in the Action Area

Other federal actions within the action area that have been consulted upon include the following:

The Final Biological and Conference Opinion on the Nationwide Aerial Application of Fire Retardant on National Forest System Land (USFWS 2023a, entire) discusses effects to bull trout from aerial fire retardant applications, which may affect bull trout in the action area as a result of chemical contamination from fire retardants entering waterways affecting water quality and thus bull trout health. Chemical applications can alter dissolved oxygen levels as a function of the altered vegetation or algal growth, impact the diversity or abundance of aquatic invertebrate prey items, or alter the water quality or prey resources; however, these effects are anticipated to only be temporary. Direct intrusions of fire retardant directly into bull trout occupied waters may result in injury or death, but this is anticipated to be a rare occurrence in the action area and effects will occur within the direct vicinity of the intrusion. Additionally, the Programmatic biological opinion and conference opinion for Fire Suppression Actions on the Boise National Forest outlines fire suppression actions that may result in disturbance to bull trout from water drafting, dipping, and scooping within rivers, lakes, and reservoirs that may change spawning, feeding, or avoidance behavior, reduce reproductive success, and lead to higher predation risk or direct mortality from entrainment while drafting water with a bucket during fire suppression activities in bull trout occupied waters. These actions are not anticipated to result in the decline of bull trout at the population level as mortality from these events is anticipated to be infrequent and few.

The biological opinion for the Payette National Forest Snow-Free Season Travel Management Plan assesses the effects of the ongoing use of approximately 2,261.5 miles of motorized roads and trails as well as 1,274.7 miles of non-motorized trails under the 2007 Travel Plan on bull trout. The action involves the authorization of vehicle use at two full vehicle ford crossings and 140 single-track trail crossings occupied by bull trout. Effects include injury and mortality to bull trout eggs, fry, and juveniles crushed in these crossings during vehicle use or affected by increased turbidity and suspended sediment that is created by vehicle crossings. As effects are limited to ford crossings on the Payette National Forest, the Service determined that the Snow-Free Season Travel Management Plan will not jeopardize the continued existence or impede recovery of the coterminous population of bull trout.

The biological opinion for the Payette National Forest's Authorization of the Yellow Pine Pit Lake Sampling Project (USFWS 2018a, entire) discussed the effects of draining and excavating the Yellow Pine Pit Lake (YPPL) as well as the effects of capture, tagging, and genetic sampling on bull trout in YPPL. This project had the potential to adversely affect bull trout during the collection of up to 750 bull trout (500 bull trout less than 65 mm in length and 250 bull trout greater than 65 mm in length) per year by seining and angling as well as through PIT tagging and fin clipping. All handled bull trout will be subject to stress, and up to 3% of the total fish handled and collected may die. As the action was limited to individuals present in the YPPL, the Service did not expect adverse effects at the population, core area, recovery unit, or rangewide levels.

The biological opinion for the Outfitter and Guide Operations on the Payette National Forest (USFWS 2021a, entire) permits 17 land-based outfitters and guides to host, lead, and organize a variety of activities including big game hunting, predator hunting, fishing, pack trips, hiking and backpacking, trail rides, ski touring, photography, mountain biking, and research and educational trips. The Opinion analyzes the effect of ford use during outfitter and guide operations that may lead to injury or death of juveniles or redds, however there will be no ford use that crosses spawning and rearing streams within the subwatershed that the action area occupies (Upper East Fork South Fork Salmon River) and thus no effects rising to the level of take within the action area itself.

The Payette National Forest Programmatic (USFWS 2021b, entire) discussed the effects of fish handling, riprap placement, turbidity and sediment, and herbicide use as a result of actions such as road maintenance, fire management, weeds, timber harvest and pre-commercial thinning, and aquatic monitoring. These activities are anticipated to result in injury or death of 48 juvenile and adult bull trout could be injured or killed annually and 51 bull trout could be injured or killed every three years. Also, bull trout within 600 ft of sediment sources or herbicide runoff may experience harm, harassment, or injury. As the action area for the Payette National Forest Programmatic consultation is large, activities will be spread out across ten years, and actions where take may occur will not be repeated in the same location annually, effects are anticipated to be dispersed across local populations. Therefore, this action may have small reductions in population numbers and the distribution of individuals, but is unlikely to have large scale impacts to bull trout across its range.

The biological opinion for the Stibnite ASAOC Removal Actions Project (USFWS 2022, entire) discussed the effects of mill and mine waste removal, stream diversions, and temporary road development on bull trout. Temporary increases in suspended sediment and turbidity, channel reconstruction, and stream diversion likely resulted in sublethal physiological effects and disturbance to bull trout, while electrofishing and block net use likely resulted in disturbance, injury, and potential mortality to individual adult, subadult, and juvenile bull trout during channel reconstruction. Because adverse effects were localized and limited to the Upper East Fork South Fork Salmon River population, the Service did not anticipate effects would rise to the South Fork Salmon River core area, Upper Snake recovery unit, or rangewide levels.

The biological opinion for the Stibnite Road Remediation Project (USFWS 2024, entire) analyzed the effects of streambank remediation actions and associated fish salvage on bull trout at emergency repair sites along the East Fork South Fork Salmon River. Fish salvage from this project is anticipated to result in three fish captured with one being injured or killed during handling. The Service concluded that the death of a single bull trout in the action area is not anticipated to greatly impact bull trout population size or distribution across the core area or range.

Additionally, there are three active programmatic biological opinions that overlap the action area including the Stream Crossing Programmatic (USFWS 2012a, entire), Idaho Habitat Restoration Programmatic (USFWS 2015c, entire), and the Payette National Forest Programmatic (USFWS 2021b, entire), which covers road maintenance, recreation operation and maintenance, fire management, invasive weed management, timber harvest, miscellaneous forest products, and aquatic and riparian monitoring. The Stream Crossing Programmatic expects incidental take of bull trout as a result of crushing of redds and individuals during temporary fords; impingement, injury, or death during the use of block nets, seines, electroshocking, and stream dewatering; and increased turbidity, although elevated suspended sediment construction and stream re-watering is not expected to rise to lethal levels. The Idaho Habitat Restoration Programmatic is expected to increase suspended sediment, cause short-term impacts to water quality due to herbicide application, and lead to the potential injury or death of bull trout from fish handling and stranding during work area isolation and dewatering. The Forest-wide Programmatic expects incidental take from fish handling activities (i.e., electroshocking, seining, using hook and line); road maintenance activities that require dewatering, salvage, and relocation of bull trout; placement of riprap; increased sediment inputs; and herbicide use. All three programmatics cover the entirety of the PNF and thus, are likely to have overlap in space and time with outfitter and guide operations. However, projects covered under these consultations do not have specified locations as of yet, which makes it difficult to estimate where or when overlap will occur, if bull trout will be affected, and how many projects and outfitter and guide activities will result in take. Therefore, it is difficult to estimate the level of impact, overlap, or cumulative effects from these consultations and the proposed outfitter and guide operations. These programmatic consultations require that every ten years the environmental baseline of the area and the expected effects be reexamined to determine if reinitiation of consultation is needed, which provides protection to the species. Furthermore, projects implemented under the following programmatic consultations are expected to positively contribute to the conservation and recovery of bull trout throughout the action area into the future.

4.3 Effects of the Proposed Action

Implementing regulations define "effects of the action" as "all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action but that are not part of the action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action" (50 CFR 402.02).

In the following evaluation, the Service in part relied upon the Forest's effects analysis in the Assessment (USFS 2024, entire), which is based on a series of assumptions about bull trout distribution, density, and habitat use in the action area. Because of the construct of these assumptions, the analysis is more likely to result in an overestimate, rather than underestimate, of the impacts of the proposed action on bull trout. When examining the potential impacts to a species that is listed as threatened under the Act, and there is substantial imprecision or uncertainty in some of the information, using assumptions that are more likely to overestimate, rather than underestimate, effects is a reasonably cautious and prudent approach for assessing impacts to populations of that species (USFWS 2023b, p. 30). Absent the consideration of the full potential of effects, detrimental impacts to the species can go unrecognized (National Research Council 1995, p. 167).

The Service also relied on previous experience with these similar types of actions and the published scientific literature regarding potential impacts to fish and their habitat to analyze the information presented in USFS 2024 (entire), and the anticipated impacts of the proposed action.

Where relevant, this Opinion will discuss environmental design features included within the proposed action that will reduce the degree or likelihood of potential impacts translating to adverse effects to bull trout and its habitat. These features include fish salvage following the IDFG scientific collection permit and the Service and NMFS guidelines prior to dewatering work areas, downstream turbidity monitoring, proper chemical containment, and staying within, or close to, instream work windows.

4.3.1 Stibnite Project Area

The effects matrices for the WCIs in the Stibnite project area are presented in USFS 2024, Appendix C. Key proposed action activities that may affect bull trout are identified in Table 21 for construction, Table 22 for operations, and Table 23 for closure and reclamation.

Table 21**.** Proposed action construction activities that may affect bull trout (USFS 2024, Table 4.1-18).

Mine Year	**Actions That Could Affect Bull Trout**
Minus 3 to Minus 1	Burntlog Route construction
Minus 3 to Minus 1	Transmission line construction
Minus 3 to Minus 1	EFSFSR tunnel and associated fishway completed, (2 years of construction) with EFSFSR, Midnight Creek, and Hennessy Creek flows diverted into the tunnel
Minus 2	Divert Meadow Creek and its tributaries around the TSF and TSF Buttress area including low-flow pipes to moderate temperature
Minus 1	YPP lake dewatering begins
Minus 1	Enhancement in EFSFSR (excluding YPP) and lower portion of Meadow Creek
Minus 1	Sediment control and rock drain constructed in East Fork Meadow Creek
Minus 1	EFSFSR and Meadow Creek enhancement, Meadow Creek restored around Hangar Flats pit
Minus 1	West End diversion completed.

Table 22. Key operations activities (USFS 2024 Table 4.1-19).

Mine Year	Actions That May Affect Bull Trout
1	Upper East Fork Meadow Creek meadow, groundwater table, and associated wetland restored
2	No significant stream changes
3	Meadow Creek diverted into constructed channel around the Hangar Flats pit footprint and downstream approximately 1,000 feet.
3	Restore the lower section of the East Fork Meadow Creek (downstream from the Rock Drain) to its new confluence with Meadow Creek
4 – 5	YPP backfill begins; no significant stream changes
6 – 7	Hangar Flats pit backfilled; no significant stream changes
7	West End Creek restored atop legacy DRSF
8	Fiddle Creek Restoration begin, but no flow diverted
8	Midnight pit backfilled; no significant stream change
9	Initial flow diverted into restored Fiddle Creek channel
10	YPP backfill completed; preparation for stream liner and placement of floodplain material and growth media; no significant stream changes
11	EFSFSR tunnel/fishway inactive with option to divert extreme high flows through tunnel to protect riparian vegetation development; EFSFSR restored on YPP and Stibnite Lake created
12	Pipe removed from upper Midnight Creek and haul roads and stream segment restored; no significant stream changes
12 -13	Flow diverted into EFSFSR, Hennessy Creek, and Midnight Creek restored channels
13	Restore East Fork Meadow Creek from upper meadow to confluence with Meadow Creek
13	Remaining road crossings removed and remaining portions of Midnight Creek restored (upstream from YPP); no significant stream changes

Mine Year	Actions That May Affect Bull Trout
13	Removal of diversion around West End pit
13	West End pit lake begins to fill; not expected to spill except possibly in extreme runoff
13	Final tailings deposited into TSF; TSF allowed to consolidate before placing stream liner and growth media
15	EFSFSR diversion tunnel deactivated
15	Flow increases in lower Meadow Creek
15	Plant site and ancillary facilities decommissioned and reclamation begins

Table 23. Key closure and reclamation activities (USFS 2024 Table 4.1-20).

Mine Year	Actions That May Affect Bull Trout
16	No significant stream changes
17	Non-perennial stream restored on the TSF buttress, and non-perennial streams and wetlands restored over backfilled Hangar Flats pit
16-18	Meadow Creek restored from toe of TSF to previously restored channel around Hangar Flats pit footprint
19	Meadow Creek surface preparation for stream liner; placement of floodplain material and grown media on top of the TSF and TSF Buttress. No significant stream changes
19-23	TSF contact water collection basins installed outside of Meadow Creek floodplain corridor; treated contact water discharged to non-perennial streams on TSF Buttress draining to restored wetland on backfilled Hangar Flats pit
19-23	Garnet Creek and associated wetland restored through decommissioned plant site
23	Plant site decommissioned
23	Meadow Creek stream restoration at TSF and TSF Buttress completed; restore perennial flow into new Meadow Creek channel and deactivate low flow pipes in Meadow Creek diversions

Mine Year	Actions That May Affect Bull Trout
23	Deactivate Meadow Creek diversions
23	Burntlog Route decommissioned and reclaimed
24	Fiddle Creek restored. All streams are restored and in final placement; no more significant stream alterations
40	End of water treatment
41	TSF contact water collection basins deactivated and Meadow Creek non-perennial diversions fully decommissioned, and non-perennial streams restored on TSF
41	Water treatment plant decommissioned, and water treatment plant site reclaimed

There will be limited mining activity in the Sugar Creek watershed (HUC 170602080202), with most effects associated with diverting the West End Creek around the West End pit. West End Creek is not fish-bearing and contributes relatively minor flow volumes to Sugar Creek (i.e., West End Creek inflow [mean flow of 0.51 cfs] is approximately 2% of Sugar Creek flow [21.2 cfs]). Predicted flow reductions in Sugar Creek attributable to the proposed action will be typically less than 1% with a maximum monthly difference of 3%. Predicted stream temperature changes will be between 0.1 and 0.3 °C, with maximum summer temperatures ranging from 15.5 °C to 15.7 °C compared to a baseline temperature condition of 15.4 °C. Application of fish habitat evaluation tools (i.e., intrinsic potential model, occupancy probability model, flow-productivity calculation, PHABSIM model) to these conditions in Sugar Creek will not indicate an observable change from existing conditions. For the other watersheds in the action area, proposed action-related effects are associated with site access and transportation, which are not expected to affect streamflow and temperature conditions to the degree that fish habitat evaluation tools will indicate change from existing conditions.

This effects analysis will focus on effects to bull trout local populations outside the mine site area in Burntlog Creek, Trapper Creek, and Riordan Creek/Lake and on local populations within the mine site area in the Upper EFSFSR and Sugar Creek because these are the areas where the majority of effects to bull trout will occur. Effects of direct mining activities are discussed in the context of the mine site. While most mining effects generally do not affect conditions outside the mine site, there is the potential for are some downstream effects caused by actions within the mine site, including temperature and chemical contaminants and these are discussed where applicable.

4.3.1.1 Watershed Condition Indicators

<u>Water Temperature</u>

As discussed in Section 4.2.2.1, water temperature is an important factor affecting the survival of each bull trout life stage. Sublethal water temperatures may influence respiration, growth rates, metabolism, and ecological interactions such as predation, competition, or disease, migration timing, and egg viability, which ultimately affect survival and population level. Elevated water temperatures may trigger avoidance of warmer areas into more suitable habitat characteristics, resulting in crowding in rearing and holding habitat.

The Water Quality Specialist Report (USFS 2023e, Section 7) provides details and references regarding the surface water temperatures during the construction, operations, and closure and reclamation periods. The SPLNT water temperature model was developed by Brown and Caldwell (2021c, entire) using two separate software packages: QUAL2K for stream temperature modeling, and the General Lake Model for simulating pit lake temperatures. After the SPLNT model had been appropriately calibrated to existing conditions, it was used to generate future temperature predictions for the proposed action in Meadow Creek, West End Creek, Sugar Creek, and the EFSFSR. A post closure timeline was also simulated to represent how the site will function after the mine facilities and permitted discharges have been removed, dewatering and mining have been discontinued, and the channels and vegetation have been fully reclaimed (USFS 2024, p. 368).

The SPLNT model results were integrated with other modeling efforts for the proposed action. Outputs from the hydrologic model and the site-wide water balance model became SPLNT inputs to simulate streams and pit lakes. Output from the General Lake Model component of the SPLNT model supported development of the SWWC model by providing temperature and dissolved oxygen profiles for the pit lakes.

The selection of simulation years for the SPLNT modeling (i.e., mine years 6, 12, 18, 22, 27, 32, 52, and 112) was based on model work planning with federal and state regulatory agencies (i.e., USFS, EPA, the Service, NMFS, OEMR, IDL, and IDEQ). Per that planning, mine year 6 was selected to represent the construction and operations periods because it represents the warmest conditions associated with the proposed action prior to the YPP reclamation activities in mine year 12. Characteristics that make mine year 6 the warmest year for the construction and operations periods are:

- The largest proposed action disturbance footprint and removal of riparian shading effects,
- Riparian plantings associated with early time restoration and reclamation activities will not have time to provide stream channel shading,
- Peak dewatering operations will result in the lowest groundwater elevations and groundwater discharge to streams will be lowest, and
- Treated water discharges of excess dewatering water will be highest with the greatest volume contribution of warmer treated water to streams.

Simulation of mine year 6 also includes the effects of the Meadow Creek diversion channel and low flow pipelines around the TSF area that will be installed at the start of construction and remain in use until closure of the TSF and restoration of the Meadow Creek channel on top of the reclaimed TSF. This cooling effect will be consistently present starting in mine year minus 3 until completion of the TSF reclamation, channel restoration, and associated environmental design features as necessary (anticipated in mine year 27). Mine year 12 represents the discontinuation of the use of the fish tunnel and the restoration of surface water flow across the restored stream channel across the YPP and through the Stibnite Lake feature but prior to the re-establishment of riparian vegetation along that restored channel segment. Mine year 18 represents the conditions at the end of mining operations.

Mine year 22 represents the conditions following completion of most closure activities with the notable exception of the TSF closure and restoration of the Meadow Creek channel on the reclaimed TSF surface which will take longer to complete due to the need to dry the TSF surface tailings so that equipment can access the TSF surface to install the reclamation cover. Mine year 27 represents the conditions following completion of the TSF closure and restoration of the Meadow Creek channel on its reclaimed surface but prior to the re-establishment of riparian vegetation. This includes discontinuation of the use of the Meadow Creek diversion around the TSF (i.e., via a constructed channel and low flow pipelines) and resumption of surface flow in the restored Meadow Creek channel. Mine years 32, 52, and 112 represent interim and final conditions associated with the re-establishment of riparian vegetation associated with restored stream segments.

For stream water temperature modeling, inherent sources of model uncertainty include:

- The actual effectiveness, timing, and sustainability of the shading effects of riparian plantings beside restored stream channels on reclaimed versus native soils and in an environment affected by weather events and wildfire, which will be based on shading effects rather than typical reclamation revegetation goals (e.g., 70% of pre-existing cover; Tetra Tech 2021, Vegetation Analysis – Methods, page B3-3; Brown and Caldwell 2021c, as cited in the USFS 2024, p. 369).
- The actual effectiveness of the constructed and lined Stibnite Lake feature in achieving simulated surface water temperature reductions attributed to the unlined YPP lake. Introduction of the lined lacustrine feature atop the lined and covered backfill in the YPP will modify the volume of diffuse subsurface groundwater inflow. The lined Stibnite Lake feature will receive minor inflow from the cover material in contrast to the existing groundwater inflow from native bedrock into the YPP lake. Depending on the hydraulic properties of the cover material compared to the native bedrock, the volume of groundwater inflow to the lake could differ from existing inflow rates with associated implications for resulting lake water temperature. As a conservative assumption, the current temperature model does not incorporate any potential cooling effects from subsurface inflow into the Stibnite Lake feature.
- Spatial variability associated with the reduction and recovery of groundwater levels and groundwater discharge to surface water.
- Potential broader effects of climate change on air temperature, meteoric precipitation, weather events, wildfire, and plant growth.

These sources of uncertainty relate largely to spatially and temporally variable implementation success and sustainability of closure activities that are difficult to simulate directly with a temperature model. Qualitatively, though, insufficiently effective closure activities or adverse changes in broader climate conditions could result in higher than predicted stream temperatures. Because of this uncertainty, the Forest is requiring additional monitoring and measures for the proposed action including increased riparian planting, mechanical shading, and snow harvesting during the closure and reclamation period.

Predicted future temperature increases from the proposed action were evaluated using a SPLNT model (Brown and Caldwell 2021c, Section 3), which calculated a MWMT. See USFS (2023a, as cited in USFS 2024, p. 375) for additional information on the modeling results. A summary of predicted water temperatures under the proposed action are presented in Table 24. The periods evaluated include the baseline conditions, those within mine operations (Mine Years 6, 12 and 18), and several in the post-closure period (Mine Years 22, 27, 32, 52 and 112). Temperatures were simulated for the years selected for the table because they correspond to peak temperature years and changes in the operational period (Mine Years 6, 12, and 18) followed by intervals of 5-, 10-, 30-, and 90-years post-closure. The SPLNT model assumes revegetation success per the Reclamation Closure Plan and Stream Restoration Design. Sensitivity analyses regarding the establishment of vegetation have been conducted and indicate that attaining more than 70% revegetation success is achievable. The post-closure period represents how the mine site will function after the facilities and permitted discharges have been removed, dewatering and mining have been discontinued, and the channels and vegetation have been fully reclaimed.

It should be noted the SPLNT model used for the temperature predictions in Table 24 do not account for changes to stream temperatures caused by changing climate conditions. This means that modeled future water temperatures (e.g., Mine Year 112) assumed that without the proposed action, stream temperatures will be similar to the historic water temperature data (Brown and Caldwell 2018, entire). In reality, water temperatures would likely be higher, and modeled water temperatures would have been higher, if climate change had been incorporated into the model. Climate change will be expected to increase water temperatures from baseline estimates to the end of the mine operations by as much as 0.1 °C to 2.0 °C based on forecasts for 2030-2059 (Isaak et al. 2016, as cited in USFS 2024, p. 376). This range of expected temperature increase attributable to climate change is based on a forecast period approximately 75 years shorter than the model predictions through Mine Year 112. Due to the potential effects of climate change and other uncertainties in stream water temperatures over the long-term, such as effects of stream restoration and riparian shading, later year model predictions have more uncertainty than earlier year model predictions. This uncertainty is discussed further in the sensitivity analysis section of Brown and Caldwell (2018, Section 5.3, pp. 5-4 to 5-5) and the uncertainty analysis section of USFS (2023a, Section 7.2.4, as cited in USFS 2024, p. 376).

Outside the Mine Site

Construction and Operations

The construction of the access roads (including the Burntlog Route) and the transmission line will occur along and over bull trout occupied streams (i.e., Cabin Creek [tributary to Warm Lake Creek], Burntlog Creek, Trapper Creek, and Riordan Creek). Riparian vegetation will not be removed except along areas of new road construction, but where possible, tree removal will be avoided. The construction of the road crossings as well as some tree trimming for the transmission line may result in a loss of riparian vegetation, as well as reduced vegetation overhead cover and stream shade until riparian vegetation can be reestablished. Stream shade will also be provided from the road crossings, even though this is an unnatural condition. Because riparian vegetation removal will be minimized or avoided where possible, it is anticipated that there will be limited, if any, effects to water temperature along the Burntlog Route and the transmission line; the proposed action will maintain the baseline condition (FA/FR) of the temperature WCI (USFS 2024, Table C-3).

Within the Mine Site

Construction

In the Upper EFSFSR, reductions in stream flows, draining of the Yellow Pine pit and loss of riparian vegetation during construction and operation will result in increased temperatures in several streams (e.g., EFSFSR downstream from Sugar Creek and EFSFSR between YPP and Sugar Creek) through Mine Year 12. Temperatures will decrease as riparian vegetation is restored (USFS 2024, Appendix C, Table C-4).

Operations and Closure and reclamation

In the EFSFSR upstream from Meadow Creek, water temperatures under baseline conditions tend to be cooler than the downstream reaches because this area consists of the headwaters, has minimal effects from historic mining, and much of the of riparian vegetation is still recovering from historic fires. Water temperatures in this section of the EFSFSR under all phases of the proposed action will be similar to those under baseline conditions because there will be no mining operations or vegetation removal along these reaches and, therefore, could be used as cool water refugia if other portions of the subwatershed have unsuitable thermal conditions.

Meadow Creek upstream from EFMC has slightly decreasing water temperatures during mine operations (Mine Year 6 through Mine Year 18, as shown in Table 24) because stream flow will be piped around the TSF and will not be exposed to solar radiation. Once the pipeline is removed (Mine Year 22), water temperatures will increase until around Mine Year 27, at which time the replanted riparian vegetation becomes more established and stream shade is increased and water temperatures begin to decrease. Vegetation replanting will take place in the five years following cover placement and stream restoration (i.e., Mine Year 23 through 27). This decrease continues through at least Mine Year 112.

Water temperatures in the warmer summer and fall months in Meadow Creek downstream from EFMC substantially decrease relative to the baseline conditions during mine operations and closure and reclamation activities (Mine Year 6 through Mine Year 18), though there is an increase at Mine Year 27, which then continues to decline until Mine Year 112 (Table 24). These decreases during mine operations are a result of decreased solar radiation in upper Meadow Creek. The removal of the low-flow piping along the TSF in Mine Year 22 will result in water temperatures increasing, though not as high as baseline conditions, and subsequently decreasing as the revegetation efforts take effect. This section retains some connection to groundwater which helps maintain a lower temperature as well.

The EFMC experiences around a 1 °C increase in summer and fall maximum water temperatures during mine operations (starting at Mine Year 6) through sometime before Mine Year 52, at which point the temperatures decline compared to the baseline conditions (Table 24). The temperature changes in EFMC during the operations phase are due to the removal of vegetation and sediments as part of the channel restoration work. Restoration activities on the EFMC are scheduled to begin in mine year 1, with the construction of the rock drain starting in Mine Year 3. Once the reclamation activities, including the establishment of the restored riparian vegetation, are fully established, particularly stream shade from overhanging vegetation, water temperatures begin to decrease (starting in Mine Year 27), and drop below baseline conditions by Mine Year 52. By Mine Year 112, the reduction in water temperature between the meadow upstream from the restored channel and the lower EFMC is around 0.3 and 0.4 °C for both the summer and fall maximums.

The EFSFSR between Meadow Creek and YPP experiences decreases in summer maximum water temperatures relative to baseline conditions during the operations period. There is a negligible increase in temperatures after Mine Year 22 (but still lower than baseline conditions) once the Meadow Creek low-flow piping along the TSF is removed. Temperatures continue to decrease once the riparian vegetation grows to a size that will provide stream shade. Stream enhancements made to the reach above YPP will result in a lower temperature than baseline conditions, which will be greater than the increase associated with warmer water entering the EFSFSR from Meadow Creek in the closure period. Fall maximum water temperature decrease throughout the operations, closure, and reclamation (Table 24). These modeling results indicate that the proposed action will have insignificant effects to water temperature. However, USFS 2024, (Table C-4, Effects Matrix for the Mine Site) states that the reductions in stream flow, draining of the YPP, and loss or riparian vegetation during construction and operation will result in increased temperatures in some streams within the action area (e.g., EFSFSR downstream from Sugar Creek and EFSFSR between YPP and Sugar Creek through Mine Year 12 [Table 24]); the proposed action will therefore degrade the baseline condition of the temperature WCI in the short-term but improve water temperature in the long-term.

Table 24. Maximum weekly water temperatures during July (Summer) and September (Fall) for modeled mine years for the proposed action (USFS 2024, Table 4.1-34).

Stream	Season	Baseline (°C)	Mine Year								Change from Baseline		
			6 (°C)	12 (°C)	18 (°C)	22 (°C)	27 (°C)	32 (°C)	52 (°C)	112 (°C)	to 27 (°C)	to 52 (°C)	to 112 (°C)
EFSFSR Upstream from Meadow Creek	Summer	13.4	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	-0.1	-0.1	-0.1
	Fall	11.0	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	-0.1	-0.1	-0.1
Meadow Creek Upstream from EF Meadow Creek	Summer[1]	14.0	12.4	12.3	12.4	12.4	20.8	18.6	17.1	15.1	6.8	3.1	1.1
	Fall[1]	12.0	10.5	10.5	10.5	10.5	16.0	13.8	12.7	11.3	4.0	0.7	-0.7
	Summer[2]	16.8	13.5	13.0	13.1	13.1	21.7	20.2	18.5	16.0	4.9	1.7	-0.8
	Fall[2]	14.2	11.2	11.0	11.1	11.0	15.9	14.4	13.1	11.5	1.7	-1.1	-2.7
Meadow Creek Downstream from EF Meadow Creek	Summer	19.4	17.6	16.5	16.3	16.1	18.5	17.9	16.6	15.2	-1.4	-2.8	-4.2
	Fall	15.9	15.5	13.6	13.2	13.0	13.9	13.3	12.4	11.6	-2.0	-3.5	-4.3
EF Meadow Creek	Summer	14.6	15.8	15.4	15.3	15.2	14.9	14.8	14.4	14.2	0.3	-0.2	-0.4
	Fall	12.6	13.5	13.1	12.9	12.8	12.8	12.6	12.4	12.3	0.2	0.0	-0.3
EFSFSR between Meadow Creek and YPP	Summer	17.3	16.3	15.6	15.8	15.9	16.3	15.9	15.2	14.7	-1.0	-2.1	-2.6
	Fall	13.9	13.5	12.6	12.6	12.4	12.5	12.3	11.9	11.7	-1.4	-2.0	-2.2
EFSFSR between YPP and Sugar Creek	Summer	14.1	16.1	15.8	15.7	15.6	15.6	15.4	14.8	14.5	1.5	0.7	0.4
	Fall	11.2	13.0	12.4	12.0	11.8	11.8	11.6	11.3	11.1	0.6	0.1	-0.1
EFSFSR Downstream from Sugar Creek	Summer	14.9	16.0	15.0	15.1	15.1	15.0	14.9	14.7	14.5	0.1	-0.2	-0.4
	Fall	11.9	12.5	11.6	11.6	11.5	11.6	11.5	11.3	11.3	-0.3	-0.6	-0.6

Increased temperatures attributable to climate change are not incorporated in the reported predicted values.
Uncertainty in predicted temperature values increases over time due to assumptions made about the effects of stream restoration and riparian shading.
[1] Temperatures based on distance weighted average of all QUAL2K reaches.
[2] Temperatures based on distance weighted average of the QUAL2K reaches along the TSF and TSF Buttress area.

The EFSFSR between YPP and Sugar Creek, and the EFSFSR roughly 1 km downstream from Sugar Creek, experience an increase in summer and fall maximum water temperatures at Mine Year 6 caused primarily by the draining of the YPP lake followed by active mining and mine dewatering that removes cooling influences of upstream shading and groundwater discharge to surface water (Table 24). By Mine Year 12, water temperatures start to drop, as the YPP is backfilled, the EFSFSR stream channel is restored, and Stibnite Lake is expected to cause a reduction in water temperatures (USFS 2024, p. 377). As riparian vegetation is re-established and begins to provide stream shade, water temperatures will continue to drop. By Mine Year 112, summer maximum water temperatures in the EFSFSR between YPP and Sugar Creek are about 0.2 °C higher than baseline conditions, but fall maximum temperatures, and summer maximum and fall maximum temperatures below Sugar Creek end up between 0.2 and 0.6 °C below baseline conditions (Table 24).

The EFSFSR downstream from the Sugar Creek confluence is influenced by both the changes in temperature in the EFSFSR upstream (described above), as well as inflow from Sugar Creek. The proposed action has negligible effects on water temperatures in Sugar Creek. The substantial increase in temperatures in the early operations phase is caused primarily by the YPP dewatering and mining. By Mine Year 12, temperatures begin to drop due to the restoration of the EFSFSR and creation of the Stibnite Lake. The temperatures after this point have minimal changes due to the influence of Sugar Creek (USFS 2024, p. 371).

Stream temperature thresholds for bull trout are discussed in Section 4.2.2.1. ESS (2022a, entire) presents quantification of baseline habitat availability (in relation to stream temperature) for bull trout and analyzes the likely effects of changes to stream temperatures on available habitat as a result of implementation of the proposed action. The following is a summary of the analysis and potential impacts to bull trout from water temperature changes in streams at the mine site.

Table 25 presents the length of streams that have positive bull trout occupancy probability that fall within the temperature threshold categories for bull trout life stages. Length of habitat for bull trout juvenile rearing are based on the amount of habitat with suitable thermal conditions using the summer (July) maximum temperatures; while spawning and incubation/emergence apply the fall (September) maximum temperature. Methods for this analysis are described in USFS 2024, Section 4.1.3.3 (Chinook Salmon Specific Effects - Water Temperature). Detailed data for bull trout in the action area are presented in ESS (2022a, entire).

Water temperatures from the YPP cascade to just under 1 km downstream from the Sugar Creek confluence do not meet the temperature thresholds for any life stage of bull trout. Although temperatures do not currently meet the thresholds, bull trout do occupy these stream reaches as rearing juveniles and adults. It is likely that bull trout will continue to rear in EFSFSR between Sugar Creek and the YPP barrier once the channel has been restored.

Under baseline conditions, bull trout primarily occur in the upper reaches of Meadow Creek and in the EFSFSR upstream from the Meadow Creek confluence, though they were periodically observed in the Meadow Creek, both upstream and downstream from the proposed TSF (USFS 2018, Table 7; MWH 2017, Section 5.4.3). Bull trout were not observed or collected in the EFSFSR downstream from the Meadow Creek confluence, but bull trout eDNA has been detected in this reach (Figure 9).

Table 25. Length of stream habitat under the watershed condition indicator categories for water temperatures for bull trout under the proposed action (USFS 2024, Table 4.1-54).

Life Stage	Baseline (km)	Mine Year								Change from Baseline to 112 (km)
		6 (km)	12 (km)	18 (km)	22 (km)	27 (km)	32 (km)	52 (km)	112 (km)	
Below Yellow Pine Pit Cascade Barrier										
Spawning	0	0	0	0	0	0	0	0	0	0
Incubation/Emergence	0	0	0	0	0	0	0	0	0	0
Juvenile Rearing	0	0	0	0	0	0	0	0	0	0
Total Available Habitat	2.01	1.48	1.66	1.66	1.66	1.66	1.66	1.66	1.66	-0.35
Above Yellow Pine Pit Cascade Barrier										
Spawning	0	0	0	0	0	0	0	0	0	0
Incubation/Emergence	0	0	0	0	0	0	0	0	0	0
Juvenile Rearing	5.02	3.34	2.61	2.61	2.61	2.77	3.40	2.77	3.40	-1.62
Total Available Habitat	24.2	16.34	16.70	17.75	17.75	16.05	16.05	16.05	16.05	-8.15

[1] Analysis based on Fall (September) MWMT.
[2] Percent of stream length is based on the modeled occupancy potential habitat.
[3] Analysis based Summer (July) MWMT.

During operations, water temperatures do not meet the thresholds for spawning and incubation in the EFSFSR or Meadow Creek. Temperatures suitable for rearing bull trout, however, do occur in both Meadow Creek and the EFSFSR. Under baseline conditions, just over 5 km of stream habitat provides suitable conditions for bull trout rearing. The length of suitable habitat is reduced compared to the baseline conditions under all Mine Years. More specifically, ESS (2022a, pp. 16–36) reports that available habitat in the EFSFSR from YPP to Meadow Creek would increase from 5.93 km (baseline) to 6.65 km (mine year 112). Available habitat in the EFSFSR from Sugar Creek to YPP would decrease from 1.12 km to 0.73 km, and in Meadow Creek, available habitat would decrease from 13.27 km to 4.40 km. Available habitat in the EFSFSR above Meadow Creek is predicted to be unaffected by the proposed action.

Most of the habitat lost in Meadow Creek is due to construction of the TSF and TSF Buttress in upper Meadow Creek. Because there will be no potential for bull trout to migrate into upper Meadow Creek, it is likely that bull trout will be extirpated from this reach (USFS 2024, p. 437).

Stream reaches in the mine site do experience significant seasonal and diurnal variations, and for mobile life stages (i.e., adults and juveniles), if MWMT are above the thresholds, fish may avoid areas within streams, if they are able, and find thermal refuges. Through stream restoration and enhancement actions, stream cover and instream structures may provide thermal refugia, assuming the thermal refugia is nearby. If, however, thermal refugia is not in close proximity, or if bull trout are not able to access the refugia (or if the movement to a new location results in an increased density that affects prey availability), these fish will be impacted, affecting growth rate, egg viability, or survival (USFS 2024, p. 437).

Changes in water temperature in Meadow Creek could affect up to approximately 32 bull trout. Unsuitable temperatures in the EFSFSR between YPP and Sugar Creek could affect 155 bull trout (USFS 2024, p. 437). Based on modeled results, bull trout will experience a significant reduction in thermally suitable habitat caused by proposed action activities (USFS 2024, p. 437).

Sediment/Turbidity

Fish population abundance, distribution, and survival have been linked to levels of turbidity and silt deposition. Excess sediment can degrade spawning gravels, reduce embryo survival and emergence, impair growth and survival of juvenile salmonids, fill pool habitat, and reduce the productivity of aquatic macroinvertebrates and other prey items for fish (Bjornn et al. 1977, Abstract; Suttle et al. 2004, p. 969). Prolonged exposure to high levels of suspended sediment may create a loss of visual capability in fish in aquatic habitats within the action area, leading to reduced feeding and growth rates; a thickening of the gills, potentially causing the loss of respiratory function; clogging and abrasion of gills; and increases in stress levels, reducing the tolerance of fish to disease and toxicants (Waters 1995, pp. 79–119; Newcombe and MacDonald 1991, entire). It can also cause the movement and redistribution of fish populations. Many fish, including salmonids, are sight feeders; turbid waters reduce the ability of these fish to locate and feed on prey. Some fish, particularly juveniles, likely will become disoriented and leave the areas where their main food sources are located, ultimately reducing growth rates.

Prey of fish populations, such as macroinvertebrates, could be adversely affected by declines in habitat quality (water quality and substrate conditions) caused by increased turbidity, decreased dissolved oxygen (DO) content, an increased level of pollutants (Coull and Chandler 1992, entire), and (although unlikely) an extreme change in pH or water temperatures (Rundle and Hildrew 1990, p. 411).

The use of roads, accessing drilling sites, and drilling activities of the Burntlog geophysical investigation may result in increased sediment production. In total, there are nine investigation sites located in RCAs (USFS 2024, p. 185). Transportation on existing routes is not expected to significantly increase sediment delivery from road use as the total number of trips will be similar to ordinary traffic levels. There is a need to access two drilling sites through areas with wetland characteristics via off road travel that could increase sediment delivery to streams. However, the use of pressure reducing mats when accessing these sites is expected to minimize disturbance to RCAs and sediment production to insignificant levels. Drilling pads will be buffered from streams with straw waddles or hay bales and cross drains, if needed, to prevent sediment produced from reaching streams, which is expected to reduce any sediment entering streams to insignificant levels. Additionally, if turbidity is observed to be elevated compared to upstream levels, operations will cease, and the source of sediment will be identified.

The Geomorphic Roads Analysis and Inventory Package Lite (GRAIP Lite) model was used to simulate sediment generation and sediment delivery to streams by travel activities associated with the proposed action (Tetra Tech 2024, entire). Based on these model results, sediment accumulation in streams is also modeled. The GRAIP Lite model used terrain data and selected parameter values representing road materials, maintenance level, and usage to calculate sediment quantities. For the proposed action, the model simulated three scenarios:

- Existing conditions involving public use of the Johnson Creek Road (CR 10-413), Stibnite Road (CR 50-412), existing portions of the Burntlog Road (FR 447), Thunder Mountain Road (FR 50375), Meadow Creek Lookout Road (FR 51290), and existing on-site roads,
- Construction conditions with public use of Johnson Creek Road, Stibnite Road, existing portions of the Burntlog Road, Thunder Mountain Road, Meadow Creek Lookout Road, and existing on-site roads and proposed action construction use of the Johnson Creek Road, Stibnite Road, and on-site roads.
- Operational conditions with public use of Johnson Creek Road, Stibnite Road, existing portions of the Burntlog Road, Thunder Mountain Road, Meadow Creek Lookout Road, and a relocated on-site road and proposed action operational usage of the new Burntlog Route and on-site roads.

Closure road usage will resemble the operational conditions with usage reducing over time. Post-closure road usage will resemble the existing conditions once new portions of the Burntlog Route have been obliterated and reclaimed as part of the closure activities.

Key differences between scenarios involve improvements in road surfaces, improvements in road maintenance, and increases in traffic level as the proposed action implements road construction and road maintenance activities per its Transportation Management Plan.

Depending on the specific section of road, existing road surfaces consist of native materials (e.g., Meadow Creek Lookout Road and Thunder Mountain Road), improved native materials (e.g., on-site roads), and gravel (e.g., portions of the Stibnite Road and Johnson Creek Road). Upon initiation of construction activities, the Johnson Creek Road, Stibnite Road, and on-site roads are upgraded to gravel roads from their existing condition. The Meadow Creek Lookout and Thunder Mountain Roads are upgraded to improved native materials.

For the operating period, the Burntlog Route and on-site roads are modeled as gravel roads. In the GRAIP Lite model, this road surface assignment is conservative for the purposes of forecasting sediment generation. Requirements for dust control and operational road conditions will result in the use of dust suppressing and road stabilizing treatments (i.e., magnesium chloride) that reduce sediment generated from roadways. For gravel roads, magnesium chloride application has a similar effectiveness as traditional bituminous and concrete treatments applied to stabilize roads and control sediment generation (USFS 2009, entire). The GRAIP Lite model does not support simulation of magnesium chloride treatments but does support simulation of bituminous surface treatments. Modeling the Burntlog Route and on-site roads using the bituminous surface treatments in GRAIP Lite (instead of as gravel roads) will yield reduced sediment generation predictions.

Under existing conditions, the Johnson Creek and Stibnite Roads are maintained to a condition suitable for passenger cars while the on-site roads, existing Burntlog Road, Meadow Creek Lookout Road, and Thunder Mountain Road are maintained to a condition suitable for high clearance vehicles. Upon initiation of construction activities, the Johnson Creek Road, Stibnite Road, and Burntlog Route are improved to a condition suitable for a moderate degree of user comfort while on-site roads are improved to a condition suitable for passenger cars. The Meadow Creek Lookout and Thunder Mountain Roads remain in their condition suitable for high clearance vehicles.

The GRAIP Lite model does not support incorporation of specific BMPs for sediment control (e.g., sediment detention ponds, ditch cleaning). Therefore, the model's quantification of sediment production conservatively does not account for the effects of sediment controlling BMPs included as requirements or design features for the proposed action.

Under existing conditions, traffic levels are categorized as low except for some of the on-site roads that experience medium levels of traffic. During construction, traffic levels on the Johnson Creek Road, Stibnite Road, and Burntlog Road increase to high and all on-site roads have a medium traffic level. Subsequently during the operating period, traffic levels on the Johnson Creek Road and Stibnite Road return to their low existing condition while traffic levels on the Burntlog Route are high and on-site traffic levels are high or medium. Traffic levels on the Meadow Creek Lookout Road and Thunder Mountain Road are low for all three scenarios.

Outside the Mine Site

Construction and Operations

Construction and use of roads can accelerate erosion and sediment delivery to streams and have been identified as the primary contributor of sediments to stream channels in managed watersheds (Trombulak and Frissell 2000, p. 18). The Burntlog Route was selected because it avoids the largest number of landslide prone areas; however, there is some landside potential along the Burntlog Route which will need to be mitigated by avalanche controls (DAC 2021, entire). During the Burntlog Route construction, including bridge and culvert installations, the potential exists for increased runoff, erosion, and sedimentation resulting from localized vegetation removal and soil excavation which could result in increased sediment load in streams. Construction of and upgrades to access roads creates a potential for increased runoff, erosion, and sedimentation as a result of localized vegetation removal and excavation of soil, rock, and sediment, which could result in increased sediment load in streams. Standards and guidelines in the Boise Forest Plan and Payette Forest Plan (USFS 2003, entire, 2010, entire) that are designed to reduce or prevent undesirable impacts resulting from proposed management activities are incorporated into the proposed action. The EDFs beyond regulatory requirements that have been proposed are listed in USFS 2024, Appendix B and include "Erosion control techniques at the proposed action will include mulching, wetland sodding; planting of vegetation to stabilize slopes; and use of silt fences, biofilters, brush mats, erosion control fabric, and/or fiber rolls along temporary swales, perimeter dikes, and stream banks." New cut or fill slopes not protected with some form of stabilization measures will be seeded and planted with native vegetation to prevent erosion. Use of temporary erosion and sediment control EDFs and BMPs (USFS 2024, Appendix B) also will be employed.

During the construction phase, the proposed action will be accessed by routes that will cross 43 streams along existing roads that will be used for mine site access (e.g., Johnson Creek), and crossing 28 streams for the Burntlog Route, including the existing Burntlog Road (Table *3*). In addition to the stream crossings, approximately 6.5 mi (18% of its 36-mi length) of the Johnson Creek Route is in close proximity to streams (i.e., within 100 ft). The number of vehicle trips per day (one way trip) is used as a metric for potential increases in erosion and sedimentation. A total of 65 vehicle trips per day will occur during the construction phase, consisting of 20 light vehicles and 45 heavy vehicles (e.g., bulldozers, rollers, graders, excavators, pickup trucks, crew-haul vehicles). The 65 trips will be along the Johnson Creek route (USFS 2023c, p. 41).

During the mining and ore processing operations phase (approximately 15 years), a total of 50 vehicle trips per day are anticipated on average (year-round) during operations utilizing the Burntlog Route. The 50 trips will consist of 17 light vehicles and 33 heavy vehicles. The 50 trips will be along the newly constructed Burntlog Route. During the closure and reclamation phase, traffic along the Burntlog Route will be reduced to a total of 27 vehicle trips per day (year-round).

For stream crossings, culverts and bridges will be installed or replaced at crossings along the Johnson Creek (CR 10-579), McCall-Stibnite (CR 50-412), and Burntlog (Forest Road 447) roads. The road improvement will not involve replacement of existing bridges at their current locations or culverts at their current locations along CR 10-579 and CR 50-412. Culverts will be repaired if a need for maintenance was observed during monitoring of the road condition. Six of the installed bridges that cross stream segments with fish passage will be new or upgraded, while 7 stream crossing culverts that cross segments with fish passage (based on drain area analyses and environmental DNA [eDNA] data) will be new, upgraded, or replaced. Existing bridges and culverts along Warm Lake Road will remain. If not properly designed, constructed, and maintained, culverts and bridges could constrict natural stream flow leading to an increase in water velocity at the downstream end of the structure. This could lead to stream bank and/or streambed erosion, and/or excessive erosion at the structure. Erosion of the streambed and/or banks could result in downstream sedimentation, a change in the morphology of the stream, and/or a change to the aquatic habitat. If a structure does not allow for adequate flow, water could pool excessively on the upstream side. As such, stream crossings associated with access roads will be designed to minimize potential impacts on surface water hydrology, water quality, and fish passage. The Forest will require stream crossings to be designed to accommodate a 100-year flood recurrence interval, unless site-specific analysis using calculated risk tools, or another method determines a more appropriate recurrence interval. The fish passage guidelines established by NMFS (2022a, entire) will be applied.

During the Burntlog Route construction including bridge and culvert installations, the potential exists for increased runoff, erosion, and sedimentation as a result of localized vegetation removal and excavation of soil, rock, and sediment, which could result in increased sediment load in streams. Project design features (USFS 2024, Appendix B), prominent regulatory and Forest Plan requirements, and anticipated permit stipulations from the IDWR and IDEQ will ensure that streambank vegetation will be protected except where removal is absolutely necessary; that new cut or fill slopes not protected with some form of riprap will be seeded and planted with native vegetation to prevent erosion; use of temporary erosion and sediment control BMPs associated with a stormwater pollution prevention plan; and that all activities will be conducted in accordance with Idaho environmental anti-degradation policies, including IDEQ water quality regulations and applicable federal regulations.

For the Burntlog Route, the potential for sedimentation will be minimized using standard erosion control measures, such as silt fencing, ditch checks, and other measures, which will be installed and maintained to minimize the potential for erosion and sedimentation. Numerous small (15- to 60-inch) drainage culverts will be installed along the Burntlog Route to reduce rutting and shunt water out of ditches and off the road prism, which will serve to reduce erosion from the road into streams. A hardened road surface with gravel surfacing will be maintained to promote an efficient and useable all-weather road while minimizing erosion (Perpetua 2022b, Section 3.1.1, p. 3-1).

Specific design requirements will be required as part of the IDWR Stream Channel Alteration Permit, such as line of approach, minimum bridge clearance and minimum culvert size per length, and anchoring on steep slopes. Bridges and culverts will be maintained to allow proper drainage and limit sediment delivery to area streams.

Based on prominent regulatory and Forest Plan requirements, as well as EDFs beyond regulatory requirements that have been proposed (USFS 2024, Appendix B), use of BMPs, and required maintenance activities, the potential for access road-related erosion and sedimentation will be equivalent to a maintained Forest Service Road (limited to periods of substantial overland flow, such as from very large rainfall events). The required road maintenance BMPs include:

- Removal of debris from roadways
- Dust control per air quality permit
- Stormwater control per multi-sector general permit
- Debris and excess vegetation removed from the bottom of ditches and culverts at the beginning of every Fall season
- Ditches graded to remove excess sediment and re-establish longitudinal and side slopes at the beginning of every spring and fall season

- Road cross slope and shoulder slopes inspected and graded as necessary at a minimum of the beginning of every spring and fall season
- Repair or upgrade culverts depending on stormwater demand and existing culvert capacity each fall season
- Snow removal for winter use
- Avoidance of snow disposal in riparian and wetland areas
- Wintertime sanding with coarse sand
- Road surface repairs to keep roadways functional

Utilities associated with the proposed action (existing transmission line upgrades and structure work, ROW clearing, new transmission line, and transmission line access roads) will cross 37 different streams (USFS 2023e, pp. 160–161, Table 7-24). Of the 37 streams, 26 will be related to the upgrade of existing IPC transmission lines, where the existing transmission line ROW crosses various streams. The existing transmission line currently crosses multiple streams, including Little Creek, Cabin Creek, Trout Creek, and Riordan Creek. The ROW overlaps with 132.4 acres of RCAs (USFS 2023d, Table 7-5) . However, the utility poles are not directly along the creeks or within the RCA, and the line is currently kept cleared for access when necessary. Upgrades of these lines, while requiring a wider clearing zone, the effects will be limited to trimming of trees that pose a fire risk to the power line.

Transmission line access roads will cross Big Creek and Cabin Creek. Bull trout DNA was detected in Cabin Creek (USFS 2020, p. 31, Table 13). The BNF conducted DNA sampling in upper Big Creek but did not detect any bull trout DNA. The new transmission line will cross three creeks with only one being perennial (Riordan Creek). According to data collected by the BNF, Riordan Creek supports bull trout upstream from Riordan Lake, and rainbow trout (*O. mykiss*; resident) and bull trout downstream from Riordan Lake. The ROW overlaps with 14.8 acres of RCAs (USFS 2023d, Table 7-5).

During transmission line upgrades and new transmission line construction, the potential exists for increased runoff, erosion, and sedimentation as a result of vegetation removal within the ROW, and the localized excavation of soil, rock, and sediment for structure work and/or ROW access roads. Project design features (USFS 2024, Appendix B) and anticipated permit stipulations from IDWR and IDEQ will be similar to the examples provided above for access roads and will ensure the use of erosion and sediment control BMPs, such as stabilizing rills, gullies, and other erosion features, associated with a stormwater pollution prevention plan. ROW vegetation clearing will retain vegetation root structure within soils thus reducing erosion concerns.

Surface water quality also could be impacted during construction by fugitive dust from vehicles and heavy equipment that settles into adjacent water bodies. Reduction of these potential impacts will be achieved through fugitive dust control. In dry months, water will be sprayed on mine haul roads as necessary to mitigate dust emissions in compliance with state and Forest Service requirements. Water used to control fugitive dust will come from the applicant’s permitted water supply or may be purchased from private water rights holders.

The extent of sedimentation effects from fugitive dust will be concentrated; however, due to the nature of sediment transport by streams, the geographic extent of the impact could extend farther downstream in the EFSFSR depending on site- and event-specific factors. The duration for traffic-related dust and erosion/sedimentation will last throughout the mine construction, operations, and post-closure periods; however, the potential for these effects will be incrementally reduced during closure and reclamation due to reduced activity in the action area and stabilization of disturbed areas. Effects of fugitive dust on fish will impact waters outside of the mine site including downstream of the action area. Health impacts to fish from sedimentation due to fugitive dust will be sub-lethal disturbance but could be prolonged in duration.

To manage sediment, the following BMPs are included as part of the proposed action:

- Prior to construction, BMPs such as berms, weed-free wattles, weed-free straw bales, and/or site grading will be used to limit erosion;
- Run-on stormwater will be diverted around mine components to prevent erosion from disturbed ground surfaces;
- Stormwater diversions will be equipped with energy dissipating features to limit erosion;
- Contact water from disturbed mine surfaces will be collected and consumed by the mine process or treated to meet discharge standards;
- Surface water discharges will be equipped with energy dissipating features to limit erosion;
- Stream water intakes will be designed and located to inhibit generation of turbidity from surface water intake;
- Diversion tunnel around the YPP will be equipped with a sediment trap located at its inlet;
- Fugitive dust will be controlled by water and dust suppressants applied to roadways along with using crushed rock running surfaces; and
- Temporary disturbance will be equipped with silt fencing, weed-free wattles, weed-free straw bales, and or diversion berms.

Under baseline conditions and during the construction period, there are 125 kilometers (km; 75 mi) of roadway available for traffic. During operations after the Burntlog Route and on-site roads are in use, there are 180 km (108 mi) of roadway available for traffic. Based on GRAIP Lite model results, the magnitudes and locations of sediment generation and sediment delivery to streams changes between the modeled scenarios as shown in Table 26.

Table 26. GRAIP Lite model results (USFS 2024, Table 4.1-22).

Metric	Baseline Conditions	Construction Phase	Change from Baseline Conditions	Operations Phase	Change from Baseline Conditions
Sediment generation (kilogram/year)	387,955	264,925	-32%	419,478	8%
Sediment delivery to streams (kg/year)	93,371	65,622	-30%	120,609	29%
Sediment accumulation in streams (metric tons/year)	8,901	6,143	-31%	11,779	32%

The decrease in overall sediment generation, delivery to streams, and accumulation during the construction period compared to existing conditions is due to the upgraded road surfaces and improved road maintenance. The increase in overall sediment generation, delivery to streams, and accumulation during the operations period compared to existing conditions is due to increased traffic and roadway lengths that offset upgrades and improvements in road conditions. Under operating conditions, the location of predicted sediment generation also changes relative to the existing conditions and construction conditions as the focus of mine-related traffic becomes the Burntlog Route and on-site roads (Table 27).

Table 27. Predicted sediment loading by road segment (USFS 2024, Table 4.1-23).

Road Segment	Baseline Conditions		Operations Phase	
	Sediment Generated (kg/year)	Sediment Delivered (kg/year)	Sediment Generated (kg/year)	Sediment Delivered (kg/year)
Johnson Creek Road	78,441	27,736	18,458	7,544
Stibnite Road	23,407	10,875	12,792	5,992
Burntlog Road/Burntlog Route	65,233	13,450	118,706	40,306
On-Site Roads	102,156	24.637	140,988	46,820
Meadow Creek Lookout Road and Thunder Mountain Road	118,717	16,675	128,534	19,947

Once the Burntlog Route is in use, predicted travel-related sediment generation and delivery on the Johnson Creek Road and Stibnite Road decreases due to the reduced traffic and their construction period upgrades and improvements of the roads. Predicted sediment generation and delivery on the Burntlog Route and on-site roads increase due to the increased traffic on these roads without the representation of magnesium chloride surface treatments and sediment control BMPs in the model. For the Meadow Creek Lookout Road and Thunder Mountain Road, predicted sediment generation and delivery increase slightly due to changes in their geomorphology where they intersect the Burntlog Road without the representation of sediment control BMPs in the model.

The effects in the predicted changes in sediment generation and delivery between scenarios are also evident in the predicted locations of sediment accumulation in streams. Under existing conditions, sediment accumulation in streams occurs primarily along the Johnson Creek Road and Stibnite Road, and to a lesser extent, in the on-site area. Construction period road upgrades and improvements are predicted to decrease the sediment accumulation along the Johnson Creek Road and Stibnite Road while sediment accumulation in the on-site area is comparable to the existing condition. Operations period predictions exhibit sustained decrease in sediment accumulation along the Johnson Creek Road with increased sediment accumulation in the on-site area. Predicted sediment accumulation along the Stibnite Road returns to existing conditions because improvements in the Stibnite Road condition are offset by sediment delivery upstream in the on-site area (USFS 2024, Figure 4.1-13).

The overall effects of construction of temporary roads and transmission lines on sedimentation on fish and aquatic habitat are expected to include localized behavioral and sub-lethal health impacts, as well as habitat alterations; however, the implementation of BMPs and EDFs will substantially reduce the effects (USFS 2024, Appendix B).

In addition to sediment delivery to streams associated with access road construction and use, instream work for culvert and bridge construction and replacement have the potential to resuspend instream sediments resulting in increased turbidity levels and downstream deposition of fine sediments. Once in streams, fine sediment may be transported downstream or deposited in slow water areas and behind obstructions, locally altering habitat conditions. As noted previously, fine sediment can fill interstitial spaces and eliminate habitat for various microorganisms, aquatic macroinvertebrates, and juvenile fish (Waters 1995, pp. 111–116).

Excessive sediment can affect salmonids at multiple life stages. Deposition of silt on spawning beds can fill interstitial spaces (Myers and Swanson 1996, p. 245; Phillips et al. 1975, p. 461; Wood and Armitage 1997, p. 203), impede water flow, and reduce dissolved oxygen levels, which can cause suffocation and entrapment of incubating embryos (Bjornn and Reiser 1991, p. 98; Chapman 1988, pp. 1–5). Elevated turbidity levels reduce availability of invertebrate food for resident adults. For example, a 12 to 17% increase in interstitial fine sediment can be associated with a 16 to 40% reduction in the total abundance of stream invertebrates (Ryan 1991, p. 212).

Increased sediment and suspended solids have the potential to also affect primary production due to reductions in photosynthesis within murky waters. Thus, overall food availability for fish may be reduced as sediment levels increase (Cordone and Kelley 1961, pp. 189–190; Henley et al. 2000, pp. 129–133; Lloyd et al. 1987, p. 18). Social and feeding behaviors may be altered as areas with high concentrations of suspended sediments would be avoided, subsequently reducing feeding efficiency, growth rates, and survival of bull trout (Berg and Northcote 1985, p. 1410; Hicks et al. 1991, pp. 483–485; Suttle et al. 2004, p. 973). For example, the growth rates of steelhead are reduced by 62% in turbid water (49 NTUs) compared to individuals reared in clear water (Sigler et al. 1984, p. 1). Increased sediment can also decrease summer rearing and overwintering cover for juveniles (Hillman et al. 1987, p. 185; Griffith and Smith 1993, p. 823). This, in combination with reduced food availability, could alter bull trout distribution as they would need to move outside of turbid areas in order to acquire necessary resources.

Fish can and do easily disperse, which is evidenced by juvenile coho salmon, arctic grayling, and rainbow trout observed avoiding turbid waters (Henley et al. 2000, p. 132). Therefore, bull trout would also be able to relocate when sediment load is increased in order to avoid elevated turbidity. Studies have shown that within one year following ground-disturbing activities, sediment loads appear to return to previous conditions, which suggests that sediment effects would be localized and short-term (Karwan et al. 2007, p. 186). Newcombe and Jensen (1996, pp. 694–698) report that suspended sediment concentrations of 500 milligrams per liter (mg/L) for three hours cause signs of sublethal stress in adult steelhead. If suspended sediment concentrations reach 22,026 mg/L at any one time, or remain at concentrations of 3,000 mg/L for three hours lethal effects could occur (Newcombe and Jensen 1996, pp. 694–698). Furthermore, moderate physiological stress such as gill trauma and temporary adverse changes in blood physiology such as elevated blood sugars, plasma glucose, or plasma cortisol can occur when suspended sediment concentrations reach 3,000 mg/L for up to an hour (Servizi and Martens 1987, p. 258, 1992, p. 1391; Bash et al. 2001, pp. 10–12; Newcombe and Jensen 1996, p. 706).

Literature reviewed in Rowe et al. (2003, p. 6) indicated that Nephelometric Turbidity Unit (NTU) levels below 50 generally elicit only behavioral responses from salmonids thereby making this a suitable surrogate for sublethal effects. Moreover, Idaho state water quality standards use NTUs when measuring suspended solids and require that turbidity plumes do not rise more than 50 NTUs over background levels, 600 feet downstream from a project site (Rowe et al. 2003, p.12). Suspended sediment and turbidity are correlated, but this correlation can vary by watershed and even within the same watershed (Henley et al. 2000, pp. 128–129). Although the relationship between suspended sediment and turbidity in the EFSFSR is unknown, we used a regression equation developed by Dodds and Whiles (2004, p. 357)[1] to estimate the suspended sediment concentration associated with 50 NTUs. The equation yields a suspended sediment concentration of 173 mg/L. According to Newcombe and Jensen (1996, p. 698), bull trout exposed to suspended sediment concentrations of 173 mg/L for one hour are likely to be subject to sublethal effects in the form of short-term reductions in feeding rate and feeding success. This finding supports the conclusion that adhering to the Idaho state water quality standard for turbidity during project implementation will result in insignificant disturbance, but not result in injury or mortality of bull trout. The proposed action also includes instream work area dewatering and isolation, staged rewatering, and turbidity monitoring that will further reduce the potential for significant turbidity effects.

[1] Dodds and Whiles (2004) conducted a regression analysis using data from 622 water quality stations located throughout the U.S. The resulting equation has an r squared value of 0.89. The equation is $\log_{10} \text{TSS (mg/L)} = 0.606 + 0.960*(\log_{10} \text{NTU})$, where TSS equals Total Suspended Solids.

Within the Mine Site

Construction

During construction, there is an increased risk to disturb, excavate, and move soil and overburden (alluvial and glacial materials), thereby raising the potential for sediment runoff and suspended sediment increases in surface waters. The TSS in surface water are generally correlated with turbidity (NTU), which is a more visually apparent estimator of sediment contamination. Under baseline conditions, turbidity is generally low (less than 5 NTU) with occasional spikes of up to 70 NTU during snowmelt or rainfall events (USFS 2023e, Table 6-14). The greatest potential for increases in stream sedimentation will come during storm events causing overland flow across exposed soil, excavated areas, and roads.

The GRAIP Lite model results shows a substantial decrease in sediment delivery, sediment input into the streams, and sediment accumulation. **Error! Not a valid bookmark self-reference.** shows the change in sediment production, delivery and accumulation during construction, and Table 29 shows the annual sediment delivery by drainage crossing type. Therefore, sedimentation in the waterways under construction will be decreased compared to baseline conditions. Additional details regarding the GRAIP model and its results are provided in Tetra Tech (2024, entire).

Table 28. Sediment production, delivery, and accumulation under baseline and construction conditions (USFS 2024, Table 4.1-24).

Metric	Baseline Conditions	Construction	Percent Change from Baseline
Kilometers of roads modeled	125	125	0
Sediment Production (kg/year)	387,955	264,925	-32%
Sediment delivery to streams (kg/year)	93,371	65,622	-30%
Sediment accumulated in streams (kg/year)	8,901,299	6,142,548	-31%

Table 29. Annual sediment delivery to drainage crossings under baseline and construction conditions (kg/year) (USFS 2024, Table 4.1-25).

Sediment Delivery per Drainage Crossing Type	Johnson Creek	Stibnite Road	Burntlog Route	On-Site Roads
Bridges				
Baseline	627	111	740	4
Construction	566	69	682	3
Culverts				
Baseline	1,477	3	1,238	208
Construction	1,340	50	757	461
Total				
Baseline	2,104	114	1,978	212
Construction	1,906	119	1,439	464

The BMPs will be employed for near-stream or instream work such as removal of legacy materials and stream restoration to minimize the potential for coarser sediment generation or mass wasting that will affect sediment transport and deposition. Under baseline conditions, sediment entering the EFSFSR primarily comes from Sugar Creek, Meadow Creek, and EF Meadow Creek (USFS 2023e, p. 64). Applicable sediment control design techniques BMPs will be used to minimize sediment runoff and erosion along roads and excavated areas. On the mine site and along the Burntlog Route, project design features and anticipated permit conditions from IDWR and IDEQ will protect streambank vegetation, require culvert maintenance, and require low impact snow removal techniques.

In addition to runoff from new ground disturbance, diversions of stream channels during the construction period have the potential to introduce turbidity during the period following the diversions. Meadow Creek and Garnet Creek will be diverted in Mine Year minus 2 while segments of Garnet Creek and EF Meadow Creed will also be reconstructed during that period. Fiddle Creek, Hennessy Creek, and Midnight Creek will be diverted in Mine Year minus 1. Design features and BMPs as described in USFS 2024, Appendix B will be employed to pre-rinse diversion channels and introduce flows slowly to limit generation of new turbidity by the diversions.

Reaction to sedimentation and turbidity by bull trout could include behavioral effects, such as avoidance, as well as potentially causing impaired respiration. Additionally, there could be habitat impacts from sediment causing increased substrate embeddedness and decreasing the spawning habitat conditions. However, EDFs and BMPs (e.g., turbidity monitoring) described in USFS 2024, Appendix B will significantly reduce the risk of these impacts to bull trout.

Operations

Active mining will disturb, excavate, and move soil and overburden, thereby raising the potential for sediment runoff and suspended sediment increases in surface waters. However, contact water controls will be in place to capture runoff from mine facilities. On the mine site and along the Burntlog Route, project design features and anticipated permit conditions from IDWR and IDEQ will protect streambank vegetation, require culvert maintenance, and require low impact snow removal techniques.

Upon completion of mining in the YPP, the pit will be backfilled and covered with a geosynthetic liner. A restored segment of the EFSFSR will be routed on top of the backfilled and covered pit and flow diverted through the tunnel will be re-routed to the restored channel. Design features and BMPs as described in USFS 2024, Appendix B will be employed to pre-rinse diversion channels and introduce flows slowly to limit generation of new turbidity by the diversions.

Also, during the operational period, surface discharge of treated waters has the potential to generate turbidity. These IPDES permitted outfalls will be constructed with energy dissipation at their discharge location to minimize the turbidity generated by introduction of additional flow into the stream channel. The TSS in surface water are generally correlated with turbidity (NTU), which is a more visually apparent estimator of sediment contamination. Under baseline conditions, turbidity is generally low (less than 5 NTU) with occasional spikes of up to 70 NTU during snowmelt or rainfall events (USFS 2023e, p. 67, Table 6-14)).

The greatest potential for increases in stream sedimentation will come during storm events causing overland flow across exposed soil, excavated areas, and roads. BMPs, such as mulching, wetland sodding; planting of vegetation to stabilize slopes; and use of silt fences, biofilters, brush mats, erosion control fabric, and/or fiber rolls along temporary swales, perimeter dikes, and stream banks (USFS 2024, Appendix B), will be employed for near-stream or instream work such as removal of legacy materials and stream restoration to minimize the potential for coarser sediment generation or mass wasting that will affect sediment transport and deposition.

The GRAIP Lite model results show an increase in sediment delivery, sediment input into the streams, and sediment accumulation, primarily because of the additional 55 km of road compared to baseline. Table 30 shows the change in sediment production, delivery and accumulation during operations, and Table 31 shows the sediment delivery to drainage crossings by location and crossing type.

Table 30. Sediment production, delivery, and accumulation under baseline and operation conditions (USFS 2024, Table 4.1-26).

Metric	**Baseline Conditions**	**Operations**	**Percent Change from Baseline**
Kilometers of roads modeled	125	180	+44%
Sediment Production (kg/year)	387,955	419,478	+8%
Sediment delivery to streams (kg/year)	93,371	120,609	+29%
Sediment accumulated in streams (kg/year)	8,901,299	11,778,886	+32%

Table 31. Annual sediment delivery to drainage crossings under baseline and operation conditions (kg/year; USFS 2024, Table 4.1-27).

Sediment Delivery per Drainage Crossing Type	**Johnson Creek**	**Stibnite Road**	**Burntlog Route**	**On-Site Roads**
Bridges				
Baseline	627	111	740	4
Construction	168	118	874	330
Culverts				
Baseline	1,477	3	1,238	208
Construction	514	172	5,346	415
Total				
Baseline	2,104	114	1,978	212
Construction	682	290	6,220	745

Applicable sediment control design techniques BMPs (USFS 2024, Appendix B) will be used to reduce sediment runoff and erosion along roads and excavated areas. On the mine site and along the Burntlog Route, prominent regulatory and Forest Plan requirements and anticipated permit conditions from IDWR and IDEQ will protect streambank vegetation, require culvert maintenance, and require low impact snow removal techniques. Surface water quality also could be impacted during operations, closure, and reclamation by fugitive dust from vehicles and heavy equipment that settles into adjacent water bodies, as described above, outside the mine site.

Potential sediment impacts on bull trout will include temporary turbidity increases during runoff events and localized deposition of fine sediment in stream channels. Some sediment may be transported to downstream areas. Turbidity increases during runoff events have the potential to temporarily change fish behavior but are unlikely to be severe enough, relative to baseline fluctuations, to cause fish mortality or health impacts (detailed in Construction and Operations Outside the Mine Site Area section). Channel dewatering and fish salvage will remove fish-bearing waters from the active mine prior to excavation. Direct impacts from sediment runoff will be restricted to access routes and areas at the edge of the active mine; and sediment impacts in these areas will be further limited by erosion control BMPs. Increases in fine sediment deposition within stream channels have the potential to decrease spawning gravel suitability and decrease benthic invertebrate production within gravel riffles. With the application of sediment reduction BMPs and surface runoff minimizing design techniques such as those mentioned above (USFS 2024, Appendix B), the impacts of sediment in surface water, as well as interstitial sediment, to fish are predicted to be measurable but not severe, limited to the mine site, and occur during the active mining period. However, the restoration efforts in the EF Meadow Creek will result in a substantial decrease in sediment input into Meadow Creek and the EFSFSR. The effects of the proposed action on sediment and turbidity during operations on bull trout will cause significant long-term and localized impacts to their behavior and health and impair bull trout habitat; however, the implementation of BMPs and EDFs will substantially reduce the effects to the fish. For more details on the effects of turbidity on bull trout see the Outside the Mine Area - Construction and Operations section above.

Closure and Reclamation

During the post closure period design features and BMPs will remain in place as mine disturbance is covered, reclaimed, and revegetated to control runoff from mine facility areas. Stream flow will be reintroduced into restored stream segments in Meadow Creek across the TSF. Design features and BMPs as described in USFS 2024, Appendix B will be employed to pre-rinse diversion channels and introduce flows slowly to limit generation of new turbidity by the diversions.

Also, during the closure/post-closure period, surface discharge of treated waters has the potential to generate turbidity. These IPDES permitted outfalls will be constructed with energy dissipation at their discharge location to minimize the turbidity generated by introduction of additional flow into the stream channel.

As noted above, the effects of sediment and turbidity during operations on bull trout will cause significant long-term and localized impacts to their behavior and health and impair bull trout habitat; however, the implementation of BMPs and EDFs will substantially reduce the effects to the fish. In addition, the restoration efforts in the EF Meadow Creek will result in a substantial decrease in sediment input into Meadow Creek and the EFSFSR.

Chemical Contaminants

The proposed action will include handling and storage of mineralized materials which could potentially leach major ions, TDS, and/or metals. Mineralized materials that will be managed include ore, development rock, and newly generated tailings. Similarly, mineralized materials will be exposed in pit walls, also resulting in exposure to oxygen and water, and the potential for leaching. Several proposed activities, including storage of mineralized materials above engineered liners and/or below engineered covers, diversion of stormwater and surface water around the disposal locations, and movement of legacy mineralized materials (tailings) from their current locations to engineered disposal facilities, will reduce, but not eliminate, the potential for the release of leached chemicals to surface water and groundwater. Because of project design features and removal of historical source materials, the expected surface water metal concentrations will be improved or consistent with existing conditions.

Remaining rock in pit walls and the development rock, deposited in the TSF Buttress and pit backfills, will be largely non-acid generating, but will be capable of leaching aluminum, antimony, arsenic, cadmium, copper, manganese, mercury, zinc, sulfate and total dissolved solids (TDS) into surface water and groundwater in concentrations that exceed water quality criteria. Therefore, active contact water collection and water treatment will be required for a period of time during the operations and closure and reclamation period until geochemical stability of mined materials can be achieved. In the case of the TSF where stabilization will depend on consolidation of tailings plus liner and cover installations over the tailings, this collection period will be approximately 40 years. The water treatment will prevent mine-impacted waters with elevated analyte concentrations from contacting surface water in the environment. Upon closure, inundation of development rock placed in pit backfills will result in analyte leaching from the backfilled material to alluvial and bedrock groundwater. However, this leaching will not materially affect the utilization of groundwater compared to its existing condition where it frequently does not meet water quality criteria except for an area where antimony and arsenic concentrations are below groundwater standards.

The proposed action will also include the use, storage, and transport of hazardous materials which, if released, could affect the environment. Hazardous materials used will include diesel fuel, gasoline, lubricants, antifreeze, other petroleum products, chemical reagents and reactants (including sodium cyanide and sulfuric acid), antimony concentrate, mercury containing residuals, lime, explosives, and other substances.

Duration of spill risk will be long term as it will last throughout the life of the proposed action. However, the duration of any single hazardous materials spill or release will be temporary (hours or days). A fuel or chemical spill at facilities will likely be readily contained and cleaned up without any release to the environment.

A spill outside of containment at the mine site or during transportation will likely involve liquid fuels or reagents. A small spill of a few gallons, or even tens of gallons, outside of secondary containment will be promptly contained and cleaned up according to the Spill Prevention Control and Countermeasures Plan (SPCCP).

A larger spill of fuel or oil outside of secondary containment will more likely occur during transportation of bulk shipments along public roads or one of the access routes. The proposed controls of transportation of hazardous materials along the access routes, and the availability of spill response resources and trained responders suggest that a spill along the access routes will be promptly contained and cleaned up. However, depending on the amount of material released, the location of the release, weather conditions, and proximity to flowing streams, the impact of the event could be negligible to major. Given the low risk of a spill, implementation of the EDFs and BMPs in USFS 2024, Appendix B and the SPCCP, effects to bull trout from a spill will be discountable.

State and federal regulations, project controls, and emergency response procedures will be in place to reduce spill risk and the extent of potential spill impacts. The Water Quality Specialist Report (USFS 2023e, Section 7) provides details and references regarding the potential sources of chemical contaminants and predicted concentrations in surface waters during the construction, operations, and closure and reclamation periods. The degree of potential predictive error from the model assumptions and project design features was evaluated through sensitivity analysis simulations. Of the model uncertainties, the sensitivity analysis mainly addressed the potential for acid-generation and leaching reactions. Additional model runs also were conducted to evaluate the sensitivity of scaling assumptions related to the proportion of preferential flow paths and finer particle gradation in the TSF Buttress and pit backfills, as well as the pit wall fracture thickness and density. Findings from the site-wide water chemistry (SWWC) model sensitivity analysis evaluation include the following:

- Varying model input parameters for the sensitivity analysis had little effect on the mine operations model results.
- In one of the model sensitivity runs, the neutralization potential ratio (NPR) cutoff for defining potentially acid generating (PAG) material was increased to 2 (resulting in a greater percentage of pit wall rock and development rock lithology types being classified as PAG). The post-closure model results were not sensitive to increasing the NPR cutoff. The lack of model sensitivity to this parameter occurs because the mass loading rates for some constituents are lower in the PAG model source term input compared to some non-PAG units. Thus, increasing the percentage of PAG rock in the TSF Buttress and pit lake models does not lead to higher predicted post-closure concentrations.
- The model is not sensitive to varying the pit wall blast-damaged zone thickness.
- The model is most sensitive to inputs that vary the bulk scaling factor of reactive rock, including the percentage of development rock fines, the percentage of rock contacted due to preferential flow paths through the TSF Embankment and Buttress, and increasing the reaction temperature.

- When the bulk scaling factor of reactive rock is increased, concentrations of arsenic, antimony, sulfate, mercury, and aluminum are predicted to increase in contact water derived from the mined materials.

Although not considered in the sensitivity analysis, mass loading from IPDES outfalls was examined in a water treatment scenario evaluated in the Water Quality Management Plan (Brown and Caldwell 2020a, entire). Results of the water treatment simulation show that concentration reductions achieved by treating mine contact water greatly outweigh any loading contribution from the water treatment plant outfall.

Overall, the sensitivity analyses and the water treatment evaluations address model uncertainty and non-conservative assumptions associated with acid-generation potential, IPDES outfalls, and leaching reaction rates. The sensitivity analysis and model treatment simulations show that changing the NPR cutoff for defining PAG material and adding the load from the water treatment plant outfall do not substantially alter predicted mine operational or post closure concentrations. However, increasing the reaction temperature in mined materials and pit walls was shown to produce higher post-closure arsenic concentrations in the pit lakes and downstream assessment nodes. Incorporation of first-flush chemistry in the model predictions will slightly increase predicted analyte concentrations.

Despite analysis area improvements to water quality as a result of the removal and reclamation of legacy mine wastes, exceedances of the most stringent water quality standards (including both human health and aquatic life) for water column antimony, arsenic, and mercury are anticipated, but predicted concentrations will be less than or comparable to existing conditions. In considering only the aquatic life criteria, which are more relevant for the protection of fish species, impacts due to antimony and arsenic are not anticipated. For mercury, impacts are predicted to be minimal but uncertainties in predicting future conditions exist (USFS 2024, p. 323).

Construction

Risk of chemical contamination from construction is generally related to spill risk as described in the section above.

Operations

Potential sources of chemical contaminants during operations were the subject of a site-wide water quality assessment that is fully described in the Water Quality Specialist Report (USFS 2023e, Section 7) along with the predicted chemical concentrations and uncertainties associated with predicted. At a high level, sources of contaminants included:

- tailings,
- ore stockpiles,
- development rock placed in the TSF embankment and buttress,
- development rock backfilled into open pits,
- treated water discharges, and
- runoff from mine disturbance.

Thirty-three analytes were tested and simulated during the analysis which identified arsenic, antimony, and mercury as the constituents of interest for water chemistry.

The predicted chemistry concentrations are summarized in Table 32, with specific concentrations for all constituents for the construction, operations, and closure periods presented in USFS 2022 (Section 4.9 as cited in USFS 2024, p. 330). Specifically, predicted concentrations in streams appear in USFS 2022; Tables 4.9-18 to 4.9-21 and Figures 4.9-22 to 4.9-25 as cited in USFS 2024, p. 330.

The West End pit lake, unlike other active mine and facility areas, will not be reclaimed or restored and will therefore have impacts on fish in perpetuity. Based on the pit lake geochemical model (USFS 2023e, Section 7.2.2.3), predicted West End pit lake water chemistry exhibits circumneutral pH conditions with TDS concentrations below 130 mg/L. Antimony, arsenic, and mercury concentrations exceed the strictest potentially applied water quality standards throughout the operating and closure period. Predicted concentrations of copper and lead are expected to exceed the strictest potentially applied water quality standards during pit dewatering operations, when produced water is routed for consumptive use and water treatment but decrease below those levels as the lake fills. Concentrations of arsenic, mercury, and antimony are predicted to slightly exceed the strictest potentially applied water quality standards permanently post-closure. The West End pit lake will be fishless given the absence of fish in West End Creek. Therefore, impacts to bull trout from contaminants in the West End pit lake will be limited to contaminants entering Sugar Creek via outlet spillage or seepage after the closure and reclamation of the mine. The discharge of West End Creek into Sugar Creek will be approximately 0.05 cfs, small relative to the flow of the creek and any contaminants from the West End pit lake will be further diluted at the confluence with the EFSFSR. Effects of the proposed action to fish, including bull trout in Sugar Creek, from the West End pit lake contaminants will be permanent and restricted to Sugar Creek and waters immediately downstream. Contaminants could contribute to elevated concentrations under existing (Baldwin and Etheridge 2019, entire) operations and post-closure conditions as described in the following section.

Table 32. Predicted exceedance of analysis criteria, operations, and post closure for assessment nodes (USFS 2024, Table 4.1-28).

Constituent of Concern		**Aluminum[1]**	**Copper[2]**	**Antimony[3]**	**Arsenic[4]**	**Mercury[5]**
Analysis Criteria		**0.050 mg/L**	**0.0024 mg/L**	**0.0052 mg/L**	**0.010 mg/L**	**2 ng/L (total mercury)**
Nodes	**Stream**					
Exceedance During Operations (Highest Concentration)[6]						
YP-T-27	Meadow Creek	None	None	Seasonal peaks lower than baseline seasonal peaks (0.007 mg/L versus 0.018 mg/L).	Seasonal peaks lower than baseline seasonal peaks (0.023 mg/L versus 0.083 mg/L).	Seasonal peaks above baseline seasonal peaks (5 ng/L versus 2 ng/L).
YP-T-22	Meadow Creek	None	None	Seasonal peaks lower than baseline seasonal peaks (0.014 mg/L versus 0.025 mg/L).	Seasonal peaks lower than baseline seasonal peaks (0.018 mg/L versus 0.075 mg/L).	Seasonal peaks above baseline seasonal peaks (5 ng/L versus 2 ng/L).
YP-SR-10	EFSFSR	None	None	Seasonal peaks lower than baseline seasonal peaks (0.018 mg/L versus 0.030 mg/L).	Seasonal peaks lower than baseline seasonal peaks (0.023 mg/L versus 0.051 mg/L).	Seasonal peaks higher than baseline seasonal peaks (4 ng/L versus 3 ng/L).
YP-SR-8	EFSFSR	None	None	Concentrations below baseline conditions (0.004 to 0.021 mg/L versus 0.006 to 0.031 mg/L) throughout mining.	Concentrations below baseline conditions (0.012 to 0.032 mg/L versus 0.018 to 0.052 mg/L) throughout mining.	Seasonal peaks higher than baseline seasonal peaks (4 ng/L versus 3 ng/L).
YP-SR-6	EFSFSR	None	None	Concentrations below baseline conditions (0.005 to 0.027 mg/L versus 0.006 to 0.030 mg/L) throughout mining.	Concentrations at or below baseline conditions (0.013 to 0.041 mg/L versus 0.017 to 0.041 mg/L) throughout mining.	Seasonal peaks at baseline seasonal peaks (3 ng/L versus 3 ng/L).

Constituent of Concern		Aluminum[1]	Copper[2]	Antimony[3]	Arsenic[4]	Mercury[5]
Analysis Criteria		**0.050 mg/L**	**0.0024 mg/L**	**0.0052 mg/L**	**0.010 mg/L**	**2 ng/L (total mercury)**
Nodes	**Stream**					
YP-SR-4	EFSFSR	None	None	Concentrations primarily below baseline conditions (0.005 to 0.063 mg/L versus 0.008 to 0.056 mg/L) throughout mining. Concentrations above baseline occur in Mine Year -2 at the transition from baseline to construction.	Concentrations below baseline conditions (0.013 to 0.097 mg/L versus 0.019 to 0.120 mg/L) throughout mining.	Seasonal peaks at baseline seasonal peaks (3 ng/L versus 3 ng/L).
YP-SR-2	EFSFSR	None	None	Concentrations primarily below baseline conditions (0.004 to 0.041 mg/L versus 0.005 to 0.037 mg/L) throughout mining. Concentrations above baseline occur in Mine Year -2 at the transition from baseline to construction.	Concentrations below baseline conditions (0.010 to 0.066 mg/L versus 0.014 to 0.076 mg/L) throughout mining.	Concentrations at or slightly above baseline conditions (4 to 10 ng/L versus 3 to 10 ng/L) throughout mining.
YP-T-6	West End Creek	None	None	None	None	Concentrations above baseline conditions 37 to 63 ng/L versus 4 to 6 ng/L) throughout mining.
YP-T-1	Sugar Creek	None	None	None	Concentrations at or slightly below baseline conditions (0.007 to 0.015 mg/L versus 0.007 to 0.016 mg/L) throughout mining.	Concentrations at or slightly above baseline conditions (6 to 9 ng/L versus 6 to 8 ng/L) throughout mining.
Exceedances Post-Closure (Highest Concentration)[6]						
YP-T-27	Meadow Creek	None	None	Seasonal peaks lower than baseline seasonal peaks (0.008 mg/L versus 0.018 mg/L) until Mine Year 20.	Seasonal peaks lower than baseline seasonal peaks (0.017 mg/L versus 0.083 mg/L) until Mine Year 20.	Seasonal peaks at baseline seasonal peaks (2 ng/L versus 2 ng/L) throughout post-closure period.

Constituent of Concern		Aluminum[1]	Copper[2]	Antimony[3]	Arsenic[4]	Mercury[5]
Analysis Criteria		**0.050 mg/L**	**0.0024 mg/L**	**0.0052 mg/L**	**0.010 mg/L**	**2 ng/L (total mercury)**
Nodes	**Stream**					
YP-T-22	Meadow Creek	None	None	Seasonal peaks lower than baseline seasonal peaks (0.006 mg/L versus 0.025 mg/L) until Mine Year 20.	Seasonal peaks lower than baseline seasonal peaks (0.013 mg/L versus 0.075 mg/L) until Mine Year 20.	Seasonal peaks at baseline seasonal peaks (2 ng/L versus 2 ng/L) throughout post-closure period.
YP-SR-10	EFSFSR	None	None	None	Seasonal peaks lower than baseline seasonal peaks (0.013 mg/L versus 0.075 mg/L) until Mine Year 20.	Seasonal peaks at baseline seasonal peaks (3 ng/L versus 3 ng/L) throughout post-closure period.
YP-SR-8	EFSFSR	None	None	Seasonal peaks lower than baseline seasonal peaks (0.011 mg/L versus 0.031 mg/L) throughout post-closure-period.	Concentrations below baseline conditions (0.012 to 0.025 mg/L versus 0.018 to 0.052 mg/L) throughout post-closure period.	Seasonal peaks at baseline seasonal peaks (3 ng/L versus 3 ng/L) throughout post-closure period.
YP-SR-6	EFSFSR	None	None	Concentrations below baseline conditions (0.005 to 0.020 mg/L versus 0.006 to 0.030 mg/L) throughout post-closure period.	Concentrations below baseline conditions (0.012 to 0.029 mg/L versus 0.017 to 0.041 mg/L) throughout post-closure period.	Seasonal peaks at baseline seasonal peaks (3 ng/L versus 3 ng/L) throughout post-closure period.
YP-SR-4	EFSFSR	None	None	Concentrations below baseline conditions (0.005 to 0.023 mg/L versus 0.008 to 0.056 mg/L) throughout post-closure period.	Concentrations below baseline conditions (0.013 to 0.063 mg/L versus 0.019 to 0.120 mg/L) throughout post-closure period.	Seasonal peaks at baseline seasonal peaks (3 ng/L versus 3 ng/L) throughout post-closure period.
YP-SR-2	EFSFSR	None	None	Concentrations below baseline conditions (0.003 to 0.016 mg/L versus 0.005 to 0.037 mg/L) throughout post-closure period.	Concentrations below baseline conditions (0.010 to 0.047 mg/L versus 0.014 to 0.076 mg/L) throughout post-closure period.	Concentrations at or slightly below baseline conditions (3 to 9 ng/L versus 3 to 10 ng/L) throughout post-closure period.

Constituent of Concern		Aluminum[1]	Copper[2]	Antimony[3]	Arsenic[4]	Mercury[5]
Analysis Criteria		**0.050 mg/L**	**0.0024 mg/L**	**0.0052 mg/L**	**0.010 mg/L**	**2 ng/L (total mercury)**
Nodes	**Stream**					
YP-T-6	West End Creek	None	None	Concentrations slightly above baseline conditions (0.008 to 0.014 mg/L versus 0.008 to 0.012 mg/L) throughout post-closure period.	Concentrations slightly above baseline conditions (0.064 to 0.094 mg/L versus 0.064 to 0.088 mg/L) throughout post-closure period.	Concentrations above baseline conditions (4 to 10 ng/L versus 4 to 6 ng/L) throughout post-closure period.
YP-T-1	Sugar Creek	None	None	None	Concentrations at or slightly above baseline conditions (0.007 to 0.017 mg/L versus 0.007 to 0.016 mg/L) throughout post-closure period.	Concentrations at baseline conditions (6 to 8 ng/L versus 6 to 8 ng/L) throughout post-closure period.

Source: SRK (2021a, entire), Brown and Caldwell (2020, entire), USFWS (2015d, entire)

[1] Aluminum: Lowest predicted for the action area based on Recommended Aquatic Life Criteria (EPA 2018b, entire); The same water quality data as in the Biotic Ligand Model were used (Brown and Caldwell 2020, entire).

[2] Copper analysis criterion was derived using the Biotic Ligand Model per guidance contained in IDEQ (2017, entire). A conservative chronic copper analysis criteria was estimated by applying the lowest of the 10th percentile chronic criteria based on regional classifications for the Salmon River Basin, Idaho Batholith, and third order streams. Per the Project Water Quality Management Plan (Brown and Caldwell 2020a, entire), preliminary calculations using the Biotic Ligand Model and site-specific data have produced similar values to the standard derived using these regional classifications.

[3] Antimony does not have a specified NMFS or USFWS standard and is based on EPA's human health chronic criterion for consumption of water and organisms is 0.0056 mg/L.

[4] Arsenic: NMFS (2014, p. 275) and USFWS (2015d, p. 260) both determined jeopardy for the chronic criterion proposed by EPA for Idaho Water Quality Standards (0.150 mg/L [150 µg/L]). NMFS (2014, p. 281) and USFWS (2015d, p. 271) directed EPA to promulgate or approve new aquatic life criterion, and in the interim directed EPA to ensure the 10 µg/L recreational use standard is applied in all Water Quality Based Effluent Limitations (WQBELs) and Reasonable Potential to Exceed Calculations using the human health criteria and the current methodology for developing WQBELs to protect human health.

[5] Mercury: NMFS (2014, p. 276) and USFWS (2015d, p. 264) both determined jeopardy for the chronic criterion proposed by EPA for Idaho Water Quality Standards (0.000012 mg/L total mercury [12 ng/L]). NMFS (2014, p. 284) directed EPA to promulgate or approve a new criterion. In the interim, implement the fish tissue criterion that IDEQ adopted in 2005. Where fish tissue is not readily available, then NMFS specified application of a 0.000002 mg/L (2 ng/L) criteria (as total mercury) in the interim. USFWS (2015d, p. 279) directed EPA to use the 2001 EPA/2005 Idaho human health fish tissue criterion of 0.3 mg/kg wet weight for WQBELs and reasonable potential to exceed criterion calculations using the current methodology for developing WQBELs to protect human health.

[6] Predicted future concentrations are reported on a monthly basis. Concentrations in some locations vary naturally on a seasonal basis and, therefore, exceed baseline in certain months (usually Spring) and are lower than baseline in other months.

Wastewater treatment plant effluent will be discharged to the EFSFSR at a location near the worker housing facility. Treated water will meet the Idaho water quality standards as shown in Table 33.

Table 33. Target post-water treatment plant effluent analyte concentrations (USFS 2024, Table 4.1-29).

Parameter	Units	Treatment Objective
pH (range)	-	6.9 – 9.0
Silver	mg/L	0.0007
Arsenic	mg/L	0.01
Cadmium	mg/L	0.00033
Chromium (III)	mg/L	0.035
Chromium (IV)	mg/L	0.0106
Mercury	mg/L	0.000012
Nickel	mg/L	0.024
Lead	mg/L	0.0009
Antimony	mg/L	0.0052
Sulfate	mg/L	250
Thallium	mg/L	0.005
Zinc	mg/L	0.054
Nitrate/Nitrite	mg/L as N	10
Ammonia	mg/L as N	2.1
Cyanide, Total	mg/L	0.0052
Cyanide, WAD	mg/L	0.0039
TDS	mg/L	500

Treatment residuals will be dewatered and transported to a permitted, off-site landfill for disposal. The sanitary wastewater treatment and discharge will occur at a single location during the active life of the mine and therefore the water quality conditions will have long-term adverse effects to bull trout through exposure to contaminants as described below for arsenic, antimony, and mercury.

Fuel storage and handling will be conducted in accordance with a SPCCP that will utilize surface storage tanks with primary and secondary containment. There will not be any uncontained or underground infrastructure associated with fuel storage. Therefore, releases from fuel storage will not be expected to contact the environment or affect bull trout, so effects will be none to negligible.

Long-term impacts from contaminants will include those during the active mine life and reclamation periods during which contact water will be treated to minimize multiple contaminants. Chemical contaminant loads were modeled under baseline, active mining, and post-reclamation conditions at multiple sites within the action area (Table 32; USFS 2023e, p. 51). Impact magnitudes for contaminants are measured relative to IDEQ criteria for protection of aquatic life.

The Water Quality Specialist Report (USFS 2023e, Section 7) provides details and references regarding water treatment plans and requirements. Three water types will require management over the life of the proposed action: contact water from mine facilities, which includes dewatering water (construction through closure); consolidation water from the TSF (in closure which includes process water); and sanitary wastewater (construction through early closure).

- Specific sources of mining impacted water that could be expected to require treatment during operations include:
- Contact water from the dewatering of the Hangar Flats, Yellow Pine, and West End pits.
- Contact stormwater runoff from the pits, TSF buttress, Bradley Tailings, SODA, Hecla Heap, ore stockpiles, truck shop, and ore processing facility.
- Toe seepage and pop-out seepage from the TSF buttress and ore stockpiles.
- Sanitary wastewater from the worker housing facility, truck shop, ore processing facility, administrative buildings, and offsite facilities.

After mine closure and final reclamation of the TSF Buttress and pit backfill surfaces which incorporate geosynthetic liners to inhibit interaction between water resources and mined materials, contact water treatment will no longer be required; but process water treatment for the TSF will continue longer, through approximately year 40 to account primarily for consolidation water from the TSF which will exhibit a diminishing flow rate over that period.

Water treatment will target constituent concentrations that meet the most stringent applicable water quality standards (USFS 2023c, p. 117, Table 7-11). During the operational period of Mine Years 4 through 6 when water treatment plant discharge is between seven and 55% of the Meadow Creek flow, the discharge will increase stream temperatures in Meadow Creek by 1 to 3 °C. During warmer months, retention times for contact water in ponds will be up to 34 days resulting in warmer water treatment plant feeds with the potential to increase Meadow Creek temperatures downstream of the treatment plant outfall by up to 2.5 °C. However, warmer water treatment plant discharge temperatures will be offset by the cooling effect of the piped diversion of Meadow Creek around the TSF with the net effect of water treatment expected to be less than 0.25 °C (Brown and Caldwell 2021e, p. 8-40).

<u>Copper and Aluminum</u>

Copper and aluminum toxicity can impact cellular metabolism and growth in salmonids, especially larvae and early life stages (Silvestri et al. 2016, entire). Under existing conditions, copper and aluminum concentrations in fish tissue are below the threshold for biological effect, except for aluminum in one sample collected in the EF Meadow Creek (MWH 2017, p. 5-50, Table 5-15). No exceedances in tissue concentrations are expected to occur during active mining and post-closure (Table 32).

However, copper has been shown to have behavioral and sublethal effects at concentrations below the analysis water quality criteria of 0.0024 mg/L (2.4 µg/L; NMFS 2014, pp. 131–133, Table 2.4.4.1). Copper has been shown to have sublethal and physiological effects on juvenile salmonids at water concentrations as low as 0.6 µg/L (0.0006 mg/L), including olfactory and behavioral effects that could decrease survival (NMFS 2014, pp. 131–133, Table 2.4.4.1). Adverse effects on growth and survival will be most likely to impact early life stages of bull trout from spawning and incubation through juvenile rearing. Olfactory and behavioral effects could occur from juvenile rearing through adult spawning. Both behavioral and sublethal physiological effects are likely to occur under baseline conditions and will continue through the active mine life into the closure and post closure periods. Effects of copper by bull trout life stage, stream reach and proposed action period are detailed in USFS 2024, Table 4.1-30a-d.

Differences between the existing condition and the post-closure condition in sub-lethal effects of copper concentrations are related to the changes in fish presence due to the removal of barriers. In the post-closure period, bull trout are expected to be present in the EFSFSR upstream of Meadow Creek, but copper concentrations will still have minimal effects because they are below the sub-lethal effects concentration. Bull trout are expected to be present in the EFSFSR between Meadow Creek and the YPP in the post-closure period where predicted copper concentrations may have olfactory and behavioral effects in adult migration, spawning, adult rearing, and juvenile outmigration plus development affects and decreased survival for incubation/emergence and juvenile rearing. These effects will also impact bull trout in Sugar Creek.

<u>Arsenic and Antimony</u>

Surface water concentrations of arsenic and antimony downstream from the mine site will be reduced during the active mining period relative to baseline conditions due to water treatment (USFS 2023e, pp. 151, 155, Table 7-22, Figure 7-27). Elevated concentrations of arsenic and antimony in surface waters can accumulate in and harm the tissues of many kinds of organisms including fish; which may suffer tissue damage to the liver and gills at high concentrations (Culioli et al. 2009, entire). Under baseline conditions, concentrations of arsenic and antimony in fish tissues are generally elevated at levels that could cause sublethal effects on multiple life stages. Bioaccumulation of both arsenic and antimony in the aquatic food web has been documented within the action area (Dovick et al. 2016, p. A). Arsenic concentrations of 10 µg/L or less can lead to chronic sublethal effects to bull trout due to foodweb bioaccumulation (NMFS 2014, p. 120). Embryo mortality could occur at aquatic arsenic concentrations above 4 µg/L (NMFS 2014).

Antimony concentrations above 7.5 µg/L in water could lead to embryonic mortality and developmental effects (LeBlanc and Dean 1984, entire), although adult bull trout will be largely unaffected by antimony concentrations seen under baseline or projected conditions. Sublethal effects, decreased survival of early life stages, and developmental effects will occur. Model results indicate antimony concentrations in the EFSFSR downstream from Sugar Creek will be reduced permanently post-closure, but arsenic concentrations will return to at or near baseline levels over time (USFS 2023e, entire). The effects of the proposed action on bull trout related to arsenic and antimony will not significantly impact these species overall relative to baseline conditions. Effects of arsenic and antimony by fish species, life stage, reach, and proposed action period are detailed in USFS 2024, Table 4.1-31a-d and Table 4.1-32a-d, respectively.

Differences between the existing condition and the post-closure condition in sub-lethal effects of arsenic concentrations are related to the changes in bull trout presence due to the removal of barriers. In the post-closure period, bull trout are expected to be present in the EFSFSR upstream of Meadow Creek and in the EFSFSR between Meadow Creek and the YPP where predicted arsenic concentrations may have sub-lethal physiological effects on adult migration, juvenile rearing, adult rearing, and juvenile outmigration plus potential egg/fecundity effects on spawning and reduced growth/survival effects on incubation/emergence. These effects will also impact bull trout in Sugar Creek.

For antimony, bull trout are expected to be present in the EFSFSR upstream of Meadow Creek in the post-closure period, but antimony concentrations will still have minimal effects because they are below the sub-lethal effects concentration. Bull trout are expected to be present in the EFSFSR between Meadow Creek and the YPP in the post-closure period where predicted antimony concentrations may have sub-lethal developmental effects during incubation/emergence and juvenile rearing but minimal effects on the other life stages. These differences are attributable to the changes in fish presence rather than changes in predicted antimony concentrations that are the same or decrease from the existing condition to the post-closure period. These effects will also impact bull trout in Sugar Creek.

<u>Mercury</u>

Baldwin and Etheridge (2019, p. 7) found that under baseline conditions, the mercury chronic (short-term exposure) aquatic life criterion (12 nanograms per liter [ng/L]) was exceeded in at least one sample at all sites, with exceedance frequencies ranging from 4% at Meadow Creek to 97% at Sugar Creek. The acute (short-term exposure) aquatic life criterion (2,100 ng/L) was only exceeded at Sugar Creek, with a frequency of 11%. Mercury concentrations in fish tissue are generally elevated but only occasionally approach thresholds for biological effect (MWH 2017, Table 5-15). Mercury concentrations in the EFSFSR downstream from Sugar Creek are predicted to increase relative to baseline conditions during active mining due to expanded excavation. Concentrations are then predicted to decrease post-closure but remain slightly elevated relative to baseline conditions (USFS 2023e, p. 145). Baseline, predicted active mine, and predicted post-closure mercury concentrations in the EFSFSR downstream from Sugar Creek will not exceed the aquatic life criterion (12 ng/L). However, uncertainty remains whether incremental change in mercury concentrations beyond baseline will increase bioaccumulation of methylmercury in fish tissue at concentrations exceeding the tissue-based criterion. Methylation and bioaccumulation of mercury generally increases downstream in most watersheds (Fleck et al. 2016, entire). Through bioaccumulation and biomagnification, methylmercury reaches the highest concentrations in the tissues of longer lived, larger, or more piscivorous fish species (e.g., bull trout). Increased methlymercury concentrations in fish can create risks for human consumption. Mercury concentrations exceeding 500-1,000 nanograms per gram (ng/g; 0.5–1.0 mg/kg) in fish can cause reduced fecundity and extremely high concentrations can cause neurological dysfunction and liver damage (Scheuhammer et al. 2015, p. 93). Tissue concentrations are generally considered to be a better predictor of physiological impacts to fish than water concentrations. Tissue concentrations of 300 ng/g (0.3 mg/kg) or higher are associated with sublethal physiological effects in salmonids (NMFS 2014, p. 150). The relationship between water concentrations of mercury and fish tissue concentrations is complex, involving a number of factors including methylation rates, foodweb effects, and the life history of individual fish (Brumbaugh et al. 2001, entire; May et al. 2000, entire). NMFS (2014, p. 159) developed a linear relationship between total mercury in river water and fish tissues based on Essig (2010, entire). Applied to average predicted mercury concentrations in proposed action reaches, this relationship predicts average fish tissue concentrations ranging from 164.9 to 593.9 ng/g (0.165 to 0.594 mg/kg; Figure 15). Results are based on the regression model developed by NMFS (2014, p. 159) with a 300 ng/g threshold for sublethal effects.

Differences between the existing condition and the post-closure condition in sub-lethal effects of mercury concentrations are primarily related to the changes in fish presence due to the removal barriers. In the post-closure period, bull trout are expected to be present in the EFSFSR upstream of Meadow Creek where predicted mercury concentrations may have potential sub-lethal effects for all life stages. Bull trout are expected to be present in the EFSFSR between Meadow Creek and the YPP in the post-closure period where predicted mercury concentrations may have potential bioaccumulation effects for adult rearing with minimal effects for other life stages. These differences are primarily attributable to the changes in fish presence rather than changes in predicted mercury concentrations that vary by less than 1 ng/L.

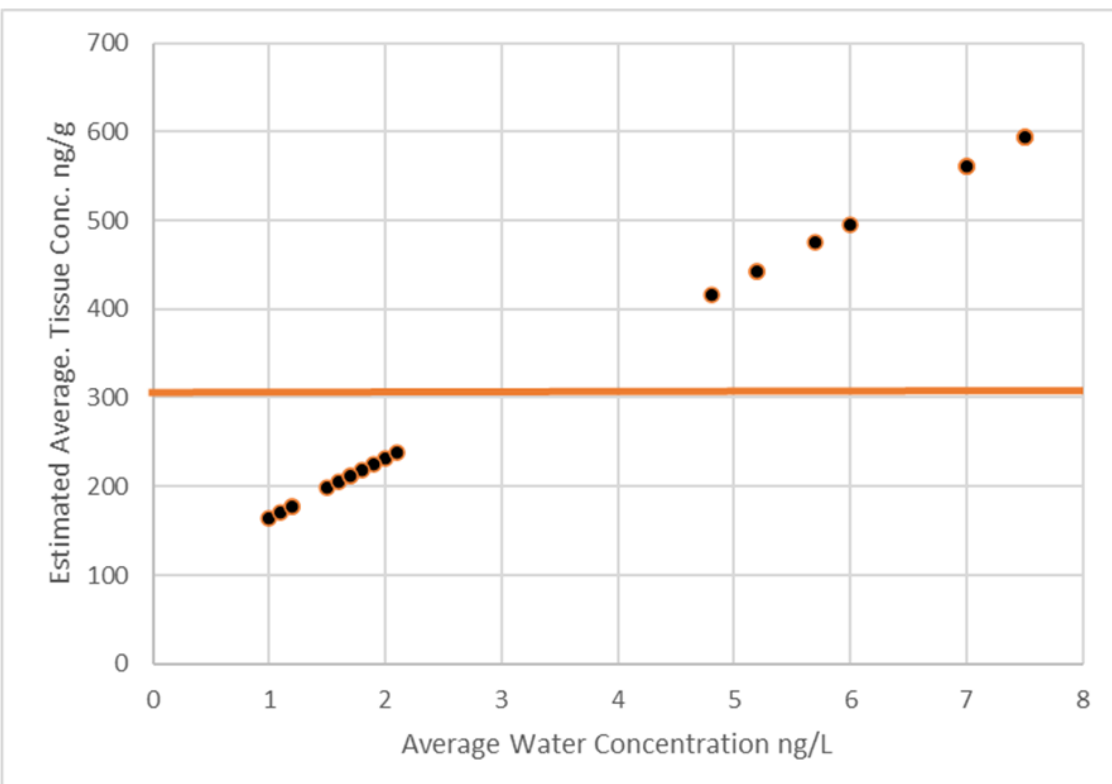

Figure 15. Relationship between predicted average water concentrations of mercury in mine site reaches and predicted average mercury concentrations in fish tissue (USFS 2024, Figure 4.1.-14).

Tissue concentrations from bull trout collected by USGS (Rutherford et al. 2020, entire) from the action area were mostly below 300 ng/g, although a few were slightly above this threshold (Figure 16). Mercury concentrations from fish tissue collected in the field are generally lower than will be expected based on water concentrations. This may be due to low methylation rates minimizing foodweb bioaccumulation in the headwater reaches of the EFSFSR watershed where wetlands represent a low proportion of the watershed area (Brumbaugh et al. 2001, entire; Eagles-Smith et al. 2016, entire).

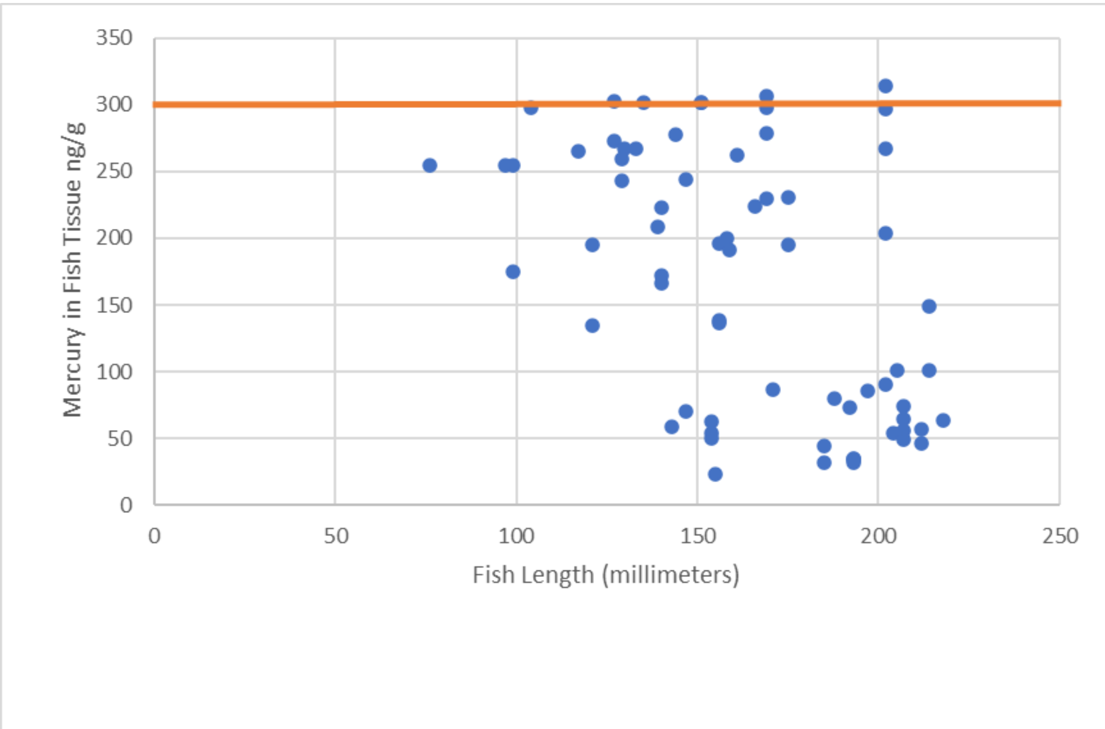

Figure 16. Mercury fish tissue concentrations by fish length in bull trout from the mine site (USFS 2024, Figure 4.1-15).

Given the small changes predicted in mercury loads and methylation, the magnitude of potential permanent impacts to downstream fish from incremental changes in long-term or permanent mercury transport downstream from the mine site is unknown. Long-term, regional influences on downstream mercury methylation are not quantified. Effects of mercury on bull trout due to the proposed action are likely to be harmful over long-term and permanent timeframes. Mercury concentrations in fish tissue could reach thresholds for biological effect, causing sublethal health impacts in some fish at an unknown higher frequency than under existing conditions. Within the action area, increases in mercury loading could cause incremental increases in the proportion of fish experiencing sublethal effects relative to baseline conditions (Figure 16). Increased mercury concentrations due to the proposed action could affect fish in downstream waters to an unknown extent. Effects of mercury by fish species, life stage, reach and proposed action period are detailed in USFS 2024, Table 4.1-33a-d.

Physical Barriers

Physical barriers can affect fish population dynamics by reducing or blocking access to fish habitat. These barriers can be natural (gradient, woody debris, etc.) or human-made (culverts, altered creek channels due to human activities). These barriers, both outside and within the mine site, are discussed below.

Outside the Mine Site

Construction

During the construction of the Burntlog Route or of temporary roads, culverts will be constructed or replaced, which may affect fish access in different sections of streams. Multiple eDNA samples were collected from streams crossing the existing Burntlog Road to identify fish-bearing streams (Stantec 2018, entire, 2019, entire).

Any new or reconstructed crossing is required to be fish passable, which will increase or re-establish fish access where it had been reduced or blocked, unless there is a risk of passing non-native fish species. There are 18 existing crossings along the Burntlog Road (FR-447) that will be replaced and 10 new crossings along newly constructed portions of the Burntlog Route. There are a total of approximately 53 miles of stream segments upstream of the Burntlog Route. Currently almost all stream crossings along the Burntlog Road are impassable culverts, particularly at low flow conditions. The key perennial streams that will be crossed are Burntlog Creek, Trapper Creek, and Riordan Creek. The headwaters of these three creeks support bull trout but not Chinook salmon nor steelhead. The smaller headwater tributaries to these three perennial streams had bull trout DNA detections, while others did not (Stantec 2018, p. 22, Table 7; 2019, p. 13, Table 13; 2020, p. 31, Table 13).

In addition to Burntlog Route, access roads to the new transmission line do cross some creeks; however, alteration to most of these crossings may not be necessary. If a crossing needs to be upgraded, the same BMPs will be followed as for crossings along the Burntlog Route. New culverts will be placed in both Big Creek and Hargrave Creek. Hargrave Creek, a tributary to Big Creek, does not support ESA listed fish species, and the BNF conducted eDNA sampling in upper Big Creek and did not detect any bull trout DNA. The potential re-establishment of access upstream from the new culverts could affect the composition of the aquatic community. Changes in types of fish present and the abundance of fish could increase the risk of injury and mortality for some species. For instance, additional habitat could benefit some species, while the presence of additional fish in previously inaccessible reaches will introduce competition for resources. These changes may affect the distribution and relative abundance of fish populations in affected streams.

Establishing or increasing access could allow non-native species, such as brook trout, to access upstream habitat that is currently blocked. Brook trout are known to compete with bull trout for resources and habitat (USFWS 2008, pp. 20–21). Brook trout also are known to hybridize with bull trout, which has the potential to negatively impact the genetic integrity of and result in negative changes to the local population of bull trout (USFWS 2008, pp. 20–21). According to the Forest Plan standard, no barrier will be removed if increasing access between non-native species to sensitive native species will occur. Additionally, brook trout presence is minimal in the Burntlog Route area (MWH 2017, Section 5.5, p. 5-94; Stantec 2019, p. 32).

Proposed action effects on bull trout during construction of temporary roads and culverts and bridges are expected to include localized behavioral effects during in-water work, fish and habitat impacts due to increased sedimentation and potential placement of riprap, injury and mortality from fish salvage, and improved passage at the crossings allowing expanded access to habitat after construction is completed. These projects will follow the procedures in Section 4.1.3.2 – Bridge and Culvert Construction and BMPs described below in Section 4.3.1.2-Dewatering, Fish Salvage, and Relocation. Effects caused by the fish exclusion and salvage, if necessary, are described in Section 4.3.1.2 (Dewatering, Fish Salvage, Relocation). Effects from sedimentation are described in Section 4.3.1.1 (Sediment and Turbidity), and effects caused by noise are described in Section 4.3.1.2 (Noise and Vibration).

Closure and Reclamation

All barrier creation or removal will be completed prior to the closure and reclamation phase of the proposed action. These actions will result in similar effects to bull trout and will follow the procedures and BMPs described below in Section 4.3.1.2-Dewatering, Fish Salvage, and Relocation.

Within the Mine Site

Fish passage barriers can negatively impact bull trout population dynamics by reducing, or completely blocking, available habitat during certain life stages. Existing fish passage barriers within the mine site were identified as either complete (no fish can move upstream or downstream at any time of year) or partial (the barrier may not exist at high flows but at certain flows [i.e., low flows)] some fish may not be able to pass). Passage barriers are further categorized by natural (not caused by human action) or artificial (caused by human action; BioAnalysts 2021, p. 13, Table 3).

Existing and predicted fish passage barriers, as well as the removal of barriers resulting from proposed action activities are shown in USFS 2024, Figure 4.1-12. Table 34 presents a summary of the conditions of the fish barriers, as well as the length of stream channel changes post-closure, which includes both the new access as well as blocked access to stream channels into existing stream reaches in construction diversion and stream enhancements.

Construction

The EFSFSR will have a tunnel/fishway constructed in mine year minus 1 that will go around the existing YPP lake and the cascade barrier upstream from the lake allowing bull trout to regain access to the upper EFSFSR. However, once access is established, fluvial/adfluvial bull trout will be exposed to construction and mining activities upstream. The negative impacts to bull trout from these construction and mining activities will be offset by the permanent increase in available habitat in the EFSFSR.

In Fiddle Creek, there is a high gradient section of stream with a culvert near the top that are complete barriers to fish passage. Fiddle Creek snorkel surveys and eDNA samples did not show bull trout presence (MWH 2017, pp. 5–82). The effort in Fiddle Creek will improve conditions for fish currently present in Fiddle Creek but will not provide passage for fish in the EFSFSR into Fiddle Creek.

Meadow Creek currently has a partial gradient barrier just upstream from EFMC. While this barrier will be removed during the construction phase of the proposed action, a new barrier will be created just upstream from the existing barrier that will prevent fish passage into upper Meadow Creek where the TSF will be constructed.

Work in the EFMC will occur in a section of creek that is not inhabited by fish due to the high gradient. Work in this section is to reduce the high levels of sediment input from the EFMC into Meadow Creek and the EFSFSR. The work in this section of the EFMC will not improve fish passage but will result in improved habitat conditions in the lower EFMC, Meadow Creek, and the EFSFSR.

Table 34. Length of bull trout habitat gained or lost under post-closure conditions relative to baseline conditions for existing and future fish passage barriers constructed or removed in mine site streams (adapted from USFS 2024, Table 4.1-21).

Stream/Location	Mine Year Created or Removed	Change in Bull Trout Habitat Attributed to Barrier[1,2]
Existing Barriers		
EFSFSR above YPP (02) Artificial Gradient	Removed Mine Year minus 1: Tunnel; Mine Year 11: Channel reconstruction	+19.54[1] +32.82[2]
EFSFSR (203) Artificial – Box Culvert	Removed Mine Year minus 1	+16.66[1] +26.42[2]
Fiddle Creek (04) Artificial – Gradient	Removed Mine Year minus 4	NP[1] +0.72[2]
Fiddle Creek (200) Artificial - Culvert	Removed Mine Year minus 4	NP[1] +0.71[2]
Meadow Creek (05) Artificial – Gradient	Removed Mine Year 3	Bull trout not present
East Fork Meadow Creek (06)	Removed Mine Year minus 1	Bull trout not present

Stream/Location	Mine Year Created or Removed	Change in Bull Trout Habitat Attributed to Barrier[1,2]
Created Barriers		
Meadow Creek Diversion Artificial – Gradient	Created Mine Year minus 2	Bull trout not present
Meadow Creek TSF Artificial – Gradient	Created Mine Year 18	+0.58[1] -1.02[2]
East Fork Meadow Creek Artificial – Rock Drain/Gradient	Created Mine Year minus 1	Bull trout not present
East Fork Meadow Creek Artificial – Gradient	Created Mine Year 22	Bull trout not present[1]

1 Results based on potential critical habitat which is not accessible critical habitat under baseline conditions.
2 Results based on usable occupancy potential, but habitat is not always accessible or occupied.

During construction on the barriers, there will be behavioral effects to bull trout, and there is potential for injury and mortality from fish salvage efforts (described in Section 4.1.3.2 Dewatering, Fish Salvage, Relocation), disturbance from construction equipment noise and vibration (described in Section 4.1.3.2 Noise and Vibration), and sublethal effects from increases in sediment and turbidity (see Section 4.1.3.1 Sediment and Turbidity). There will be a permanent loss of 8,500 m of bull trout critical habitat in upper Meadow Creek.

Operations and Closure and reclamation

Species-specific impacts to fish habitat resulting from passage barriers were assessed for bull trout through the evaluation of the extent of both critical habitat and occupancy probability. Additional information is provided in ESS (2019, Sections 2.1 and 2.2, pp. 6-17) and (2022b, Sections 2.1 and 2.2, pp. 5-16).

Once the mining activities at the YPP are completed (Mine Year 11), the EFSFSR will be reconstructed into a volitionally passable stream channel. Once the stream channel restoration is complete, the EFSFSR flows will be routed through the restored channel with the tunnel to be used solely for high flows and will be decommissioned in Mine Year 17.

The greatest potential change to bull trout adult passage comes in Mine Year minus 1 with the completion of the fishway (tunnel), which may provide volitional access to habitat that they have not volitionally accessed for decades. If successful, this improved access will provide other benefits besides just access to new habitat, but includes input of marine-derived nutrients, improved connectivity to critical habitat, as well as increasing spawning and rearing habitat. The fishway may be a partial barrier by discouraging upstream migration of some adult fish, but the probable passage rate is unknown. By Mine Year 11, the EFSFSR, where the YPP is located, will have been restored, providing natural conditions for volitional passage. Additionally, the box culvert, 2.88 km upstream from the YPP cascade barrier will be modified to provide full passage under all flow conditions. This substantially increases the amount of habitat available to bull trout through volitional passage that is not currently accessible (Table 34). Additionally, the removal of the barrier at the YPP provides an opportunity for adfluvial and fluvial populations of bull trout to access upstream habitat that may provide cooler temperatures. The location of the barrier in Meadow Creek that blocks passage into the TSF will be a permanent barrier.

The effects of the proposed action on bull trout access upstream from the existing YPP cascade barrier for adults to upstream habitat are expected to provide permanent habitat benefits generally within the action area, even with the loss of a portion of Meadow Creek blocked by the barrier to the TSF and TSF Buttress.

Based on the current known extent of bull trout occupancy, bull trout may be extirpated from the reaches in Meadow Creek upstream from the TSF when the reaches within the footprint will be dewatered and flow will be diverted into the diversions that route water around the facilities. With the gradient barrier that will be created along the TSF, there will be no mechanism by which bull trout will be able to volitionally (i.e., naturally) recolonize the reaches upstream from or on top of the TSF. Based on bull trout density in the upper Meadow Creek watershed, there will be a potential loss of 111 bull trout (Table 41), and a loss of around 8,500 meters of critical habitat. The creation of gradient barriers in Meadow Creek will begin in Mine Year minus 2 with the diversion of Meadow Creek and be followed by the TSF barrier in Mine Year plus 18 (Table 34).

<u>Change in Peak/Base Flows</u>

Construction

During the construction phase, surface runoff in contact with mine facilities under construction is captured, treated, and discharged. During the first year of mine construction (Mine Year minus 2), contact water is collected, treated, and discharged, slightly increasing flow. In Mine Year minus 1, dewatering operations and diversion of water for inventory in the TSF will have started by the end of the year. Table 35 shows the flows and the percent change in flows, during August through April (low flow period) from construction through post-closure.

Decreased flows during the remaining construction phase of the project could cause a reduction in available habitat, which could increase competition for resources (food and habitat), and trigger movement to other habitat that may be of lesser quality. These are typically sub-lethal effects but have the potential to result in direct mortality of bull trout.

Table 35. Flow and percent change in stream flow from baseline stream flow for the low-flow period (August through April) over the construction through post-closure mine phases USFS 2024, Table 4.1-35).

Mine Year	USGS Gage 13311250 EFSFSR Upstream from Sugar		USGS Gage 1331100 EFSFSR at Stibnite (%)		USGS Gage 13310800 EFSFSR Upstream from Meadow Creek (%)		USGS Gage MC-6 Meadow Creek (%)	
	Flow (cfs)	% Change	Flow (cfs)	% Change	Flow (cfs)	% Change	Flow (cfs)	% Change
Minus 4		N/A		N/A		N/A		N/A
Minus 2	14.4	1.5	11.4	1.8	4.3	0.0	6.2	3.4
Minus 1	11.3	-6.8	9.4	-2.1	3.6	0.0	5.0	-3.8
1	10.6	-12.4	9.6	-4.4	4.0	0.0	4.8	-8.1
2	12.7	-21.2	11.5	-6.2	4.6	0.0	6.1	-11.2
3	10.5	-18.6	9.1	-8.6	3.9	0.0	4.4	-16.0
4	11.8	-18.1	9.9	-12.0	4.2	0.0	4.8	-22.6
5	13.1	-6.9	11.1	1.4	4.3	-0.2	6.0	3.7
6	10.8	-18.7	8.9	-13.1	4.4	-0.5	3.9	-22.3
7	11.2	-24.8	9.3	-20.4	4.6	-0.5	3.9	-36.4
8	15.5	-18.6	13.6	-11.1	5.6	-0.2	7.0	-20.0
9	12.8	-14.1	11.1	-4.8	4.5	0.0	5.7	-8.8
10	11.2	-16.4	10.1	-5.1	3.9	0.0	5.4	-9.3
11	13.7	-14.9	11.9	-4.5	5.0	0.0	5.9	-8.4
12	17.5	-10.1	14.4	-4.2	6.1	0.0	7.2	-7.9
13	13.7	-13.5	11.8	-6.0	4.6	-1.7	6.2	-9.8
14	11.7	-11.0	9.8	-5.9	3.7	-3.6	5.3	-8.2
15	18.9	-5.1	15.6	-3.0	6.2	-1.6	8.5	-5.9
16	14.6	-3.0	11.5	-1.1	4.4	-1.2	6.1	-3.1
17	12.3	-4.2	9.6	-3.0	3.6	-3.8	5.1	-3.9
18	13.3	-4.1	10.5	-3.1	4.0	-2.7	5.6	-4.5
19	10.6	-3.1	8.4	-2.6	2.9	-2.8	4.7	-3.6
20	13.3	-2.4	10.5	-1.4	4.0	-1.6	5.6	-2.0
Post-Closure	12.4	0.9	9.7	1.7	3.5	-1.9	5.1	-0.6

The slight reductions (less than 2% and less than 0.1 cfs) in predicted flows at USGS Gauge 13310800 on the EFSFSR upstream from Meadow Creek in the post-closure period are associated with lower predicted groundwater levels in the Hangar Flats Pit area during the early post-closure period due to the effects of dewatering pumping and groundwater production. These effects extend toward the lower portion of the EFSFSR near the confluence with Meadow Creek, and they diminish with groundwater recovering later in the post-closure period.

Operations and Closure and Reclamation

Predicted changes in stream flows associated with water management activities are related to:

- abstraction of stream flow for consumptive use by proposed action activities,
- discharge of treated contact water to stream flow,
- groundwater pumping for mine dewatering and consumptive use,
- installation of mine facilities that modify stream channels and surface water runoff, and
- installation of geosynthetic liners that modify groundwater recharge.

Abstraction from the EFSFSR via an intake located upstream of the diversion tunnel has the most direct effect on flow in the EFSFSR but does not affect flow in the upstream segments of the EFSFSR, Meadow Creek, or Sugar Creek. Removal of water from the stream via the intake results in a direct reduction in EFSFSR stream flow. The rate of water removal varies during the proposed action. Predicted removal rates are largest during the early mining period (i.e., average 1 to 2.5 cfs [750 to 1,875 acre-feet annually] during mine years 1, 2, and 3) because there is limited groundwater pumping during those years for mine dewatering and the TSF is building its water inventory during that period. During the period when mine dewatering is at its highest pumping rates, there will be no removal of water from the stream (i.e., mine years 4 through 8). When the need for mine dewatering decreases after mine year 8, removal of water from the EFSFSR resumes through the end of the proposed action (i.e., mine years 9 through 15) with predicted intermittent stream withdrawals up to 2 cfs (1,500 acre-feet annually) during periods when reclaim water from the TSF is not expected to meet process demand (i.e., summer periods when TSF water is lost to evaporation). Effects of water abstraction from the EFSFSR will occur only within the proposed action lifespan.

Discharges of treated water to the EFSFSR and Meadow Creek have a direct effect on those flows but do not affect the flow in upstream segments of the EFSFSR or Sugar Creek. Treated water discharges are predicted to primarily occur in mine years 4 through 8 when the peak mine dewatering is occurring and then again in the closure and post-closure periods. During mine years 4 through 8, predicted treated water discharge rates are between 1 and 4 cfs (750 to 3,000 acre-feet annually). During the other operating mine years, water discharges are not predicted because the process needs for water are greater than the volume of contact water and dewatering production collected. In the closure and post-closure periods, the process water in the TSF will be drained, treated, and discharged. From mine years 15 through 22, TSF water will be accumulated then treated seasonally with a discharge rate of approximately 2 cfs (750 acre-feet annually) during the summer period. Most of the TSF water will be removed during that seven-year period but residual water will be collected for treatment and discharge for the period predicted to be mine years 23 through 40. After year 40, treatment and discharge rates are predicted to diminish from 0.3 cfs (225 acre-feet) in mine year 23 down to no discharge after mine year 40. Effects of treated water discharge will occur only until the cessation of water treatment.

Groundwater pumping for mine dewatering and consumptive use occurs during mine years 1 through 15 with the peak rates occurring in mine years 4 through 8. Groundwater pumping lowers groundwater levels in the area of the Yellow Pine Pit, Hangar Flats Pit, and West End Pit between 10 feet (away from the immediate pit areas) up to several hundred feet (at the pit bottoms). Lowering groundwater levels have the potential to reduce groundwater discharges to streams, thereby reducing overall stream flow. Because of the mine site hydrogeology, groundwater discharges in the mine site are a relatively small component of total stream flows. In the upper segments of the EFSFSR above its confluence with Meadow Creek, monitoring data indicate that the EFSFSR gains approximately 0.5 cfs (375 acre-feet annually) from groundwater inflow. Monitoring indicates alternating zones of groundwater discharge to streams and infiltration from streams to groundwater in Meadow Creek and in the EFSFSR with most of the groundwater discharge occurring in the EFSFSR between the Fiddle Creek confluence and the Yellow Pine Pit. The net effect of those discharge and infiltration zones balance over those stream segments with approximately 3 cfs (2,250 acre-feet annually) of groundwater discharge balanced by that amount of infiltration. Effects of lowered groundwater levels will occur throughout the groundwater pumping period (i.e., mine years 1 through 15) and for approximately another 10 years following the end of pumping as groundwater levels take time to recover to their pre-pumping water levels.

Installation of mine facilities that modify stream channels will primarily change the location of stream flows without changing stream flow volumes over the long term. However, dewatering and diversions required to complete the stream channel modifications will have temporary effects on the stream flows until the modified channels are completed and rewatered.

Installation of geosynthetic liners will inhibit infiltration of water from the ground surface to recharge groundwater, resulting in slightly lower groundwater levels compared to existing conditions. These geosynthetic liners will affect groundwater recharge starting with the construction of the lined TSF facility and lined diversion channels in the Meadow Creek drainage. Additional geosynthetic liners will be added during closure to the TSF top surface and TSF Embankment/Buttress in the Meadow Creek drainage and to the YPP backfill in the EFSFSR drainage. Fluctuations in alluvial groundwater levels due to seasonal recharge are approximately 4 ft in the mine site based on monitoring data. Therefore, upon installation of the geosynthetic liners groundwater levels in the immediate vicinity of the TSF and YPP will be lowered by a few feet. During the operations, the effects of this reduced recharge will not be detectable due to the drawdown effects of groundwater pumping. However, the recharge effects will persist permanently even after groundwater pumping effects have recovered. Therefore, there will be localized permanent areas of slightly lower groundwater levels in the immediate vicinity of the TSF and Yellow Pine Pit. Monitoring data indicate that these are areas of groundwater discharge to streams under existing conditions, and with lower groundwater levels, that condition is expected to persist.

Changes in stream flow directly affect fish and their habitat. Changes to stream flow were evaluated using simulated monthly discharges for the August to March low-flow period for Mine

Years minus 2 through post-Service (2023b, pp. 76-78, Section 7.2.2.4; as cited in USFS 2024, p. 382) provides additional descriptions of how much streamflow changes as a function of mine operations, including locations without gaging data (i.e., downstream from Sugar Creek). During the first year of construction, contact water is collected, treated, and discharged, thus slightly increasing flow.

After the first year of construction, stream flows typically decrease during the low-flow period. Stream flow reductions result from diversion of flow for mine use plus reduced groundwater discharge associated with mine dewatering. The YPP will not be refilled by groundwater. At closure, a geosynthetic liner will be placed over the pit backfill to isolate the backfill material from surface water. The backfilled pit will refill over time with groundwater as the water table recovers after being dewatered during mine operations. Table 35 shows predicted (simulated) monthly stream flows during the August to March low flow period at three USGS gaging stations and one location in lower Meadow Creek in mine site streams (USFS 2024, Figure 4.1-4) and predicted change from average baseline low flow period stream flows. Figure 17 shows the percent change in simulated stream flows graphically.

The greatest predicted changes to stream flow under the Proposed Action will be in the EFSFSR and in Meadow Creek in the vicinity of the TSF. While most of the streams will return to at or near baseline flows post-closure (post-closure flows represent an average of the predicted flows from Mine Years 21 through 112), Meadow Creek flows downstream from the TSF will be reduced by a maximum of 36.4% during mine operations. Flow increases in Mine Year 5 at some nodes are due to discharge of treated dewatering production at a time when dewatering production to maintain dry open pits is greater than the usage needs of the mine.

Predicted Sugar Creek flows are approximately 3% less than the baseline conditions during the operational period. During the post-closure period when the West End pit lake is initially forming, predicted Sugar Creek flows decrease slightly due to reduced inflow from West End Creek by up to 9% (i.e., 0.8 cfs). Predicted flow reductions persist for approximately 50 years post-closure before decreasing to an approximately 1% (i.e., 0.1 cfs) difference indefinitely compared to the baseline conditions. Downstream of the EFSFSR and Sugar Creek confluence, the average seasonal low flows are 20.1 cfs compared to 22.1 cfs under baseline conditions (9% reduction), while the minimum predicted low flow is 15.7 cfs compared to 18.2 cfs (14% reduction). These reductions are attributable to the total of upstream capture of surface water, groundwater dewatering, and water abstraction for consumptive use partially offset by discharge of treated water. Flows fully recover within 10 years from cessation of operations (Brown and Caldwell 2021e, as cited in USFS 2024, p. 382).

Decreased flows cause a reduction in available habitat, including migratory habitat, which could increase competition for resources (food and habitat), and trigger movement to other habitats that may be of lesser quality. The habitat effects caused by decreased flows will be long-term (occurring during operations) and occurring in Meadow Creek, the EFSFSR at Stibnite, and the EFSFSR upstream from Sugar Creek. Flows in the EFSFSR upstream from Meadow Creek will be stable until Mine Year 12 when they decrease (less than 5%) through Mine Year 20. Permanent effects from changes in streamflow that occur during the post-closure period are negligible across all of the mine site streams.

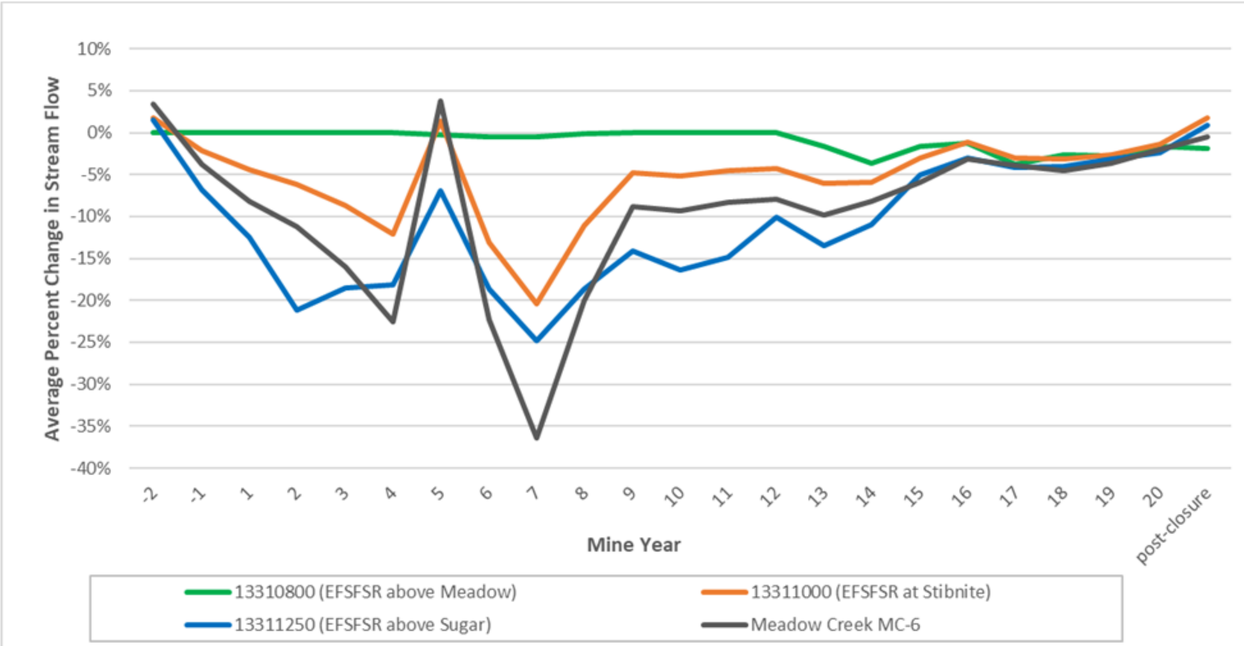

Figure 17. Average percent change in stream flow during the low flow period (August to March) (USFS 2024, Figure 4.1-16).

Riparian Conservation Areas

RCAs will be affected during construction, operations, and closure and reclamation phases. The number of miles of roads and road density will increase until the temporary roads, including the new portion of the Burntlog Route are decommissioned during the closure phase. Table 36 shows the acres of RCA affected (but not necessarily lost) by different activities during construction and operations. The total acres of RCA affected will be 631.5, all of which will be restored per the requirements of the CMP (Tetra Tech 2023, entire); however, the restoration may not be in the same location as the original RCA disturbed.

Table 36. Effects to riparian conservation areas in acres for each proposed action activity (USFS 2024, Table 4.1-36).

proposed action Activity	RCA Acres Affected
Burntlog Route – Existing Road	2.4
Burntlog Route Cut/Fill	11.2
Burntlog Route Borrow Source	1.9
EF Meadow Creek Access Road	0.3
EF Meadow Creek Borrow Area	40.4
EF Meadow Creek Rock Drain	3.9
East Fork South Fork Salmon River Tunnel Inlet	4.1
East Fork South Fork Salmon River Tunnel Outlet	3.3
Fiddle GMS	18.6
Garnet Creek Restoration	2.1
Hangar Flats Construction Laydown	0.0
Hangar Flats Haul Road	6.3
Hangar Flats Incidental	5.5
Hangar Flats Pit	14.9
Hangar Flats Stockpile	3.0
Johnson Creek Road – Existing Improvements	11.4
Midnight Diversion	3.7
Plant Diversion	1.0
Plant Outfall	0.3
Plant Site	34.0
Plant Site Access Road	7.5
Plant Site Haul Road	27.7
Plant Site Haul Road Incidental	0.3
Plant Site Stockpile	1.1
Pond Tunnel Area	4.6
Security Building	0.0
Spent Ore Disposal Area	16.4

proposed action Activity	RCA Acres Affected
Stibnite Road - Existing	0.0
Transmission Line Access - Minor Improvements	0.9
Transmission Line ROW - New	1.0
Transmission Line Structure Work Area	0.0
Truck Shop	14.5
Tailings Storage Facility	166.6
Tailings Storage Facility Access Road	0.0
Tailings Storage Facility Buttress	60.0
Tailings Storage Facility Diversion	5.6
West End Access Road	21.0
West End Creek Outfall	0.4
West End Diversion	2.9
West End Pit	30.3
Workers Housing	1.9
Yellow Pine Access Road	10.1
Yellow Pine Pit Construction Laydown	5.2
Yellow Pine Pit	80.1
Yellow Pine Pit Incidental	5.1
Total	**631.5**

Moderate sized trees will be removed during construction; however, during and after operations, trees will be replanted, particularly along Meadow Creek. When possible, any trees felled from proposed action activities will be left in place. Overall the proposed action will degrade the baseline condition of RCAs, which is currently FUR (USFS 2024, Tables C-2 and C-4).

4.3.1.2 Effects to Individuals

Altered Physical Stream Structure

The proposed action will result in stream channel changes, including dewatering, restoration, and enhancements within the active mine site (USFS 2024, Figure 4.1-7; Tetra Tech 2023, CMP, Appendix C1). Physical alterations to stream structure that will result in impacts to bull trout generally fall into three phased categories:

- Construction: Dewatering of some stream channels and other aquatic habitats and facility construction prior to the active mining period. Fish salvage and other measures will minimize impacts.
- Active Mining Period: Maximum dewatering and reduction of stream habitat will occur during this period. Operation of the EFSFSR fishway will occur during this period to allow fish to bypass active mining areas and minimize impacts. Reclamation and restoration of some stream habitats will occur during this period. All in-water work will be conducted between May and August 1, though if flows in May are still too high to safely conduct in-water work, or if there are clear signs of incubating eggs, in-water construction activities will be delayed, but will not be extended past August 1.
- Reclamation and Restoration: Excavated areas will be filled and reclaimed. Stream channels will be restored, and additional fish barriers eliminated resulting in a net increase in accessible stream habitat relative to baseline conditions.

Construction

The operation of the EFSFSR fishway will allow any fish passing through the fishway to access upstream areas not volitionally accessible under existing conditions, thereby limiting the overall fish population impact of habitat reduction in the area of the active mine for approximately 12 years. The fishway will serve to reduce the overall impacts of dewatering, diversion, and stream channel section elimination in the active mine. Protective measures, such as routing stream flow around construction areas or during stream restoration activities will be implemented to protect water quality.

The Fisheries and Aquatic Resource Mitigation Plan (Brown and Caldwell, Rio ASE, and BioAnalysts 2021, Section 5.4.7, pp. 5-21 to 5-26) and the Fishway Operations and Management Plan (Brown and Caldwell, McMillen Jacobs, and BioAnalysts 2021, Section 2, pp. 2-1 to 2-12; Section 3.8, p. 3-10) describe in detail how impacts to fish populations will be minimized through fish salvage in dewatered channels, reducing runoff impacts, use of fish screens to prevent entrainment, and operation of the EFSFSR fishway or trap and haul alternatives. However, despite these measures, bull trout are likely to be adversely affected through fish salvage in dewatered channels. These effects will include injury and potential mortality from capture with nets and electrofishing, impingement on blocknets deployed during instream work area dewatering and isolation, and handling during trap and haul operations as discussed in the next section (Dewatering, Fish Salvage, and Relocation).

Operations

Construction and operations will eliminate the existing YPP lake and stream reaches currently occupied by bull trout upstream from the YPP lake in the active mine site. These waters will bypass the active mine site during the construction and early mine operation periods and be replaced with restored channel and lake habitat during the latter stages of operations (Table 37). The YPP lake will be replaced with a lake feature called Stibnite Lake, which will be designed to serve similar functions to the existing YPP lake including lentic fish rearing/feeding habitat and temperature buffering (Rio ASE 2021, Appendix D, Reach EF3). During the 12-year period in which the YPP lake is unavailable and before the Stibnite Lake is created, bull trout will not have access in the mine site to lake habitat, an important habitat for the adfluvial bull trout. Stibnite Lake will be created around Mine Year 11 and is expected to provide the required lake habitat conditions needed by the adfluvial bull trout.

Relative to baseline conditions, construction during the active life of the mine will result in a maximum of 4% loss of stream channel length above the Sugar Creek confluence occurring by Mine Year 12 based on total estimated stream length (Rio ASE 2021, p. 3-3, Table 3-2 and SFA Ledger calculations). Reclamation and restoration starting in the active mining period and continuing post-closure will result in a 4% increase in total channel length relative to baseline conditions. Restored channels have been designed to improve habitat conditions. Specific stream channel restoration plans are discussed in the Stibnite Gold Stream Design Report (Rio ASE 2021, Section 3). Table 37 presents the annual timeline of major changes to physical stream channel including elimination and restoration.

The spatial extent and magnitude of these changes will be reduced by fisheries protection measures such as the EFSFSR fishway. By Mine Year 11, the fishway will be replaced with a restored open stream channel through which volitional passage could occur. Incremental improvements in fish passage and habitat quality will occur through the restoration process leading to an improved permanent condition relative to baseline.

Removal and restoration of stream channels will occur at different times on different stream sections ranging from Mine Year minus 3 to Mine Year 41 (Table 37). Fish will be removed through salvage activities prior to dewatering and channel loss, and direct impacts to individuals are discussed in the following section. Phased re-watering will follow channel restoration. Fish will not be present initially in restored channels but will re-populate after phased re-watering. The restored channels are expected to provide substantially improved habitat conditions for bull trout, particularly in the EFSFSR where the YPP lake and cascade barrier are currently located. Operations period water management changes are depicted in the Stibnite Gold Water Management Plan (Brown and Caldwell 2021e, Figures 6-2 - 6-4).

Table 37. Annual timeline of major changes to physical stream habitats (USFS 2024, 4.1-37).

Mine Years	Activity
Pre-Production/Construction (Minus 3 to Minus 1)	
Minus 3 to Minus 1	Existing Garnet Creek diversion extended around plant site; restored downstream from plant site (design reach GC2)
	Begin construction of EFSFSR fish tunnel around YPP (up to approximately 2 years to build)
	Divert Meadow Creek and tributaries around TSF and TSF buttress area including low-flow pipes to moderate temperature
Minus 1	Fiddle Creek piped beneath growth media stockpile
	Midnight Creek diverted into EFSFSR upstream from the tunnel, and Hennessy Creek diverted into Fiddle Creek
	EFSFSR tunnel and associated fishway completed; EFSFSR diverted into tunnel and YPP lake dewatering begins
	Upper Midnight Creek placed in pipe under the West End haul road
	West End Creek diverted around West End pit (design reach WE2)
	Enhancement in EFSFSR (excluding YPP) and the lower portion of Meadow Creek (design reaches MC6, EF2A, EF2B, and EF2C)
	Sediment control and rock drain constructed on EF Meadow Creek (design reach BC2)
Mine Operations (1 to 15)	
1	Upper EF Meadow Creek meadow, groundwater table, and associated wetlands restored
3	Divert Meadow Creek into a constructed channel around Hangar Flats pit footprint and downstream approximately 1,000 feet (design reaches MC4B, MC5, and MC6)
	Restore the lower section of EF Meadow Creek (120 meters downstream from the rock drain) to its new confluence with Meadow Creek (design reach BC3)
5	YPP backfill begins
6-7	Hangar Flats pit backfilled (design reach HF1)
8	Midnight pit backfilled
10	YPP backfill completed
	YPP backfill surface preparation for stream liner and placement of floodplain material and growth media
	Construct West End pit lake overflow channel

Mine Years	Activity
11	YPP stream restoration including EFSFSR, Hennessy Creek, and Midnight Creek (design reaches EF3, MNC2, and HC1&2)
	Flow restored to EFSFSR and Hennessy Creek over the YPP backfill
	EFSFSR diversion tunnel inactive with option to divert extreme high flows through tunnel to protect riparian vegetation development
	Stibnite lake fills and spills
12	Pipe removed from upper Midnight Creek haul roads and stream segment restored (design reach MNC1)
13	Flow restored to lower Midnight Creek including restored stream over YPP backfill
	Remaining road crossings removed and remaining portions of Midnight Creek restored (upstream from YPP, design reach MNC2)
	Removal of diversion around West End pit
	West End pit lake begins to fill; not expected to spill except possibly in extreme runoff
15	Final tailings deposited into TSF; TSF allowed to consolidate before placing stream liner and growth media
	EFSFSR diversion tunnel deactivated
	Plant site and ancillary facilities decommissioning/reclamation begins
Closure and Post-Closure (16 to 112)	
17	Non-perennial streams restored on TSF Buttress
	Stockpiles used up from Hangar Flats stockpile area; non-perennial streams and wetlands restored over the backfilled pit
18	Meadow Creek Restored from toe of TSF Buttress to previously restored channel around Hangar Flats footprint (design reaches MC3 and MC4A)
19 to 23	Meadow Creek surface preparation for stream liner; placement of floodplain material and growth media atop TSF and TSF Buttress
	TSF contact water collection basins installed outside of Meadow Creek floodplain corridor; treated contact water discharged to non-perennial streams on TSF Buttress draining to restored wetland on backfilled Hangar Flats pit
23	Plant site decommissioning completed
	Garnet Creek and associated wetland restored through decommissioned plant site (design reach GC2)
	Meadow Creek stream restoration at TSF and TSF Buttress completed; restore perennial flow into new Meadow Creek channel and deactivate low flow pipes in Meadow Creek diversions (design reaches MC1A, MC1B, MC1C, MC1D, MC1E, and MC2)

Mine Years	Activity
	Maintain former Meadow Creek diversions for non-perennial hillslope runoff to reduce volume of TSF contact water
24	Fiddle Creek restored after growth media stockpile removed (design reach FC2)
40	End water treatment
41	TSF contact water collection basins deactivated and Meadow Creek non-perennial diversions fully decommissioned, and non-perennial streams restored on TSF
	Water treatment plant decommissioned, and water treatment plant site reclaimed

Closure and Reclamation

Continued restoration of stream and lake habitats, particularly as riparian vegetation grows and provides more shade and woody debris in the waterway, will result in a net increase in stream length, habitat quality, and accessible fish habitat post-closure relative to baseline conditions and volitional fish access, including bull trout, to habitats upstream from the YPP lake (Rio ASE 2021, entire). Changes in age structure, habitat use, productivity, and species composition within the action area will occur during the period of active mining due to extensive physical stream structure changes (USFS 2024, Figure 4.1-17).

Stream enhancements in the EFSFSR and lower Meadow Creek will include improvements to physical channel processes and habitat largely within the existing stream channel. This will be accomplished by selectively installing large woody debris and rock structures, creating pools, enabling improved sediment sorting, and generally increasing hydraulic and habitat diversity. These types of stream enhancements have been shown to provide improved habitat conditions and increased survival for salmonids as well as improved prey availability by creating habitat for invertebrates (Beechie et al. 2013, entire; Walls 2020, entire). Enhancement efforts also may include floodplain reconnection and establishment of riparian vegetation, achieved by excavation of legacy fill material down to bankfull level (Rio ASE 2021, Section 1.3, p. 1-6). These enhancements will provide improved fish habitat, including for bull trout. However, the effects of stream enhancement construction activities will have an adverse short-term, localized impact on bull trout through dewatering and fish salvage during instream construction.

Dewatering, Fish Salvage, Relocation

Stream crossing and stream channel projects will use the same dewatering, fish salvage, and relocation procedures. To protect bull trout, standard procedures for channel segment isolation, dewatering, fish salvage, and fish relocation will be used during dewatering or maintenance of natural stream and diversion channels, based on the USFWS Recommended Fish Exclusion, Capture, Handling, and Electroshocking Protocols and Standards (USFWS 2012b, entire). This procedure was developed for the approved 2022 – 2024 ASAOC removal work on site and will be adapted for use under the proposed action. Additional sources of information on fish protection protocols may be considered in developing the program. For example, the Bonneville

Power Administration (BPA) Habitat Improvement Program (HIP) III (BPA 2023, pp. 34–49) provides a series of conservation measures intended to protect and restore fish and wildlife habitat affected by construction activities.

For channel isolation and dewatering, to minimize impacts to fish, cofferdams will isolate portions of the proposed channel within the existing ordinary high- water mark to keep water and fish out of a channel until construction is completed. Once construction of a channel is completed (including prewashing the substrate), water will be slowly reintroduced into the new channel (one-third of the flow initially), with seine block nets keeping fish from entering the new channel. Seine block nets will be placed in the upstream end of the channel with fish salvage steps described in the next paragraph. Next, two-thirds of the flow will be released into the new channel until flows and turbidity stabilize, and then ultimately all flow will be released into the new channel and the seine block net to the new channel removed.

Fish salvage steps before stream dewatering will be:

- Isolate stream channel via weirs, block nets, sandbags, straw bales, and tarps to prevent fish movement into the fish salvage area. Isolation may occur well in advance of fish salvage operations to prevent adult bull trout from entering the stream or lake.
- Partially dewater isolated stream section to improve fish capture efficiency (if needed). Some diverted water should be conveyed through diversion channel(s) to prevent increased turbidity downstream. Isolate water used to pre-wet and clean diversion channel. Use pumps to extract turbid water for land application until diverted water reaches ambient turbidity levels in undisturbed stream.

Work area isolation provide a means to limit potential effects to fish by preventing movement into the work area with the goal of safely removing as many fish outside of the work area as practicable. Protocols established in BPA’s Habitat Improvement Program will be followed for work area isolation and fish salvage, which include:

- When work area isolation is required, design plans will include all isolation elements, fish release areas, a pump to be used to dewater the isolation area, and, when fish are present, a fish screen that meets NMFS’s fish screen criteria (NMFS 2022b, entire). Wider mesh screens may be used after all fish have been removed from the isolated area.

Salvage activities will take place during conditions to minimize stress to fish species, including bull trout, typically periods of the coolest air and water temperatures which occur in the morning versus late in the day. A fish biologist will determine an operational plan to remove bull trout, with the least amount of harm to the fish, before in-water work begins. This will involve either passive movement of fish out of the reach through slow dewatering, or actively removing the fish from the reach. Should active removal be warranted, a fish biologist will clear the area of fish before the site is dewatered using one or more of a variety of methods including seining, dipping, or electrofishing, depending on specific site conditions. Salvage operations will follow the ordering, methods, and conservation measures specified as follows:

- Slowly reduce water from the work area to allow some fish to leave the work area volitionally.

- Block nets will be installed at upstream and downstream locations and maintained in a secured position to exclude fish from entering the action area. Block nets will be secured to the stream channel bed and banks until fish capture and transport activities are complete. Block nets may be left in place for the duration of the proposed action to exclude fish as long as passage requirements are met.
- Nets will be monitored hourly anytime there is instream disturbance.
- If block nets remain in place more than one day, the nets will be monitored at least daily to ensure they are secured to the banks and free of organic accumulation. If the proposed action is within bull trout spawning and rearing habitat, the block nets must be checked every 4 hours for fish impingement on the net, per BPA (2023) requirements unless a variance is granted.
- Capture fish through seining and relocate to streams as described in Table 40.
- While dewatering, any remaining fish will be collected by hand or dip nets.
- Seines with a mesh size to ensure capture of residing bull trout will be used.
- Minnow traps may be left in place overnight and used in conjunction with seining.
- Electrofish to capture and relocate bull trout not caught during seining. This step is to be used as a last resort; after all passive techniques have been exhausted.
- Continue to slowly dewater the stream reach.
- Collect any remaining bull trout in transport buckets with cold water and relocate to the stream.
- Limit the time bull trout will be held in a bucket and release them as quickly as possible.
- The number of bull trout within a bucket will be limited, and bull trout will be of relatively comparable size to minimize predation.
- Aerators for buckets will be used or the bucket's water will be frequently changed with cold, clear, water at 15-minute, or more-frequent, intervals.
- Buckets will be kept in shaded areas; or if in exposed areas, covered by a canopy.
- Dead fish will not be stored in buckets used to transport fish but will be left on the streambank to avoid mortality counting errors.

Fish handling and salvage may be required when instream work areas need to be isolated or dewatered and bull trout do not move out of the work area on their own. Bull trout may be herded out of the work area or may be removed from an exclusion area as it is slowly dewatered using methods such as hand or dip-nets, seining, trapping with minnow traps (or gee-minnow traps), or electrofishing. If fish handling is required, it will be done by either electrofishing before de-watering or hand-netting or trapping during or after dewatering.

Fish salvage work will be done by qualified personnel and follow Service Recommended Fish Exclusion, Capture, Handling, and Electroshocking Protocols and Standards (USFWS 2012b, entire) and NMFS (2000, entire) Guidelines for Electrofishing Waters Containing Salmonids

Listed Under the Endangered Species Act. Table 38 shows the activities in bull trout habitat that will require dewatering and fish salvage with specific in-water work windows.

Effects to Bull Trout from Fish Salvage

Electrofishing

The effects of electrofishing on salmonids will consist of exposure to an electric field, capture by netting, impingement on block nets, and handling associated with transferring the fish back to the river. Most of the studies on the effects of electrofishing have been conducted on adult fish greater than 300 mm (12 in) in length (Dalbey et al. 1996, p. 560). The few studies that have been conducted on juvenile salmonids indicate that spinal injuries due to electrofishing are substantially lower than they are for large fish. Smaller fish intercept a smaller head-to-tail potential from the electrical field than larger fish (Sharber and Carothers 1988, p. 117) and may, therefore, be subject to lower injury rates (Dalbey et al. 1996, p. 569; Thompson et al. 1997, p. 154). McMichael et al. (1998, p. 895) found a 5.1% injury rate for juvenile middle Columbia River steelhead captured by electrofishing in the Yakima River subbasin; Ainslie et al. (1998, p. 916) reported injury rates of 15% for direct current applications on juvenile rainbow trout.

The incidence and severity of electrofishing damage is partly related to the type of equipment used and the waveform produced (Sharber and Carothers 1988, pp. 119–121; Dalbey et al. 1996, entire; Dwyer and White 1997, entire). Continuous direct current or low-frequency (equal or less than 30 hertz [Hz]) pulsed direct current (PDC) have been recommended for electrofishing because lower spinal injury rates occur with these waveforms (Ainslie et al. 1998, p. 916).

In low conductivity waters in Idaho, examination of brook trout removed during 3-pass electrofishing at PDC frequencies of 30 Hz or 60 Hz found no difference in the number or severity of spinal injuries, with spinal compressions and misalignments observed in 4% of the brook trout captured at each frequency (Chiaramonte et al. 2020, p. 691). Few studies have examined the long-term effects of electrofishing on salmonid survival and growth (Ainslie et al. 1998, entire; Dalbey et al. 1996, entire). Monitoring of injuries to captive rainbow trout exposed to PDC during a hatchery study documented a mortality rate of 1.1%, and shocking-induced bruise injuries healed in 92% of the fish within 57 days (Schill and Elle 2000, p. 730). Overall, these studies indicate that although the fish may suffer injuries and may grow at slower rates or not at all, few die as a result and most recover.

The IDFG assessed the impacts of electrofishing on trout during removal sampling across 162 stream reaches, and with an estimated mean population mortality of 0.34% (range 0.02 - 2.78%), concluded effects were not significant at the population scale (Elle and Schill 1999, p. 29). Based on review of IDFG annual Section 6 reports provided to the Service, the observed bull trout mortality rate is less than 1% of the total number of bull trout encountered during electrofishing conducted under Idaho’s fisheries management plan and scientific collection permit program from 2010 to 2018.

Although McMichael et al. (1998, p. 898) indicated apparent electrofishing injury rates for wild salmonids were only 5%, a review of other studies suggests an injury rate of 25% (Nielson 1998, entire) to account for variable site conditions and experience levels. As noted above, electrofishing will be conducted by qualified personnel with appropriate training and experience, who will follow standard guidelines (USFWS 2012b, entire; NMFS 2000, entire) and follow the procedures listed at the beginning of the section and in USFS 2024, Appendix C that will minimize the levels of stress and mortality related to electrofishing. Field crews will be trained in observing fish for signs of stress and shown how to adjust electrofishing equipment to minimize that stress. Therefore, the Service will estimate an injury rate of 25% of the total number of fish electrofished and a mortality rate of 1%.

Netting/Trapping

At some sites requiring de-watering of a stream reach, fish will be removed from the stream reach by netting or trapping if they do not move out of the work isolation area on their own. Capturing and handling fish cause them stress, though they typically recover fairly rapidly from the process. Types of stress include increased plasma levels of cortisol and glucose (Frisch and Anderson 2000, p. 23; Hemre and Krogdahl 1996, p. 250). Even short-term, low intensity handling may cause reduced predator avoidance for up to 24 hours (Olla et al. 1995, p. 393).

The primary contributing factors to stress and death from handling with nets and buckets are differences in water temperatures (between the river and wherever the fish are held), dissolved oxygen conditions, the time that fish are held out of the water, and physical trauma. Stress on salmonids increases rapidly from handling if the water temperature exceeds 64.4 °F or dissolved oxygen is below saturation. Protection measures described at the beginning of this section and in USFS 2024, Appendix B, Table B-3 included in the proposed action are designed to reduce the potential for injury and mortality during capture and handling. These measures include limiting the amount of time fish are held in a bucket; limiting the number of fish in a bucket; using aerators for buckets; changing bucket water at 15 minute, or more frequent, intervals; and keeping buckets in shaded areas. However, the Service expects handling will disrupt normal behavior and cause short-term stress for all handled bull trout.

Bridge and Culvert Construction along the Burntlog Route

The construction of stream crossings (road and transmission lines) will occur in the construction phase and be completed by the time mining operations are to begin. Protective measures on new roads include side-ditching, culverts, guardrails, and bridges, where necessary, with design features to provide fish passage and limit potential sediment delivery to streams.

A segment of new road construction for the Burntlog Route will be located on the south side of the Riordan Creek drainage and cross Riordan Creek north of Black Lake. Along the Burntlog Route, the streams are mostly unnamed, small headwater tributaries. Larger stream crossings, include Burntlog Creek, Trapper Creek, and Riordan Creek, which support bull trout in their headwaters. The smaller headwater tributaries to these three perennial streams had bull trout DNA detections, while others did not (Stantec 2018, p. 22, Table 7, 2019, p. 33, Table 13, 2020, p. 31, Table 13).

Improvements to fish passage will be made along the Burntlog Route within the action area in streams of fish-bearing size. This will be completed by identifying and replacing collapsed, undersized, or otherwise degraded or poorly designed culverts at road crossings and committing appropriate resources to fix and improve these structures that have not already been replaced for fish passage. (USFS 2024, Appendix B, Table B-1, p. B-5). There are 6 bridges and 7 culverts proposed for replacement (**Error! Reference source not found.**) on fish-bearing streams.

There are a number of fish-bearing waterways along the proposed Burntlog Route that will require bridge or large culvert crossings. Most of these waterways have existing bridges or culverts that will need to be replaced. There are only three new proposed crossings (two bridges and one culvert) along the proposed alignment. The following sections describe the measures to install each type of crossing during construction.

For each bridge and fish-bearing culvert location, additional geotechnical work will need to be performed to confirm the assumptions made in design. This geotechnical work will involve drilling a small hole adjacent to the stream bank, but outside of the waterway. After receiving confirmation from the geotechnical work of competent soils, construction may commence on the proposed structures.

Anticipated equipment includes an excavator, bulldozer, loader, skid steer, dump truck, and a crane. It is expected piles or micro-piles will be used at the Johnson Creek and Trapper Creek crossings, so appropriate pile driving/drilling equipment will be needed at these two locations. The actual sequence and methods may vary depending on site-specific conditions, contractor preferences, and weather. The Fish and Aquatic Resource Mitigation Plan describes the pre-work and post-work steps for in-water work (Brown and Caldwell, Rio ASE, and BioAnalysts 2021, sec. 5).

Culverts

For each culvert location, a temporary stream diversion may be constructed during allotted in-water work windows per the Fish and Aquatic Resource Mitigation Plan. The diversion will maintain the natural flow rate and water quality of the stream.

The existing culvert will be removed using an excavator or other equipment. Excavated material will be stockpiled away from the stream channel and reused or disposed of appropriately. Each bank of the creek will be excavated and compacted so that bedding material can be placed for the culvert footings. Precast concrete spread footings would then be installed using a crane or other equipment for the box culvert along each side of the streambed. The steel-plate or aluminum box culvert will be delivered to the site and assembled in the staging area along the roadway. When completed, the box culvert will be placed on the precast concrete footings using a crane or other equipment.

The culvert will be aligned with the stream channel and the footings embedded below the streambed. The culvert will have adequate size, spanning a minimum of 1.2 times the bankfull width. The culvert will also have appropriate slopes and roughness to allow fish passage and sediment transport. The culvert headwalls and footings will be armored with riprap to prevent scour and erosion. The streambed will be backfilled with native soils and compacted in accordance with the USFS Stream Simulation approach to re-establish the waterway. Embankment slopes will be stabilized as required (seeding, mulching, etc.). Any impacts to the stream banks will be re-established to match the existing condition to the extent possible, using native stream materials.

Within an allotted in-water work window, isolated water will be used to pre-wet and clean the channel prior to reestablishing flows through the culvert. The stream diversion will be removed, and the stream will be restored to its original alignment and flow rate. The culvert site will be cleaned, and any excess material will be hauled away, re-establishing the waterway to as close to a pre-construction condition as possible.

Bridges

The contractor will have the locations of the bridge foundations staked by a survey crew, including any areas of avoidance near the work area. As necessary, bank diversions (i.e., sandbags, coffer dams, or other methods) will be installed during the in-water work windows along the stream banks. The stream may be narrowed slightly, allowing the water to remain in the existing channel with sufficient flow for aquatic passage. Temporary fencing (orange construction fencing) and appropriate temporary erosion and sediment control measures will be installed adjacent to the stream banks or bank diversions to minimize potential of sediment getting into the stream.

For the proposed bridges replacing existing structures, the new bridge will be installed in stages so that the existing bridge can remain functional until the new bridge is usable. For the bridge crossings without an existing bridge, a temporary crossing will be established to get necessary equipment to each side of the stream.

The construction work area limits will be cleared and grubbed away from the waterway by removing all unsuitable material. The excavator, dozer, and skid steer will be used to excavate to subgrade for the bridge footings. Precast concrete spread footings will be installed at most of the proposed bridge locations, except at Johnson Creek and Trapper Creek where piles or micro-piles will be used. All piles will be installed in the uplands, outside of the existing channel banks. Once the bridge footings are set the abutments will be built, complete with the appropriate riprap armoring down to the streambank.

The bridge deck structure will be lifted with a crane onto the abutments from the adjacent roadbed. The final abutment connections will be made to the bridge girders. Bridge deck panels and railings will then be installed from the top of the bridge. The roadbed and embankment slopes will be finished.

Embankment slopes will be stabilized as required (seeding, mulching, etc.). Any impacts to the stream banks will be re-established to match the existing condition to the extent possible, using native stream material in accordance with the USFS Stream Simulation approach. Lastly, the temporary bank diversions (sandbags/coffer dams) and construction fencing will be removed within an allotted in-water work window, restoring the stream to its natural course.

Dewatering, fish salvage, and relocation may be necessary for culvert replacement, new culvert and bridge installation, and potentially for bridge maintenance on the Burntlog Route, and will cause disturbance and injury or mortality to bull trout. The standard procedures for dewatering, salvage, and relocation detailed above will be followed for these Burntlog Route stream crossings and for other applicable projects as shown in Table 38.

<u>Effects to Bull Trout from Bridge and Culvert Construction and the Burntlog Geophysical Investigation</u>

Bull trout in the Burntlog Creek, Trapper Creek, and Riordan Creek local populations will be affected by the proposed culvert and bridge construction. In addition to fish salvage effects, other effects include noise disturbance and reductions in habitat from water drafting for geotechnical investigation.

Drilling near streams has the potential to affect bull trout through pressure waves and sound. In order to avoid injury, instantaneous sound levels should be less than 206 peak dB and sound emitted over extended time (sound emitted repeatedly) should be less than 187 dB (183 dB for fish less than 2 grams) exposure level, referenced at 1 micropascal for sound traveling through water, measured at a distance of 10 meters (Fisheries Hydroacoustic Working Group 2008, entire). However, sound levels over 150 dB can trigger behavioral effects, such as moving to and from other locations.

The Service (USFWS 2024a, pp. 6–7) reports that a geotechnical drilling study conducted by Perpetua in 2017 produced peak and average pressures as well as peak particle velocities that were below the thresholds recommended to avoid injury to fish under two grams by the Fisheries Hydroacoustic Working Group (2008, entire) and the Alaska Department of Fish and Game (1991, entire). The Burntlog Route geophysical work is expected to produce similar pressures and particle velocities as the 2017 study for a few hours at each site during Mine Year minus 3. Additionally, drilling will not occur after August 15, when spawning and rearing could occur, at sites that are within 50 feet of flowing water. If present near drilling activities, bull trout may experience minor localized disturbance from noise and are expected to move away from the temporary disturbances. Thus, effects from noise and pressure created during drilling activities are expected to be insignificant to bull trout (USFWS 2024, pp. 6-7).

For the Burntlog Route geophysical investigation, water drafting will occur in Johnson Creek, which is known to be occupied by bull trout, and is expected to take up to 6,050 gallons over the duration of the drilling activities. A maximum of 0.4% decrease in flow (at a maximum withdrawal rate of 0.33 cubic feet per second) may occur during intermittent pumping. This amount of stream flow withdrawal will be insignificant as pumping would not be continuous, and it would remove under 1% of the streamflow, which would not alter habitat availability. Water drafting also has the potential to entrain or impinge individual bull trout; however, NMFS fish screen criteria will be followed to protect all life stages, reducing the chance of impingement or entrainment to discountable levels (USFWS 2024, pp. 6-7).

Other effects associated with the proposed Burntlog Route culvert and bridge work include disturbance from noise associated with equipment operations and pile driving/drilling. The sound level for a typical construction vehicle (such as an excavator) is typically between 80 and 120 dB. These levels are below those that could impair fish health or behavior. Effects are unlikely, but if they occur, they will be limited to localized behavioral impacts such as movement disruption or area avoidance for bull trout.

All pile driving/drilling will occur in upland areas, outside of the existing channel banks. Because pile driving will not occur in-water, hydroacoustic effects will be greatly reduced. However, sound from “dry” pile driving does travel through the substrate via “sound flanking”

(Washington Department of Transportation 2019, p. 7.51). Although “dry” pile driving is not expected to result in sound pressure levels that reach the peak level threshold of 206 dB_{peak} determined to injurious to fish (Jones & Stokes and Illingworth and Rodkin 2009, pp. 4-20 to 4-22), sound pressure levels are likely to reach the fish disturbance threshold of 150 dB_{rms} within the culvert and bridge work areas.

Dewatering, fish salvage, and relocation may be necessary for culvert replacement, new culvert and bridge installation, and potentially for bridge maintenance on the Burntlog Route, and will cause disturbance and injury or mortality to bull trout. The standard procedures for dewatering, salvage, and relocation detailed above will be followed for these Burntlog Route stream crossings and for other applicable projects as shown in Table 38.

Table 38 shows that a total of 279 bull trout could be affected in Burntlog, Trapper, and Riordan Creeks and tributaries by fish salvage during construction of the Burntlog Route culverts and road stream crossings. The same number of bull trout will be injured or killed during decommissioning of the Burntlog Route (Table 38).

Stream Channels

Cofferdams will isolate portions of the stream channel slated for restoration within the existing ordinary high-water mark to keep water and fish out of the new channel until construction is completed. Once the new channel is completed (including prewashing the substrate), water will be slowly reintroduced into the new channel (one-third of the flow initially), with seine block nets keeping bull trout from entering the new channel. Seine block nets will be placed in the upstream end of the original channel, which will then be electrofished to remove all bull trout before all flow can be rerouted into the new channel. Any bull trout captured will be moved upstream of the seine block net. Once the original channel is cleared, two-thirds of the flow will be released into the new channel, and then ultimately all flow will be released into the new channel and the seine block net to the new channel removed. The original channel will be permanently blocked from the new channel and then filled with clean native alluvium as the new floodplain. Steps for isolating the stream channel include:

- Temporary cofferdams placed between the actively flowing river surface water and all active work areas. May place temporary cofferdams at additional locations to achieve required water quality standards, or to simplify construction determined by the contractor.
- Fill material for bulk bags or ‘super sacks”, if used, shall be clean, washed, and rounded material similar in gradation to existing channel substrate, and not contain fines. Material must be approved before use.
- Cofferdams and diversion dams must be built in a manner to meet turbidity limits as defined in the project specifications. Use of gravel and soil to build a pushup type cofferdam or flow diversion dam are acceptable at all locations not connected to surface water flow but will not be allowed in the actively flowing channel.

When reintroducing water to dewatered areas and newly constructed channels, a staged rewatering plan will be applied. The following will be applied to all rewatering efforts:

- Turbidity monitoring protocol will be applied to rewatering effort.

- Pre-wash the area before rewatering. Turbid wash water will be detained and pumped to the floodplain or sediment capture areas rather than discharging to fish-bearing channels.
- Install seine nets at upstream end to prevent fish from moving from downstream until 2/3 of the total flow is restored to the channel.
- Starting in early morning, introduce 0.33 of new channel flow over period of 1 to 2 hours.
- Introduce second third of flow over the next 1 to 2 hours and begin fish salvage of bypass channel if fish are present.
- Remove upstream seine nets once 2/3 flow in rewatered channel and downstream turbidity is within acceptable range (less than 40 NTU or less than 10% of the background condition).
- Introduce final third of flow once fish salvage efforts are complete, and downstream turbidity verified to be within acceptable range.
- Install plug to block flow into old channel.
- Follow same steps when rewatering mainstem.

Turbidity monitoring will include:

- Record turbidity reading, location, and time for background reading approximately 100 feet upstream from the project area using a recently calibrated turbidimeter or via visual observation.
- Record the turbidity reading, location, and time at the measure compliance location point.
    - 50 feet downstream for streams less than 30 feet wide
    - 100 feet downstream for streams between 30 and 100 feet wide
    - 200 feet downstream for streams greater than 100 feet wide
- Turbidity will be measured (background location and compliance point) every 4 hours while work is being implemented.
- If exceedances occur for more than two consecutive monitoring intervals (after 8 hours), the activity will stop until the turbidity level returns to background.
- If turbidity controls (cofferdams, wattles, fencing, etc.) are determined ineffective, crews will be mobilized to modify, as necessary. Occurrences will be documented in the project daily reports.

Construction

Fish salvage and relocation will be conducted prior to stream channel dewatering due to mining, construction, restoration, road crossing maintenance, or other activities. The Fisheries and Aquatic Resources Mitigation Plan (Brown and Caldwell, Rio ASE, and BioAnalysts 2021, pp. 5-3 - 5-4, Table 5-1; Section 5.4.7, pp. 5-21 to 5-26) outlines the sequence for fish salvage work including site preparation, work area isolation, fish capture, fish handling, and fish relocation. Specific fish salvage efforts are identified in (Table 38). Dewatering will impact streams including EFSFSR upstream from YPP lake, EFSFSR downstream from YPP lake, Fiddle Creek, Meadow Creek and tributaries, and EFMC. In total, 17.11 km of stream channel are estimated to be subject to dewatering and fish salvage, with some reaches dewatered, and fish salvaged, more than once (Table 39). Fish relocation areas have been established for both permanent and temporary removal associated with different salvage locations (Table 40). Permanent fish relocation will be used where stream channels will be diverted and dewatered over long periods of time (e.g., permanent relocation will occur as a result of TSF and EFSFSR tunnel). Temporary relocation areas will be used where short-term operation activities (e.g., culvert replacement, stream enhancements, and stream restoration) will require relocation upstream from the isolated work area, and the fish will then be allowed to migrate back into the work area once the instream work is completed and access is re-established.

Table 38. Predicted fish handling and salvage activities by mine phase and year (USFS 2024, Table 4.1-38).

Mine Phase	Mine Year	Action	Fish Handling	Frequency/Duration	Work Window	Bull Trout Present	Stream Length (ft)	Abundance
EFSFSR Tunnel and Fishway								
Pre-Production	Minus 2 to Minus 1	Temporary Fish Barrier on lower EFSFSR. In the FOMP Appendix D provides additional details on fish barrier.	Work area isolation and fish salvage protocols established in (Brown and Caldwell, Rio ASE, BioAnalysts 2021; BPA 2023; NMFS 2000; USFWS 2012).	One-time event to install fish barrier. Installation of the fish barrier would occur several months prior to dewatering YPP lake. The barrier may be erected for 1-6 months prior to fish salvage event in YPP. Set up would likely occur either in the fall or early spring prior to any adult migrations.	September 15 - April 1: Set up barrier prior to adult migrations of ESA-listed species.	Juvenile ESA-listed species of Chinook salmon and steelhead may be present as well as overwintering adult and subadult bull trout. Westslope cutthroat trout are likely to be present. No adult steelhead or Chinook salmon would need to be handled during fish barrier installation.	Linear stream length (i.e., <50 ft) affected to erect barrier.	1
Pre-Production	Minus 1	Yellow Pine pit dewatering and fish salvage operations. In the FMP, Table 5-10 provides additional information on fish capture methods for YPP Fish salvage.	Fish would be relocated downstream of the development area. Fish capture and handling protocols would follow (BPA 2023; NMFS 2000; USFWS 2012). Fish capture methods (Table 5-10) and relocation areas for fish salvaged (Table 5-11) (Brown and Caldwell, Rio ASE, BioAnalysts 2021).	One-time fish salvage event. See FMP Appendix D Table 5-10 for timing considerations that would apply to YPP fish salvage operations (BC et al. 2021a). Fish salvage may take up to a week not including prior equipment staging and coordination.	After September 15 to avoid adult salmonid spawning and migration period. Stream temperature is also an important consideration to minimize stress.	Present	YPP lake area=18,267m^2 (See FMP Table 5-6)	104 (based on 2019-2020 population estimates)
Pre-Production	Minus 1	Hennessy Creek-Hennessy Creek diverted into Fiddle Creek, which flows into EFSFSR above EFSFSR Tunnel.	Non-fish bearing	Hennessy Creek would be diverted once and maintained for approximately 12 years.	Not applicable	Non-fish bearing stream	Not applicable	No fish salvage is expected for Hennessy Creek.
Pre-Production	Minus 1	Midnight Creek-Midnight Creek diverted into EFSFSR above EFSFSR Tunnel.	Non-fish bearing	Midnight Creek would be diverted once and maintained for approximately 12 years.	Not applicable	Non-fish bearing stream	Not applicable	No fish salvage is expected for the Midnight Creek.

Mine Phase	Mine Year	Action	Fish Handling	Frequency/Duration	Work Window	Bull Trout Present	Stream Length (ft)	Abundance
Mine Operations	Minus 1 to 11	Regarding the EFSFSR Tunnel flow control weir, the FOMP does not propose active fish salvage within the accessway as stream flows decrease. Rather, the FOMP recommends supplying supplementary flow to passively flush (i.e., no fish handling or salvage) remaining juvenile fish down the accessway until visual inspection of the accessway determines that there are no fish remaining. Supplementary water would be provided by mechanical or gravity means as long as necessary to flush juvenile fish downstream through the length of the accessway.	No fish handling required	The accessway will naturally flow at least once each year as streamflow exceeds 25 cfs (FOMP see Figure 3-1). Based on average conditions, mid-April (April 17) and late July (July 30) are the approximate dates when streamflow would crest and then eventually recede from the flow control weir (FOMP see Figure 3-1). Late July represents a time period when receding stream flows would occur over the flow control weir. Additionally, the accessway has a planar, smooth floor from 1.5% to 4.5% longitudinal gradient which when combined with supplementary flow would reduce the need for fish salvage operations in the accessway.	Not Applicable - The primary management strategy is to avoid impacts to all ESA-listed species.	Juveniles, any species: 1-inch clear bar spacing on picket panels provides exclusion of adults and facilitates guidance for juvenile fish. However, this does not preclude the possibility of very small juvenile fish from passing through picket panels and moving down the accessway. The exclusion barrier at the north portal also prevents adults from entering the juvenile orientation pool or accessway	Not Applicable	No fish salvage is expected for the accessway.
Mine Operations	Minus 1 to 11	Trap and Haul- Trap and haul would only be used if fish arrive volitionally at the downstream end of the tunnel, but do not ascend the fishway (see FOMP Appendix C Table 1). The table provides the conditions under which trap and haul would be initiated.	Trap and haul fish handling protocols would follow information summarized in FMP (Table 5-10) and FOMP (Appendix C).	Trap and haul could occur each year the EFSFSR tunnel fishway is operational. Trap and haul frequency each year is only expected to occur 1-2 times per day depending on multi-species presence (see FOMP Appendix C Table 1). The period that trap and haul would occur coincides with 1-week prior to the spawning period (all species). See spawning periods noted in FOMP Appendix C Table 2. Trap and haul could occur each year during the operational phase of the fishway (from -1 to 11).	Work window for trap and haul is one week prior to and including spawning periods noted for each species (see FOMP 1.3 Target Species): Bull trout - Aug 8 to Sep 15 As noted in Table 1 if adults present in the adult holding/ resting pool below the fishway have not entered the fishway over a 48-hour period and proceeded up the fishway they will be collected and transported upstream without further delay.	Present	Not Applicable	Escapement Estimates to EFSFSR: 1200
Mine Operations	11-17	Tunnel Decommissioning and Channel maintenance period- However, the tunnel may be used for a period of time for channel maintenance and protection (see FOMP-Section 3.10).	Establish fish salvage protocols summarized in the FMP (see Section 5.3).	The channel maintenance and protection period is expected to last two years but may continue for up to five more years (see FOMP Table 1-1 Timeline). The tunnel would be decommissioned only once for permanent closure. Final tunnel decommissioning would occur in Year 17.	September 15 to April 1-The work window for initial and final closure of the EFSFSR Tunnel would coincide with the established maintenance work window (see FOMP Table 3-1). Fishway would be dewatered slowly to allow fish salvage operations as the EFSFSR channel is activated (see FOMP Appendix E Channel Activation) during initial channel activation.	Some ESA-listed juvenile species may be present in the EFSFSR Tunnel fishway at the time the EFSFSR channel is activated.	Not Applicable	145

Mine Phase	Mine Year	Action	Fish Handling	Frequency/Duration	Work Window	Bull Trout Present	Stream Length (ft)	Abundance
Mine Operations	11	Stibnite Lake and EFSFSR Channel Restoration	No handling required.	One-time event applies to lake and EFSFSR channel bypassed by EFSFSR tunnel. Stibnite Lake and EFSFSR would be restored. Restoration work would be completed in isolation from active flowing stream channels. No active flowing stream channels or fish-bearing waters would be influenced during restoration that would require fish salvage. Stibnite Lake would be filled gradually in the reactivation of the channel.	September 15 to April 1-Work window for channel activation. FOMP Appendix E summarizes EFSFSR channel activation.	None-At the time of restoration there would be no fish within the restoration construction area. Fish presence would begin once the channel is fully wetted and activated.	Not Applicable	None-No actively migrating ESA-listed adults or juvenile species are expected in the restored lake and stream channel until fully activated. Fish would enter volitionally once block nets are removed.
Mine Operations	12	Hennessy Creek Diversion removed and stream restored	No fish handling required.	One-time event to reconnect stream to EFSFSR. Hennessy Creek diversion would be removed and restored to EFSFSR.	Not applicable	Non-fish bearing stream	Reconnecting tributary stream only.	None
Mine Operations	12	Midnight Creek Diversion removed and stream restored.	No fish handling required.	One-time event to reconnect stream to EFSFSR. Midnight Creek diversion would be removed.	Not applicable	Non-fish bearing stream	Reconnecting tributary stream only.	None
Mine Development								
Pre-Production	Minus 3	Payette-Warm Lake Road 2-Big Creek culvert replacement 1-Hargrave Culvert replacement	Fish salvage and temporary displacement at replacement road-stream crossings. Fish would be temporarily displaced following protocols established in (Brown and Caldwell, Rio ASE, and BioAnalysts 2021; BPA 2023; NMFS 2000; USFWS 2012).	1-Year: One-time event to improve fish passage.	To be determined-No ESA-listed species present	No	~120 ft linear distance per road-stream crossing	No ESA-listed fish species present.
Pre-Production	Minus 3 to Minus 1	Burntlog Route Culverts; Road-stream crossings would be accomplished during the pre-production phase as the alternate route is used (Perpetua 2021)	Fish salvage and temporary displacement at road-stream crossings (Perpetua 2021). Fish would be temporarily displaced following protocols established in (Brown and Caldwell, Rio ASE, and BioAnalysts 2021; BPA 2023; NMFS 2000; USFWS 2012).	2-years: Multi-year activity: Once during pre-production and again once after final mine closure/reclamation work has been completed (Perpetua 2021. More detail provided in RFAI-146 on road-stream crossings.	Work Windows: July 15 to August 15	Yes	Cumulative stream crossings total 1,840 linear feet of perennial stream	279

Mine Phase	Mine Year	Action	Fish Handling	Frequency/Duration	Work Window	Bull Trout Present	Stream Length (ft)	Abundance
Pre-Production	Minus 3	Biological community monitoring (Brown and Caldwell et al. 2021a Table 7-3).	Nine electrofishing sites and 28 snorkel sites that correspond to baseline sampling locations (see Brown and Caldwell, Rio ASE, and BioAnalysts 2021; Table 7-3). Electrofishing is not being proposed for monitoring at this time but would be considered if resource agencies desire more precise measures of abundance than can be attained with snorkeling.	Multi-year: Monitoring sites may be adjusted annually to accommodate newly restored stream reaches to continue baseline monitoring efforts. Biological monitoring would occur throughout construction, closure, and restoration and enhancement phases of the proposed action and planned on an annual basis (Brown and Caldwell et al. 2021a).	Monitoring would occur over the summer and fall (redd surveys) months to emulate baseline sampling.	Bull trout anticipated but may be dependent on-site location and temporal sampling event during the project.	Similar to baseline sampling	No fish salvage. Expected abundance likely to vary annually but should be similar to baseline sampling fish abundance. Species assemblage may vary as the EFSFSR tunnel becomes operational.
Pre-Production	Minus 3 and Minus 2	Lemhi Off-site mitigation Little Spring Creek completed	Fish salvage and temporary displacement at replacement road-stream crossings. Fish would be temporarily displaced following protocols established in (Brown and Caldwell, Rio ASE, and BioAnalysts 2021; BPA 2023; NMFS 2000; USFWS 2012).	2-years 1st year off-channel construction activity with no fish handling or salvage needed. 2nd Channel activation and mainstem in-water work requires fish handling and salvage.	July 1 to August 23	Yes	~6,800 ft linear stream length (existing channel length)	680
Pre-Production	Minus 2	Diversion of Garnet Creek around Plant site and haul roads. Stream would be diverted around mine facilities and would remain within the newly diverted channel (Rio ASE 2020). Lowermost section of Garnet (i.e., GC1) would be restored for limited fish use near the confluence with EFSFSR. Garnet Creek would remain within newly established channel.	No fish salvage of ESA-listed species expected in non-fish bearing stream (MWH 2017).	1-year: One-time event: Garnet Creek currently flows through diverted channel	Not applicable	Non-fish bearing stream	1,548 existing linear feet of stream.	Non-fish bearing stream

Mine Phase	Mine Year	Action	Fish Handling	Frequency/Duration	Work Window	Bull Trout Present	Stream Length (ft)	Abundance
Pre-Production	Minus 1	Blowout Creek-Sediment control and rock drain	Fish salvage and temporary displacement. Fish capture and handling protocols would follow (Brown and Caldwell, Rio ASE, and BioAnalysts 2021; BPA 2023; NMFS 2000; USFWS 2012). No fish salvage of ESA-listed species expected in these reaches (i.e., BC2A rock drain and BC2B and BC3-diversion around burrow source).	1-year: One-time event to improve stream habitat and sediment sources from upper Blowout Creek	September 1 to April 15	No	Rock drain 1,576 linear feet of high gradient stream (approximately 17% gradient). Diversion around borrow source 2,626 linear feet.	No ESA-listed fish species present.
Pre-Production	Minus 2	Diversion of upper Meadow Creek and tributaries around TSF/DRSF. Preparation of roads, ditches, and pipelines to divert water around development area.	Fish salvage and relocation event. Fish would be relocated downstream of the development area. Fish capture and handling protocols would follow (BPA 2023; NMFS 2000; USFWS 2012)	1-year: One time event to prepare upper Meadow Creek for TSF/DRSF development.	July 15 to August 15	Yes	19,597 ft existing linear perennial stream length. Upper disturbance limit to downstream end of buttress.	12
Pre-Production	Minus 1	EFSFSR Barrier elimination-Box culvert	Fish salvage and temporary displacement. Fish would be relocated upstream of current barrier. Fish capture and handling protocols would follow (BPA 2023; NMFS 2000; USFWS 2012).	1-year: One time event to improve fish access to upper EFSFSR and Meadow Creek	Work Windows: July 15 to August 15	Yes	120 ft linear feet of exist stream	1
Pre-Production	Minus 1	Fiddle Creek Growth Media Stockpile	Fish salvage and relocation event. Fish would be relocated upstream of growth media stockpile. Fish capture and handling protocols would follow (BPA 2023; NMFS 2000; USFWS 2012)	Multi-year: Development of Fiddle Creek GMS would occur once during pre-production phase. Stream would be restored during closure phase. Stream habitat in Fiddle Creek would be reduced via pipe for a period of 26 years.	See FMP BC et al. 2021a	No	1,689 ft existing linear stream length	No ESA-listed fish species present.

Mine Phase	Mine Year	Action	Fish Handling	Frequency/Duration	Work Window	Bull Trout Present	Stream Length (ft)	Abundance
Pre-Production	1	Upper Blowout Creek Meadow Grade Control	Fish salvage and relocation event (Reach BC1. Fish capture and handling protocols would follow (Brown and Caldwell, Rio ASE, and BioAnalysts 2021; BPA 2023; NMFS 2000; USFWS 2012)	1-year: One-time event to improve stream habitat and sedimentation from Blowout Creek	See FMP BC et al. 2021a	No	100 ft existing linear	No ESA-listed fish species present.
Pre-Production	Minus 1	EFSFSR Enhancement-Stream enhancement with LWD (single piece), boulders, wood jams (multiple pieces) and pool excavation to enhance instream conditions (RioASE 2021).	Temporary displacement of fish during placement of boulders and single LWD placement. Fish salvage and relocation for wood jams and pool excavation. Fish capture and handling protocols would follow (Brown and Caldwell, Rio ASE, and BioAnalysts 2021; BPA 2023; NMFS 2000; USFWS 2012).	1-year: One-time event to improve stream habitat in EFSFSR	Work Window: July 15 to August 15	Yes	Enhancement reaches equal 11,166 feet in total stream length. Enhancement treatments are approximately 30% of total stream length. ~25% (2,791.5 feet) would be treated with single logs and boulders. ~5% (558.3 feet) would be treated with pools and log jams.	91
Pre-Production	Minus 1	Midnight Creek Diversion-Midnight Creek would be diverted and rerouted by pipe under the haul roads and channelized downstream of lower haul road to enter the EFSFSR upstream of the proposed south tunnel portal (Perpetua 2021; RioASE 2021).	No fish salvage of ESA-listed species expected in non-fish bearing stream (MWH 2017).	1-year: One-time event to realign Midnight Creek.	Not applicable	Non-fish bearing	No applicable	Non-fish bearing stream
Mine Operations	3	Lower Meadow Creek (i.e., MC4b.2, MC5, and MC6a) diverted into a restored channel around Hangar Flats pit footprint while reach MC6b channel alignment would remain intact with only stream enhancement features (RioASE 2021).	Fish salvage and relocation event. Fish would be relocated downstream of these reaches in Meadow Creek or EFSFSR. Fish handling protocols (BPA 2023; NMFS 2000; USFWS 2012)	1-year: One-time event for in-water work to activate new stream.	July 15 to August 15 Typical steps in activation of a new stream channel described in Brown and Caldwell et al. 2021b (Appendix E).	Yes	5,052 feet existing linear stream length	3
Closure and Post-Closure	17-23	Upper Meadow Creek-Begin restoration of stream with tributary reconnection at mine year 17 and full restoration by year 23	No fish salvage of ESA-listed species expected during closure and post-closure period.	7 years: Yearly activity from 17 to 23	No work window to restore and reconnect streams on the TSF development area. Typical steps in activation of a newly restored stream channel described in (Brown and Caldwell et al. 2021b-Appendix E).	No	Not applicable	TSF/DRSF would not have fish present during this mine phase.

Mine Phase	Mine Year	Action	Fish Handling	Frequency/Duration	Work Window	Bull Trout Present	Stream Length (ft)	Abundance
Closure and Post-Closure	18	Lower Meadow Creek restored from toe of TSF buttress to previously restored channel around Hangar Flats footprint	Fish salvage and relocation event. Fish would be relocated downstream TSF/DRSF in Meadow Creek or EFSFSR. (Brown and Caldwell, Rio ASE, and BioAnalysts 2021a; BPA 2023; NMFS 2000; USFWS 2012)	1-year: One-time event for in-water work to activate new stream.	July 15 to August 15	Yes	2,082 feet existing linear stream length	1
Closure and Post-Closure	24	Fiddle Creek Growth Media Storage Removed and Stream Restored	Fish would be prevented from entering the conveyance pipe prior to dewatering thus allowing time for fish to flush downstream. See FOMP Appendix E for channel activation process (Brown and Caldwell, McMillen Jacobs, and BioAnalysts 2021). If needed, fish capture and handling protocols would follow recommendations established in FMP (BPA 2023; NMFS 2000; USFWS 2012).	1-year: One-time event to restore habitat during closure phase. Growth media storage and pipe removed.	See FMP: Brown and Caldwell et al. 2021a	No	Not Applicable	No fish in conveyance pipe prior to full dewatering and activation of new channel. Stream restored adjacent to pipe.
Closure and Post-Closure	23+	Burntlog Route Decommissioning (Perpetua 2021)	Fish salvage and temporary displacement for removal of road-stream crossings (Perpetua 2021). Fish would be temporarily displaced following protocols established in (Brown and Caldwell, Rio ASE, and BioAnalysts 2021; BPA 2023; NMFS 2000; USFWS 2012).	2-years: Multi-year event occurring once during pre-production and again once after final mine closure/reclamation work has been completed (Perpetua 2021).	Depending on species and life stage presence.	Yes	1,840 linear feet of perennial stream. (50-foot buffer width per crossing).	279

Source: BPA (2023, entire); Brown and Caldwell, Rio ASE, and BioAnalysts (2021, entire); Brown and Caldwell, McMillen Jacobs, and BioAnalysts (2021, entire); NMFS (2000, entire); MWH (2017, entire); Rio ASE (2021, entire); USFWS (2012, entire)

Table 39. Purpose, location, stream length, and lake area affected from dewatering (USFS 2024, Table 4.1-39).

Purpose	Location	Stream Length Affected (m)	Lake Area Affected (m^2)	Fish Salvage Operations
Mine Site Excavation and EFSFSR Tunnel	EFSFSR upstream from YPP Lake	475	N/A	Work area isolation, fish salvage, relocation
	YPP Lake	N/A	18,267	
	EFSFSR downstream from YPP Lake	639	N/A	
Growth Media Stockpile	Fiddle Creek	515	N/A	
TSF Development	Meadow Creek and Tributaries	7,249	N/A	
Hangar Flats Development	Meadow Creek	2,175	N/A	
Stream Restoration	EF Meadow Creek	2,532	N/A	
EFSFSR Tunnel Maintenance	EFSFSR	Variable	N/A	Work area isolation, fish salvage, and temporary displacement
Stream Enhancement	Meadow Creek	718	N/A	
Stream Enhancement	EFSFSR	2,706	N/A	
Culvert Replacement	EFSFSR Box Culvert	100	N/A	

Source: Brown and Caldwell, Rio ASE, and BioAnalysts (2021, pp. 5-9 to 5-10, Table 5-6)

Table 40. Fish salvage locations and permanent and temporary fish relocation areas (USFS 2024, Table 4.1-40).

Fish Salvage Location	Fish Relocation Type	Relocation Stream	Relocation Area
EFSFSR from YPP lake outlet to North Portal of Tunnel	Permanent	EFSFSR	Downstream from North Portal of Tunnel to confluence with Sugar Creek
		EFSFSR	Downstream from confluence with Sugar Creek
		Sugar Creek	Upstream from confluence with EFSFSR
YPP Lake	Permanent	EFSFSR	Downstream from North Portal of Tunnel to confluence with Sugar Creek
		EFSFSR	Downstream from confluence with Sugar Creek
		Sugar Creek	Upstream from confluence with EFSFSR
EFSFSR from South Portal of Tunnel to YPP lake inlet	Permanent	EFSFSR	Downstream from North Portal of Tunnel to confluence with Sugar Creek
		EFSFSR	Downstream from confluence with Sugar Creek
		Sugar Creek	Upstream from confluence with EFSFSR
Fiddle Creek	Permanent	Fiddle Creek	Upstream from Fiddle Creek media stockpile
Meadow Creek	Permanent	Meadow Creek	Downstream from TSF development
		EFSFSR	Upstream from confluence with Meadow Creek
		EFSFSR	Downstream from confluence with Meadow Creek
EFSFSR Box Culvert Replacement	Temporary	EFSFSR	EFSFSR downstream from isolation work area
			EFSFSR upstream from isolation work area
Meadow Creek (restoration)	Temporary	Meadow Creek	Upstream from isolation work area

Fish Salvage Location	Fish Relocation Type	Relocation Stream	Relocation Area
Meadow Creek (enhancement)	Temporary	Meadow Creek	Upstream from isolation work area

Source: Brown and Caldwell, Rio ASE, and BioAnalysts 2021 (2021, p. 5-24, Table 5-11)
Permanent = Salvaged habitat will be eliminated. Fish will not return from Relocation Area.
Temporary = Salvaged habitat will not be eliminated. Relocation Area is near Salvage Location and fish will be allowed to return upon completion of in-channel work.

Although McMichael et al. (1998, p. 898) indicated apparent electrofishing injury rates for wild salmonids were only 5%, a review of other studies suggests an injury rate of 25% (Nielson 1998, entire) to account for variable site conditions and experience levels. All fish salvaged will be impacted by some level of salvage related stress. Salvage-related mortality, injury, and stress will have a long-term impact on bull trout within the Stibnite project area. Additional information on the rescue and relocation protocols and implementation is provided in the Fisheries and Aquatic Resources Mitigation Plan (Brown and Caldwell, Rio ASE, and BioAnalysts 2021, Section 5.4.7, pp. 5-21 to 5-26). Appendix C of the CMP contains maps by Mine Year that show the proposed action site disturbances, including stream segments that will be restored, which will require diversion (i.e., dewatering; Tetra Tech 2023, Appendix C). Effects on bull trout due to salvage in dewatered stream channels (Table 41) will result in injury, stress, and mortality of adults, subadults, and juveniles.

Table 41. Potential number of bull trout impacted in dewatered stream channels based on observed densities (adapted from USFS 2024, Table 4.1-41).

Stream	Reach ID	Site ID	Enhanced and Restored Stream Length (m)	Mean Linear Density (bull trout/m)	Number of Bull Trout Affected
Meadow Creek	MC1	MWH-034	6,073	0.01	61
	MC2	MWH-016	561	0.02	11
	MC3	MWH-047	731	0.01	7
	MC4	MWH-015	1,068	0.03	32
	MC5	MWH-028	847	Not Present	0
	MC6	MWH-014	766	Not Present	0
EF Meadow Creek	BC1	MWH-027	639	Not Present	0
	BC2	-	814	Not Present	0
	BC3	MWH-028	209	Not Present	0
East Fork South Fork Salmon River	EF2	MWH-011 MWH-022	2,914	Not Present	0
	EF3	MWH-030	1,027	0.09	91
	EF4	MWH-030	693	0.09	
Fiddle Creek	FC2	MWH-023	548	Not Present	0

Yellow Pine Pit Lake

Construction

Salvage and relocation of fish from the YPP lake (19,267 m^2) will require a more focused effort compared to fish salvage in dewatered stream reaches. However, impacts to bull trout and injury and mortality rates are expected to be similar. A fish barrier will be installed and designed to allow fish to leave the YPP lake but not allow fish to migrate upstream. The purpose of the barrier will be to ensure that the fewest number of individual bull trout are present in the YPP lake when the draining process begins. The YPP lake will be blocked from fish passage in advance of the completion of the EFSFSR fish tunnel and diversion of the EFSFSR into the tunnel to minimize fish abundance in the lake prior to dewatering (Brown and Caldwell, McMillen Jacobs, and BioAnalysts 2021, Sections 5.4.6.1 and 5.4.6.2). In other respects, dewatering and fish salvage in the YPP lake will be similar to other areas of the proposed action, with an anticipated injury and mortality rate of 25%, and following USFWS Recommended Fish Exclusion, Capture, Handling, and Electroshocking Protocols and Standards (USFWS 2012b, entire) and Guidelines for Electrofishing Waters Containing Salmonids Listed Under the Endangered Species Act (NMFS 2000, entire). Table 38 shows that a total of 104 bull trout could be affected in YPP by fish salvage during dewatering of the lake.

Noise and Vibration

In order to avoid injury, instantaneous sound levels should be less than 206 peak dB and sound emitted over extended time (sound emitted repeatedly) should be less than 187 dB (183 dB for fish less than 2 grams) exposure level, referenced at 1 micropascal for sound traveling through water, measured at a distance of 10 meters (Fisheries Hydroacoustic Working Group 2008, entire). However, sound levels over 150 dB can trigger behavioral effects, such as moving to and from other locations.

In addition to sound effects, excessive ground vibrations have the potential to affect Chinook salmon , particularly the sensitive egg life stage (Timothy 2013, entire; Kolden and Aimone-Martin 2013, entire). Smirnov (1954, as cited in Alaska Department of Fish and Game 1991) found significant egg mortality caused by ground vibrations with a peak particle velocity (PPV) of 2 inches per second (ips). Faulkner et al. (2008, p. 1) found that PPVs up to 9.7 ips resulted in significantly higher mortality in rainbow trout eggs but there was no increase in mortality when exposed to PPVs of 5.2 or less. The Alaska Department of Fish and Game have PPV restrictions of 2.0 ips to protect salmonids (Timothy 2013, entire). The reported PPV value for an in-situ soil sampling rig at a distance of 100 feet is 0.011 ips (ATS Consulting 2013, p. 32, Table 7).

Construction

The effects of equipment noise and pile driving/drilling have been addressed above in the Stream Crossings section. Blasting may occur during construction of the new portions of the Burntlog Route. Blasting can cause serious injury or mortality to fish; however, these activities will follow applicable regulations and standards (described in more detail below). There may be increased noise caused by the construction vehicles. The sound level for a typical construction vehicle (such as an excavator) is between 80 and 120 dBs. These levels are below those that could impair fish health or behavior. Blasting along Burntlog Route will not occur within streams or next to stream crossings; blasting will only occur where the roadway needs to be cut into the slope.

Effects will be localized insignificant behavioral impacts such as movement disruption or area avoidance for bull trout.

Operations

Because all blasting will be conducted in compliance with applicable regulations and standards (Brown and Caldwell, Rio ASE, and BioAnalysts 2021, Section 5.6, pp. 5-30 to 5-36), the noise and vibration effects to bull trout will be minimized, but may result in sublethal effects such as stress and localized behavioral impacts.

Explosives will be used to fracture rock from mine operations. Explosives detonated near water produce shock waves that may be lethal or damaging to fish, fish eggs, or other aquatic organisms. Outside of the zone of lethal or harmful shock waves, the vibrations caused by drilling and blasting have the potential to disturb fish causing stress or altering behavior. Most of the blasting required at the mine site will be in and near the Yellow Pine, Hangar Flats, and West End pits, with some that may be required for construction of stream diversions at the YPP, TSF, and TSF Buttress. Such blasting will generally occur on hillsides and at higher elevations, with considerable distance between streams and the origin of the blasts.

Blasting and drilling activities near fish-bearing streams have the potential to affect bull trout by producing hydrostatic pressure waves, and create underwater noise and vibration, thereby temporarily altering instream conditions. Safe setback distances for blasting in or near water for the protection of fish have been established (Kolden and Aimone-Martin 2013, entire; Timothy 2013, entire; Wright and Hopky 1998, entire). Blasting standards will be followed (Brown and Caldwell, Rio ASE, and BioAnalysts 2021, Section 5.6, pp. 5-30 to 5-36) as well as BMPs set forth in Wright and Hopky (1998, entire) and Timothy (2013, entire), These standards have been shown to minimize the risk of injury or mortality to all life stages of fish (Timothy 2013, entire).

As part of the Environmental Monitoring and Management Plan, an Explosives and Blasting Management Plan will be developed to ensure compliance with the blasting requirements of the Mine Safety and Health Administration, 30 CFR 56, Subpart E – Explosives and 30 CFR 57, Subpart E – Explosives. The blasting plan will include the setback distances and other BMPs such as modifying blasting variables including charge size, and vibration and overpressure monitoring (USFS 2024, Appendix B).

A spreadsheet tool was developed to compute the required setback distances from fish-bearing streams and lakes (Brown and Caldwell, Rio ASE, and BioAnalysts 2021, pp. 5-33 to 5-34). The results indicate that a 425-foot blasting setback from the closest point in the blast field to stream and lake habitats should be protective in most cases, assuming a 40-foot bench height. These findings were used to examine likely areas where blasting will be near streams or lakes. For a 20-foot bench height, the examination indicated that a 239-foot blasting setback could be met everywhere within the mine plan. Considering a 40-foot bench, blasts may encroach on the 425-foot blasting setback in limited areas adjacent to the YPP lake near the EFSFSR fish tunnel and adjacent to the Hangar Flats pit where Meadow Creek is closest to the pit. In those areas where blasting is nearer to streams and lakes and impacts may occur, it is possible that the bench heights could be adjusted to 20 feet, reducing the required setback, while still being protective of bull trout.

In addition to protective setbacks and bench height, other methods may be employed when warranted, such as using controlled blasting techniques following industry BMPs, including those identified in Wright and Hopky (1998, entire) and Timothy (2013, entire), modifying blasting variables including charge size, and vibration and overpressure monitoring.

Because all blasting will not occur in bull trout streams and be conducted in compliance with applicable regulations and standards (Brown and Caldwell, Rio ASE, and BioAnalysts 2021, pp. 5-30 to 5-36), and because the noise from the heavy equipment is expected to be below the acceptable sound levels to protect fish, including behavioral effects (refer to Construction of Access, Roads, Utilities, and Offsite Facilities) the noise and vibration effects of operations to bull trout behavior are expected to be insignificant.

4.3.2 Lemhi Restoration Project Area

The compensatory mitigation project on the Lemhi River is intended to provide improved habitat conditions for bull trout. Bull trout spawn in the tributaries and rear in the tributaries as well as the mainstem. Adverse effects to these fish from Lemhi restoration (also known as the Little Springs Conservation Easement), will be short-term during construction, but restoration is expected to provide long-term benefits. Studies have shown that restoration activities in the Lemhi River have resulted in increases in bull trout populations (Uthe et al. 2017, entire). The IDFG (2023, as cited in the USFS 2024, p. 445) estimates that less than 100 fish/km would be present in the restoration reach.

This compensatory mitigation project will be conducted so that no work will occur in the flowing channel to minimize or avoid impacts caused by sediment and turbidity, changes to water quality (spills risk or chemical contaminants), and noise and vibration. Creating the side channels before restoring the main channel is key to reducing the impacts. The text below describes the process that will be taken to avoid working in-water (USFS 2024, Section 4.1.4).

Work areas will be isolated for performing work within the in-water work window (first quarter of July (Q1) through the third quarter of August (Q3)). Cofferdams will be placed within the existing Lemhi River channel to isolate areas for excavated connections between the existing and new channel. The new channel will then be activated, and additional cofferdams will be required to complete filling of the existing Lemhi River channel and installation of wood habitat structures.

Cofferdams will isolate portions of the proposed channel within the existing ordinary high-water mark to keep water and fish out of the new channel until construction is completed. Once the new channel is completed (including prewashing the substrate), water will be slowly reintroduced into the new channel (one-third of the flow initially), with seine block nets keeping fish from entering the new channel. Seine block nets will be placed in the upstream end of the original channel, which will then be electrofished to remove all fish before all flow can be rerouted into the new channel. Any fish captured will be moved upstream of the seine block net. Once the original channel is cleared, two-thirds of the flow will be released into the new channel, and then ultimately all flow will be released into the new channel and the seine block net to the new channel removed. The original channel will be permanently blocked from the new channel and then filled with clean native alluvium as the new floodplain. The steps for staged dewatering include:

- Temporary cofferdams placed between the actively flowing river surface water and all active work areas. Temporary cofferdams may be placed at additional locations to achieve required water quality standards or to simplify construction determined by the contractor.
- Fill material for bulk bags or ‘super sacks”, if used, shall be clean, washed, and rounded material similar in gradation to existing channel substrate, and not contain fines.
- Cofferdams and diversion dams must be built in a manner to meet turbidity limits as defined in the project Specifications. Use of gravel and soil to build a pushup type cofferdam or flow diversion dam are acceptable at all locations not connected to surface water flow but will not be allowed in the actively flowing channel.

Staged rewatering – when reintroducing water to dewatered areas and newly constructed channels, a staged rewatering plan will be applied. The following will be applied to all rewatering efforts (USFS 2024, Appendix B):

- Turbidity monitoring protocol will be applied to rewatering effort.
- Pre-wash the area before rewatering. Turbid wash water will be detained and pumped to the floodplain or sediment capture areas rather than discharging to fish-bearing channels.
- Install seine nets at upstream end to prevent fish from moving from downstream until 2/3 of the total flow is restored to the channel.
- Starting in early morning, introduce 1/3 of new channel flow over period of 1 to 2 hours.
- Introduce second third of flow over the next 1 to 2 hours and begin fish salvage of bypass channel if fish are present.
- Remove upstream seine nets once 2/3 flow in rewatered channel and downstream turbidity is within acceptable range (less than 40 NTU or less than 10% of the background condition).
- Introduce final third of flow once fish salvage efforts are complete, and downstream turbidity verified to be within acceptable range.
- Install plug to block flow into old channel.
- Follow same steps when rewatering mainstem.

Turbidity monitoring will include:

- Record turbidity reading, location, and time for background reading approximately 100 feet upstream from the project area using a recently calibrated turbidimeter or via visual observation.
- Record the turbidity reading, location, and time at the measure compliance location point.
    - 50 feet downstream for streams less than 30 feet wide
    - 100 feet downstream for streams between 30 and 100 feet wide
    - 200 feet downstream for streams greater than 100 feet wide

- Turbidity will be measured (background location and compliance point) ever 4 hours while work is being implemented.
- If exceedances occur for more than two consecutive monitoring intervals (after 8 hours), the activity will stop until the turbidity level returns to background. The Offices of Species Conservation will be notified for all exceedances and corrective actions at project completion.
- If turbidity controls (cofferdams, wattles, fencing, etc.) are determined ineffective, crews will be mobilized to modify, as necessary. Occurrences will be documented in the project daily reports.

Water Temperature

Stream temperatures are affected by multiple factors, including surface heat exchange (e.g., solar radiation, evaporation, and conduction) and hyporheic flows. Removal of riparian vegetation in the mainstem will be avoided where possible, and some riparian vegetation in the floodplain, where the new channel will be constructed, may need to be removed.

The width:depth ratio in the mainstem will be reduced, which will provide long-term improvements to water temperature by creating a deeper, narrower (but not channelized) stream channel and creating a condition that is more conducive to stream shading over a larger percentage of the channel width. Additionally, the area is a groundwater discharge zone along the stream and the hyporheic exchanges will likely determine stream temperatures. Hyporheic exchange often increases with increasing channel complexity in a floodplain, which will result in reduced water temperatures (Gooseff et al. 2007, entire).

Riparian vegetation will be replanted prior to or at the beginning of the first growing season following construction. Reestablishment of vegetation will be achieved in disturbed areas to at least 70% of the pre-project conditions within three years. An appropriate mix of species will be used to achieve establishment and erosion control objectives, preferably comprised of forb, grass, shrub, or tree species native to the Lemhi restoration project area or region and appropriate for the site. Invasive species will not be used. Vegetation, such as willow, sedge, and rush mats, will be salvaged from disturbed or abandoned floodplains, stream channels, or wetlands to be replanted during site restoration. Fencing will be installed as necessary to protect the vegetation. Surface fertilizer will not be replied within 50 feet of any stream channel, waterbody, or wetland. Depending on site conditions, short-term stabilization measures may include, but are not necessarily limited to the use of non-native sterile seed mix (when native seeds are not available), weed-free certified star, jute matting, and/or other similar techniques.

Because the new channels will not have full riparian habitat at the time construction is completed, and because there may be a need to remove some riparian vegetation in the mainstem, there will be a temporary reduction in stream shade. As a result, there will be a temporary increase in solar radiation with a potential associated increase in temperature until the riparian vegetation recovers. Hyporheic exchange may offset the effects of temperature changes caused by temporary stream shade reduction. Therefore, there may be some effect to water temperature in the restoration area, which is expected to be minimal and will not significantly affect bull trout use of FMO habitat in the restoration reach. There will also be long-term benefits to bull trout through improved riparian habitat conditions, increased habitat complexity, and increased hyporheic exchange which will reduce water temperatures.

Sediment/Turbidity

Work on the Lemhi River will be conducted to avoid work in the flowing channel. Construction will be staged so that the new channel will be created first (see the description of the staged dewatering and rewatering process above). Once the new channel is completed, the channel will be ‘pre-washed’ into a reach equipped with sediment capture devices prior to the introduction of flow into the new channel. After this stage is completed, flow will be rerouted into the side channel and a cofferdam used to block the flow in the mainstem so work can occur in the mainstem with no active flow. Similarly, to the work on the side channel and in the mainstem, prior to the reintroduction of flows the different channels, gravels will be ‘pre-washed’ to ensure a minimization of suspended sediment. Any topsoil and native channel material displaced by construction will be stockpiled away from the channel for use during site restoration. When construction is finished, all streambanks, soils, and vegetation will be cleaned and restored as necessary using stockpiled topsoil and native channel material to renew ecosystem processes that form and maintain productive habitats.

All BMPs (including turbidity monitoring) for the Lemhi restoration project are provided in USFS 2024, Appendix B. The effects to bull trout individuals resulting from sedimentation during construction in the Lemhi restoration project area will be insignificant and temporary.

Water Quality

Because there is no expected increase in traffic on SH 28, there will be no relative difference in spill risk from road use. Regulatory requirements (49 CFR 171 – 49 CFR 180), design features, and BMPs (USFS 2024, Appendix B) will be in place to manage spill risk during the restoration activities. The use of machinery for the construction will increase the risk for accidental spills of fuel, lubricants, hydraulic fluid, or similar contaminants. To reduce the risk of accidental releases to streams the following measures will be included:

- Equipment staging, fueling, storage, and washout areas will be located at least 150 feet from aquatic areas.
- Any waste liquids generated at the staging areas will be temporarily stored under cover on an impervious surface until it can be properly transported for off-site treatment and/or disposal.
- There will be spill containment kits adequate for the types and quantity of hazardous materials present in the construction are.
- Equipment will be thoroughly cleaned before use on the Lemhi restoration project area.
- Equipment operated in live water will use hydraulic fluids that are non-toxic to salmonids.

Further, the restoration activities will be staged to limit equipment activity in proximity to flowing water. Existing access roads and paths will be preferentially used whenever practicable. There is a low risk of a spill during the construction of the project, however if a spill occurs, the magnitude of impacts could be significant to individuals exposed to harmful concentrations of hazardous materials depending on the type of material releases, the location of the spill, and the presence of bull trout. However, given the low risk of a spill, implementation of the SPCCP and BMPs in USFS 2024, Appendix B, effects to bull trout will be discountable.

Peak/Base Flow

There will be a change in localized flow (i.e., within the Lemhi restoration project area) because of the increase in the number of active channels, however, there will be no change in regional flow (flows throughout the subbasin). While there is an overall reduction in flow in the main channel compared to baseline conditions, there will be a substantial increase in habitat complexity. Additionally, due to the increased floodplain connectivity, there will be a greater area of connection to the underlying aquifer, thus increasing the groundwater-surface water exchange and improving the hyporheic connection. The change in flows will not impact bull trout migration or rearing because of the improved channel conditions and increased channel complexity, which will be designed to improve migration and rearing habitat.

Altered Physical Stream Structure

The purpose of the Lemhi project is to add side channel habitat with improved channel complexity. The existing single-threaded channel of a reach of the Upper Lemhi River will be bifurcated and obstructed using natural materials at multiple locations to induce flow into relic channels on the flood plain. This activity will be augmented by 1,744 meters of complete channel excavation and 2,034 meters of partial channel excavation on private land for a total of 3,775 meters of new habitat.

Construction activities will include construction of the side channels before connecting to the mainstem. Once the side channels are completed, the water will be rerouted from the mainstem into the side channels so that construction on the mainstem can occur with minimal water in the channel. Work in the mainstem will occur during the approved work window (July Q1 through August Q3). The dewatering and rewatering states are described above.

The removal of riparian vegetation during construction of temporary access roads will be minimized. If vegetation removal is required, then the vegetation will be cut at ground level and not grubbed. Existing stream crossings will be used, when possible, but if any crossings need to occur during construction, the number of crossing locations will be minimized.

The Lemhi restoration project will substantially change the channel complexity and floodplain connectivity by adding side channels with increased channel braiding, thus increasing and improving the juvenile rearing habitat, and likely improving spawning habitat conditions. Additionally, the work in the mainstem will include decreasing the width:depth ratio in strategic locations that will aid in natural adjustments in the rest of the channel. Streambank vegetation will be preserved and protected to the extent practicable. The Lemhi restoration project will increase and improve bull trout rearing habitat. The Lemhi restoration project actions will result in long-term beneficial effects to bull trout, however, during construction in the mainstem, there may be short-term adverse effects to bull trout as they are moved to a new channel, and as the flows recede. If bull trout are still present, they may require a salvage operation (see below) to move them either upstream or downstream from the active construction area.

Dewatering, Fish Salvage, Relocation

Work on the Lemhi River will be staged to avoid work in the flowing channel. Any work within the wetted channel in the mainstem will be isolated from the active stream whenever ESA-listed fish are reasonably certain to occur, or if the work area is less than 300 feet upstream from known spawning habitats.

Dewatering of the mainstem will occur at a rate slow enough to allow all fish to naturally migrate out of the work area. Where gravity feed diversion is not possible, screened pumps may be installed to avoid repetitive dewatering and rewatering. The pump will be screened in accordance with the NMFS Fish Screen Criteria (NMFS 2022b, entire). Seepage water will be pumped to a temporary storage and treatment site in upland areas to allow water to percolate through soils and vegetation before reentering the stream channel.

As flows recede in the mainstem, any stranded fish will be moved by the most appropriate method based on the habitat conditions (e.g., electrofishing, seining). Fish salvage activities will occur under conditions that will minimize fish stress, typically during the periods of the coolest air and water temperatures (i.e., morning). Fish salvage and relocation will be conducted prior to stream channel dewatering. The Fisheries and Aquatic Resources Mitigation Plan (Brown and Caldwell, Rio ASE, and BioAnalysts 2021, pp. 5-3 and 5-4, Table 5.4 and pp. 5-21 to 5-26 Section 5.47) outlines the sequence for fish salvage work including site preparation, work area isolation, fish capture, fish handling, and fish relocation for the proposed action, and the same methods will be followed for the Lemhi restoration project activities. Fish salvage work will follow USFWS Recommended Fish Exclusion, Capture, Handling, and Electroshocking Protocols and Standards (USFWS 2012b, entire) and NMFS (2000, entire) Guidelines for Electrofishing Waters Containing Salmonids Listed Under the Endangered Species Act.

Fish salvage will prevent population-level impacts to fish in the Lemhi River but result in some incidental injury (up to 25% of total salvage) or mortality (1%). All fish salvaged will be impacted by some level of salvage related stress. Salvage-related mortality, injury, and stress will impact individual fish from all fish species within the Lemhi restoration project area. While there will be volitional movement downstream as flows are ramped down, the number of fish leaving is unknown. Prior to complete dewatering, the channel will be assessed for the presence of ESA-listed fish. IDFG will electrofish the segment as necessary to remove as many fish as possible for transport and release downstream.

Bull trout present in the restoration reach could be impacted by salvage operations and subjected to sublethal handling stress, injury, or mortality. Bull trout use the restoration reach for FMO habitat only, so redds and young juveniles will not be present. Table 38 shows that a total of 680 bull trout could be affected in the Lemhi Restoration Project Area by fish salvage during project implementation.

Noise and Vibration

In order to avoid injury, instantaneous sound levels should be less than 206 peak dB and sound emitted over an extended time (sound emitted repeatedly) should be less than 187 dB (183 dB for fish less than 2 grams) exposure level, referenced at 1 micropascal for sound traveling through water, measured at a distance of 10 meters (Fisheries Hydroacoustic Working Group 2008, entire). However, sound levels over 150 dB can trigger behavioral effects, such as moving from to other locations.

In addition to sound effects, excessive ground vibrations have the potential to affect Chinook salmon, particularly the sensitive egg life stage (Timothy 2013, entire; Kolden and Aimone-Martin 2013, entire). Smirnov (1954, as cited in Alaska Department of Fish and Game 1991, p. 7) found significant egg mortality caused by ground vibrations with a peak particle velocity (PPV) of 2 inches per second (ips). Faulkner et al. (2008, p. 1) found that PPVs up to 9.7 ips resulted in significantly higher mortality in rainbow trout eggs but there was no increase in mortality when exposed to PPVs of 5.2 or less. The Alaska Department of Fish and Game have PPV restrictions of 2.0 ips to protect salmonids (Timothy 2013, entire). The reported PPV value for an in-situ soil sampling rig at a distance of 100 feet is 0.011 ips (ATS Consulting 2013, p. 32, Table 7).

There may be increased noise caused by the construction vehicles, but there will be no blasting. Specialty mufflers will be used for continuously running generators, pumps, and other stationary equipment, and most of the construction activities will occur outside the flowing channel. While construction equipment will be used to construct the channels, other than the placement of the blockage weir, the construction equipment will be used along the channels in which fish have either been diverted or blocked. The sound level for a typical construction vehicle (such as an excavator) is typically between 80 and 120 dB. These levels are below those that could impair fish health or behavior. Effects are unlikely, but if they occur, they will be limited to localized behavioral impacts such as movement disruption or area avoidance for bull trout.

4.3.1 Summary of Effects

Table 42 summarizes the adverse effects to bull trout from construction through closure and reclamation phases.

Table 42. Adverse effects to bull trout by impact type for bull trout (double dashes indicate insignificant effects or not applicable; adapted from USFS 2024, Table 4.1-62).

<table>
<tr><th>Effect Pathway</th><th>Location</th><th>Phase</th><th>Effects to Bull Trout</th></tr>
<tr><td colspan="4">Stibnite Project Area – Watershed Condition Indicators</td></tr>
<tr><td rowspan="3">Physical Barriers</td><td rowspan="2">Outside Mine Site Area</td><td>Construction</td><td>Behavioral (disturbance from noise and vibration); injury and mortality from fish exclusion and salvage at crossings; and sediment effects are likely from instream work at crossings.</td></tr>
<tr><td>Closure and Reclamation</td><td>Behavioral (disturbance from noise and vibration); injury and mortality from fish exclusion and salvage at crossings; and sediment effects from instream work at stream crossing during decommissioning of the Burntlog Route in Mine Year 23.</td></tr>
<tr><td>Within Mine Site Area</td><td>Construction</td><td>Behavioral (disturbance from noise and vibration); injury and mortality from fish exclusion and salvage; loss of habitat in upper Meadow Creek from new barrier construction associated with the TSF; completion of the fishway tunnel in Mine Year Minus 1 will increase available habitat in the upper</td></tr>
</table>

Effect Pathway	Location	Phase	Effects to Bull Trout
			EFSFSR.
		Operation, Closure and Reclamation	Loss of 8,500 m of critical habitat in upper Meadow Creek and the extirpation of 111 bull trout with the creation of the TSF gradient barrier.
Sediment and Turbidity	Outside the Mine Site Area	Construction	Behavioral and sublethal effects from increased levels of instream sediment/turbidity, and habitat effects from increased substrate embeddedness.
	Within the Mine Site Area	Construction	Behavioral and sublethal effects from increased levels of instream sediment/turbidity.
		Operation	Behavioral and sublethal effects; decreased food productivity; and impaired critical habitat from increased levels of instream sediment/turbidity.
		Closure and reclamation	Behavioral and sublethal effects; decreased food productivity; and impaired critical habitat from increased levels of instream sediment/turbidity
Water Quality – Spill Risk	Outside the Mine Site Area	Construction; Operation, Closure and Reclamation	-- Potential behavioral, sublethal, and lethal effects; decreased food productivity; and impaired critical habitat from potential spill of hazardous materials. However with implementation of the SPCCP and BMPs, the risk to bull trout from a spill is discountable.
Water Quality – Chemical Contaminants	Within Mine Site Area	Construction[2]	Construction effects are the same as for Spill Risk
		Operation	Behavioral, sublethal, and lethal effects and impaired critical habitat from exposure to hazardous materials including copper, arsenic, antimony, and mercury.

Effect Pathway	Location	Phase	Effects to Bull Trout
Water Temperature	Within Mine Site Area	Construction	--
		Operation, Closure and Reclamation	Increased water temperatures will reduce the amount of thermally suitable habitat within the Mine Site Area. Increased water temperature could adversely affect bull trout in Meadow Creek and in the EFSFSR between YPP and Sugar Creek.
Peak/Base Flow	Within Mine Site Area	Construction	Up to a 7% reduction in flow in the EFSFSR upstream from Sugar Creek resulting in reduction of available habitat.
		Operation, Closure and Reclamation	Reductions in flows of up to 36% in Meadow Creek and 35% in EFSFSR during Operation, and around a 4% decrease during Closure.
Stibnite Project Area – Effects to Bull Trout			
Altered Physical Stream Structure	Within Mine Site Area	Construction	Loss of lake habitat (YPP) and impaired critical habitat. Construction effects are the same as described in Section 4.3.1.2 (Dewatering, Fish Salvage, Relocation and Noise and Vibration), and Section 4.3.1.1 (Sediment and Turbidity).
		Operation	Loss of lake habitat (YPP)
		Closure and Reclamation	--
Dewatering, Fish Salvage, Relocation	Stream Crossing	Construction (Burntlog Route)	Sub-lethal or lethal effects from electrofishing at stream crossings.
		Closure (Burntlog Route)	Sub-lethal or lethal effects from electrofishing at stream crossings.
	Stream Channels	Construction	Sub-lethal or lethal effects from electrofishing at stream crossings.
	Yellow Pine Pit Lake	Construction	Sub-lethal or lethal effects from electrofishing at stream crossings.
Noise and Vibration	Within and Outside Mine Site Area	Construction	Behavioral; sub-lethal
		Operation	Behavioral; sub-lethal
Bull Trout Specific Effects			
Water	Within Mine Site	Construction	--

Effect Pathway	Location	Phase	Effects to Bull Trout
Temperature	Area	Operation	Behavioral; decreased food productivity; sub-lethal or lethal; impaired critical habitat. Loss of 0.35 km of thermally suitable habitat below YPP.
Occupancy Probability	Within Mine Site Area	--	Loss of occupancy potential in upper Meadow Creek.
PHABSIM	Within Mine Site Area	--	Reduced habitat due to reduced flows.
Lemhi Restoration Project Area – Effects to Bull Trout			
Physical Barriers	Lemhi	Construction	Temporary loss of access to FMO habitat in the Lemhi River.
Sediment and Turbidity	Lemhi	Construction	Temporary increases in suspended sediment/turbidity resulting in sub-lethal effects and impaired critical habitat.
Water Quality	Lemhi	Construction	-- In the event of a spill, the magnitude of impacts could be significant to individuals exposed to harmful concentrations of hazardous materials depending on the type of material releases, the location of the spill, and the presence of bull trout. However with implementation of the SPCCP and BMPs, the risk to bull trout from a spill is discountable.
Water Temperature	Lemhi	Construction	-- There may be some effect to water temperature in the restoration area, which is expected to be minimal and will not significantly affect bull trout use of FMO habitat in the restoration reach.
		Operation	-- Long-term benefits to bull trout and critical habitat through improved riparian habitat conditions, increased habitat complexity, and increased hyporheic exchange which will reduce water temperatures.
Peak/Base Flow	Lemhi	Construction	--
Lemhi Restoration Project Area – Effects to Individual Bull Trout			

Effect Pathway	Location	Phase	Effects to Bull Trout
Altered Physical Stream Structure	Lemhi	Construction	Temporary critical habitat impairment.
		Operation	--
Dewatering, Fish Salvage, Relocation	Lemhi	Construction	Sub-lethal or lethal effects from fish salvage.
Noise and Vibration	Lemhi	Construction	--

The effects summarized Table 42 will impact bull trout in the Upper EFSFSR, Sugar Creek, Burntlog Creek, Trapper Creek, and Riordan Creek local populations in the Stibnite project area. These effects range from insignificant disturbance from equipment noise and blasting to loss of habitat due to barrier creation in Meadow Creek and the extirpation of bull trout in upper Meadow Creek, as well as the loss of YPP lake habitat for an adfluvial population of bull trout (until Stibnite Lake is constructed). Increased water temperatures could adversely affect bull trout in Meadow Creek and in the EFSFSR between YPP and Sugar Creek. Reductions in instream flows will reduce available habitat and impact bull trout in Meadow Creek and the EFSFSR. Bull trout will also experience behavioral, sublethal, and lethal effects and impaired critical habitat from exposure to hazardous materials including copper, arsenic, antimony, and mercury. Dewatering, fish salvage, and relocation are a component of many proposed action activities and will result in sublethal and lethal effects to bull trout. Bull trout will be adversely affected by activities during the Construction Phase (Mine Years minus 3 to minus 1), Operations Phase (Mine Years 1 to 15), and Closure and Post-Closure Phase (Mine Years 16 to 41; Table 21, Table 22, and Table 23). The proposed action also includes actions that improve habitat conditions for bull trout including removing passage barriers and restoring stream habitat.

Because adverse effects in the Stibnite project area are localized and limited to individual foraging, migrating, overwintering, spawning, and early rearing bull trout in the Upper EFSFSR , Burntlog Creek, Trapper Creek, and Riordan Creek local populations, and the proposed action is expected to maintain population size and growth and survival (USFS 2024, Appendix C, Tables C-3 and C-4), the Service does not expect effects at the South Fork Salmon River core area, Upper Snake recovery unit, or rangewide levels.

The Lemhi restoration project will impact bull trout in approximately 7,000 feet of the mainstem of the Lemhi River. Bull trout will be adversely affected (sublethal) by the temporary loss of access to FMO habitat and short-term exposure to suspended sediment. Approximately 63 bull trout will be injured or killed during electrofishing associated with dewatering and fish salvage.

Because adverse effects in the Lemhi restoration project area are localized and limited to individual foraging, migrating, and overwintering bull trout in the mainstem Lemhi River, and project actions will not occur in any local populations, the Service does not expect effects at the Lemhi River core area, Upper Snake recovery unit, or rangewide levels.

4.4 Cumulative Effects

The implementing regulations for section 7 define cumulative effects to include the effects of future State or private activities that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Private lands make up about 16.1% and state lands make up approximately 3.2% of the action area (USFS 2024, Figure 4.1-27). On-going management activities within the action area that could potentially impact bull trout and that will overlap with the proposed action in space and time include private land ownership and associated recreational activities (e.g., fishing), projects associated with private timber sales, wildland fuels reduction, and energy development (transmission lines, alternative energy), projects associated with mining and special uses, and road improvement and maintenance. For example, unauthorized road maintenance activities by Valley County resulted in the removal of log jams and the subsequent destruction of bull trout habitat in the EFSFSR in 2004, as well as increased erosion from several culvert replacements (USFS 2007b, p. 11). Other Valley County Road maintenance practices on the EFSFSR road that may affect bull trout include herbicide application in RCAs and side casting sediments during road blading (USFS 2022a, p. 3-23). The types of projects or activities listed are currently having or may have future incremental effects on bull trout.

4.5 Conclusion

After reviewing the current status of bull trout, the environmental baseline in the action area, effects of the proposed action, and cumulative effects, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of bull trout. The Service's rationale for this conclusion is presented below.

As summarized in Table 42, the proposed action will have localized adverse effects to bull trout through elevated water temperature that result in disturbance to individual bull trout but injury or mortality is not expected. Noise from equipment operation, geotechnical drilling, pile drilling or driving, and blasting will similarly result in disturbance to bull trout, with no injury or mortality; significant effects to redds, if present, are not anticipated from these activities. Temporary increases in suspended sediment/turbidity, during stream crossing upgrades, channel reconstruction, and stream diversions are likely to result in sublethal physiological effects and disturbance to bull trout. Behavioral, sublethal, and lethal effects and impaired critical habitat are likely from exposure to hazardous materials including copper, arsenic, antimony, and mercury. Significant reductions in stream flow will adversely affect bull trout through the habitat loss. Additional adverse effects (disturbance, injury, and potential mortality) to individual adult, subadult, and juvenile bull trout are anticipated through the use of electrofishing and block nets associated with the work area isolation, fish salvage, and relocation for in-water work projects (Table 38). To minimize effects, these activities will occur during the Services' approved in-water work windows and will adhere to all protective measures described in the Assessment (USFS 2024, entire) and to all required permit conditions.

Adverse effects from the proposed action are localized and limited to individual foraging, migrating, overwintering, spawning, and early rearing bull trout in the Upper EFSFSR, Sugar Creek, Burntlog Creek, Trapper Creek, and Riordan Creek local populations, which represent 5 out of 27 local populations (18.5%) in the core area. The proposed action is also expected to maintain population size and growth and survival (USFS 2024, Appendix C, Tables C-3 and C-4). For these reasons the Service does not anticipate effects to the survival and recovery of the South Fork Salmon River core area, Upper Snake recovery unit, or the coterminous rangewide population.

Similarly, adverse effects to bull trout from construction of the Lemhi restoration project are limited to individual bull trout using FMO habitat in the Lemhi River; actions will not occur in any local populations. In addition, habitat restoration will result in long-term benefits to individual bull trout. For these reasons, the Service does not anticipate effects to the survival and recovery of the Lemhi River core area, Upper Snake River recovery unit, or the coterminous rangewide population.

The proposed action is expected to result in injury and mortality of 629 bull trout (402 in the Stibnite project area and 227 in the Lemhi restoration project area). In Idaho, it is estimated that there are 1.13 million bull trout within all recovery units (High et al. 2008, p. 1687). The potential loss of 629 bull trout represents 0.06% of bull trout in the State. This makes adverse effects to bull trout negligible at the population scale and range wide. Furthermore, the calculated estimates were rounded up to the nearest whole fish before totaling for the project and are thus expected to be high estimates. The Service does not expect the potential loss of 629 bull trout to measurably affect South Fork Salmon and Lemhi core areas, or the Upper Snake River recovery unit in the short- or long-term timescale. The Service also does not expect any injuries or deaths associated with this proposed action to have measurable effects to the conservation or recovery of the species.

4.6 Incidental Take Statement

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened fish and wildlife species, respectively, without specific exemption. Take is defined as “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct.” Harm is defined by the Service as an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined as “an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering” (50 CFR 17.3).

Incidental take is defined as take “that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant” (50 CFR 402.02). Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of an Incidental Take Statement.

4.6.1 Form and Amount or Extent of Take Anticipated

4.6.1.1 Stibnite Project Area and Lemhi Restoration Project Area

Based on the effects analysis above, the Service finds incidental take of adult, subadult, and juvenile bull trout is reasonably certain to occur in the form of injury and mortality via (1) loss of habitat from predicted stream baseflow reductions, increases in water temperature, and creation of the TSF barrier in upper Meadow Creek; (2) increases in sediment delivery; (3) exposure to hazardous levels of copper, arsenic, antimony, and mercury; and (4) dewatering, fish salvage, and relocation during stream crossing and stream channel work. Incidental take anticipated in the Lemhi restoration project area is in the form of injury and mortality from dewatering and fish salvage.

The amount of take expected in the action area local populations from habitat loss, increases in instream sediment and turbidity, and exposure to contaminants is not practical to quantify because of the wide-ranging distribution of bull trout, the unlikely identification and detection of dead or impaired species at the egg and larval stages, that losses may be masked by seasonal fluctuations in numbers; and aquatic habitat modifications are difficult to ascribe to particular sources, especially in already degraded watersheds. In addition, the effects of management actions associated with some mining operations (e.g., restoration and reclamation) are largely unquantifiable in the short term and may only be measurable in the long-term effects to the species or population levels (USFWS 2014, p. 133).

For these reasons, the Service has determined that the actual amount or extent of the anticipated incidental take due to changes in habitat conditions in the affected streams is unquantifiable. In cases where we determine the level of take is unquantifiable, the Service uses surrogates to measure the amount or extent of incidental take, and whether the amount of take anticipated has been exceeded. Pursuant to 50 CFR 402.14(i)(1)(i), a surrogate can be used to express the anticipated level of take in an Incidental Take Statement, provided three criteria are met: (1) measuring take impacts to a listed species is not practical; (2) a causal link is established between the effects of the action on the surrogate and take of the listed species; and (3) a clear standard is set for determining when the level of anticipated take based on the surrogate has been exceeded. In this Opinion we use the extent and magnitude of predicted stream flow depletions, increases in instream temperatures, and the extent and magnitude of expected sediment loading to measure the amount and extent of take.

Anticipated Take from Habitat Loss

Stream Baseflow Reductions

After the first year of construction, stream flows typically decrease during the low-flow period. Stream flow reductions result from diversion of flow for mine use plus reduced groundwater discharge associated with mine dewatering. Table 35 shows predicted (simulated) monthly stream flows during the August to March low flow period at three USGS gaging stations and one location in lower Meadow Creek in mine site streams (USFS 2024, Figure 4.1-4) and predicted change from average baseline low flow period stream flows. Figure 17 shows the percent change in simulated stream flows graphically.

Decreased flows cause a reduction in available habitat, including migratory habitat, which could increase competition for resources (food and habitat), and trigger movement to other habitats that may be of lesser quality. The habitat effects of the proposed action caused by decreased flows will be long-term (occurring during operations) and occurring in Meadow Creek, the EFSFSR at the mine site, and the EFSFSR upstream from Sugar Creek. Flows in the EFSFSR upstream from Meadow Creek will be stable until Mine Year 12 when they decrease (less than 5%) through Mine Year 20. Permanent effects from changes in streamflow that occur during the post-closure period are negligible across all of the mine site streams.

The greatest predicted changes to stream flow will be in the EFSFSR and in Meadow Creek in the vicinity of the TSF. While most of the streams will return to at or near baseline flows post-closure (post-closure flows represent an average of the predicted flows from Mine Years 21 through 112), Meadow Creek flows downstream from the TSF will be reduced by a maximum of 36.4% during mine operations. Flow increases in Mine Year 5 at some nodes are due to discharge of treated dewatering production at a time when dewatering production to maintain dry open pits is greater than the usage needs of the mine.

Predicted Sugar Creek flows for the proposed action are approximately 3% less than the baseline conditions during the operational period. During the post-closure period when the West End pit lake is initially forming, predicted Sugar Creek flows decrease slightly due to reduced inflow from West End Creek by up to 9% (i.e., 0.8 cfs). Predicted flow reductions persist for approximately 50 years post-closure before decreasing to an approximately 1% (i.e., 0.1 cfs) difference indefinitely compared to the baseline conditions. Downstream of the EFSFSR and Sugar Creek confluence, the average seasonal low flows for the proposed action are 20.1 cfs compared to 22.1 cfs under baseline conditions (9% reduction), while the minimum predicted low flow is 15.7 cfs compared to 18.2 cfs (14% reduction). These reductions are attributable to the total of upstream capture of surface water, groundwater dewatering, and water abstraction for consumptive use partially offset by discharge of treated water. Flows fully recover within 10 years from cessation of operations (Brown and Caldwell 2021e, as cited in USFS 2024, p. 382).

Take Exceedance

Authorized take will be exceeded if the measured level of baseflow (i.e., August through April) depletions exceed the predicted baseflow depletions described for each affected stream reach over the construction through post-closure mine phases as shown in Table 35.

Increases in Stream Temperatures

Increases in water temperature during proposed action implementation will result in take of bull trout through the loss of thermally suitable habitat in the areas/reaches described below:

Within the entire mine site, under baseline conditions, available (thermally suitable) habitat for bull trout was calculated to be 26.21 km. At Mine Year 112, available habitat for bull trout was calculated to be 17.71 km. The quantity of available habitat for bull trout would decrease by 32.4% due to increases in water temperature.

In Meadow Creek, under baseline conditions, available (thermally suitable) habitat for bull trout was calculated to be 13.27 km. At Mine Year 112, available habitat for bull trout was calculated to be 4.40 km. The quantity of available habitat for bull trout would decrease by 66.8% due to increases in water temperature, which will result in the estimated take of 32 bull trout.

In the EFSFSR from the confluence with Sugar Creek to YPP, available (thermally suitable) habitat for bull trout was calculated to be 1.12 km. At Mine Year 112, available habitat for bull trout was calculated to be 0.73 km, a 34.8% decrease. The quantity of available habitat for bull trout would decrease by 34.8% due to increases in water temperature, which will result in the estimated take of 155 bull trout.

Take Exceedance

Authorized take will be exceeded if measured increases in water temperature, which we will use as a surrogate for quantifying the take of individual bull trout, exceed the predicted increases in water temperature in each of the affected stream reaches shown in Table 35.

Anticipated Take from Sediment Delivery

As discussed above, the Service can use surrogates to measure the amount or extent of incidental take. In this Opinion, the modeled (GRAIP-Lite) annual amount of sediment delivery to streams will be used as surrogates to determine the level of anticipated take of bull trout that may result from sediment impacts during the construction (During construction, there is an increased risk to disturb, excavate, and move soil and overburden (alluvial and glacial materials), thereby raising the potential for sediment runoff and suspended sediment increases in surface waters. The TSS in surface water are generally correlated with turbidity (NTU), which is a more visually apparent estimator of sediment contamination. Under baseline conditions, turbidity is generally low (less than 5 NTU) with occasional spikes of up to 70 NTU during snowmelt or rainfall events (USFS 2023e, Table 6-14). The greatest potential for increases in stream sedimentation will come during storm events causing overland flow across exposed soil, excavated areas, and roads.

The GRAIP Lite model results shows a substantial decrease in sediment delivery, sediment input into the streams, and sediment accumulation. **Error! Not a valid bookmark self-reference.** shows the change in sediment production, delivery and accumulation during construction, and Table 29 shows the annual sediment delivery by drainage crossing type. Therefore, sedimentation in the waterways under construction will be decreased compared to baseline conditions. Additional details regarding the GRAIP model and its results are provided in Tetra Tech (2024, entire).

Table 28 and Table 29) and operation (Table 30 and Table 31) phases.

The introduction of sediment in excess of natural amounts can have multiple adverse effects on bull trout and their habitat. The effect of suspended and deposited sediment beyond natural background conditions can be fatal at high levels. Embryo survival and subsequent fry emergence success have been highly correlated to percentage of fine material within the streambed. Low levels of suspended sediment may result in sublethal and behavioral effects such as increased activity, stress, and emigration rates; loss or reduction of foraging capability; reduced growth and resistance to disease; physical abrasion; clogging of gills; and interference with orientation in homing and migration. The effects of increased suspended sediments can cause changes in the abundance and/or type of food organisms, alterations in fish habitat, and long-term impacts to fish populations. No threshold has been determined at which fine-sediment addition to a stream is harmless. Even at low concentrations, fine-sediment deposition can decrease growth and survival of juvenile salmonids (Weaver and Fraley 1991, entire; Weaver and White 1985, entire; Furniss et al. 1991, pp. 302–303).

The GRAIP Lite model results shows a substantial decrease in sediment delivery, sediment input into the streams, and sediment accumulation during the construction phase (During construction, there is an increased risk to disturb, excavate, and move soil and overburden (alluvial and glacial materials), thereby raising the potential for sediment runoff and suspended sediment increases in surface waters. The TSS in surface water are generally correlated with turbidity (NTU), which is a more visually apparent estimator of sediment contamination. Under baseline conditions, turbidity is generally low (less than 5 NTU) with occasional spikes of up to 70 NTU during snowmelt or rainfall events (USFS 2023e, Table 6-14). The greatest potential for increases in stream sedimentation will come during storm events causing overland flow across exposed soil, excavated areas, and roads.

The GRAIP Lite model results shows a substantial decrease in sediment delivery, sediment input into the streams, and sediment accumulation. **Error! Not a valid bookmark self-reference.** shows the change in sediment production, delivery and accumulation during construction, and Table 29 shows the annual sediment delivery by drainage crossing type. Therefore, sedimentation in the waterways under construction will be decreased compared to baseline conditions. Additional details regarding the GRAIP model and its results are provided in Tetra Tech (2024, entire).

Table 28). Table 29 shows the annual sediment delivery by drainage crossing type; during construction sedimentation in the waterways under construction will be decreased compared to baseline conditions.

The GRAIP Lite model results shows a substantial increase in sediment delivery, sediment input into the streams, and sediment accumulation during the operation phase (Table 30). Table 31 shows the annual sediment delivery by drainage crossing type; during operations sediment delivery to drainage crossings will increase compared to baseline conditions at Stibnite Road, Burntlog Route, and on-site road drainage crossings (there will be a decrease at Johnson Creek crossings).

During the closure and reclamation phase, sediment delivery to bull trout streams is expected to decrease due to leaving sediment design features and BMPs in place as mine disturbance is covered, reclaimed, and revegetated to control runoff from mine facility areas. Design features and BMPs as described in USFS 2024, Appendix B will be employed to pre-rinse diversion channels and introduce flows slowly to limit generation of new turbidity by the diversions. IPDES permitted outfalls for treated water will be constructed with energy dissipation at their discharge location to minimize the turbidity generated by the introduction of additional flow into the stream channel.

Take Exceedance

Authorized take of bull trout from sediment delivery is likely during the operations phase. Anticipated take will be exceeded if measured changes in sediment delivery exceed the predicted changes in sediment delivery as shown in Table 28, Table 29, Table 30, and Table 31.

<u>Anticipated Take from Chemical Contaminants</u>

Copper

Assessment Table 4.1-30a-d shows that predicted concentration levels of copper are likely to result in take of all life stages of bull trout in the construction, operations, and closure/post-closure phases. Take will be in the form of olfactory, behavioral, and developmental effects and decreased survival.

Take Exceedance

Authorized take will be exceeded if measured concentrations of copper exceed the predicted concentrations of copper shown in Assessment Table 4.1-30a-d.

Arsenic

Assessment Table 4.1-31a-d shows that predicted concentration levels of arsenic are likely to result in take of all life stages of bull trout in the construction, operations, and closure/post-closure phases. Take will be in the form of sublethal physiological effects; effects to egg/fecundity; and reduced growth and survival, and embryo mortality.

Take Exceedance

Authorized take will be exceeded if measured concentrations of arsenic exceed the predicted concentrations of arsenic shown in Assessment Table 4.1-31a-d.

Antimony

Assessment Table 4.1-32a-d shows that predicted concentration levels of antimony are likely to result in take of early life stages of bull trout in the construction, operations, and closure/post-closure phases. Take will be in the form of potential effects to egg/fecundity, and embryo developmental effects and decreased survival.

Take Exceedance

Authorized take will be exceeded if measured concentrations of antimony exceed the predicted concentrations of antimony shown in Assessment Table 4.1-32a-d.

Mercury

Assessment Table 4.1-33a-d shows that predicted concentration levels of mercury are likely to result in take of adult bull trout in the construction, operations, and closure/post-closure phases. Take will be in the form of physiological effects resulting from bioaccumulation of mercury.

Take Exceedance

Authorized take will be exceeded if measured concentrations of mercury exceed the predicted concentrations of mercury shown in Assessment Table 4.1-33a-d.

Anticipated Take from Physical Barriers

Based on the current known extent of bull trout occupancy, bull trout may be extirpated from the reaches in Meadow Creek upstream from the TSF when the reaches within the footprint will be dewatered and flow will be diverted into the diversions that route water around the facilities. With the gradient barrier that will be created along the TSF, there will be no mechanism by which bull trout will be able to volitionally (i.e., naturally) recolonize the reaches upstream from or on top of the TSF. Based on bull trout density in the upper Meadow Creek watershed, there will be a potential loss of 111 bull trout resulting from the loss of around 8,500 m of critical habitat**.**

Take Exceedance

Authorized take will be exceeded if there is more than 8,500 m of bull trout critical habitat is lost in upper Meadow Creek due to the barrier gradient associated with the TSF.

<u>Anticipated Take from Fish Handling and Salvage in the Stibnite Project Area and Lemhi Restoration Project Area</u>

To quantify take associated with dewatering and fish salvage (capture and handling), the Service will use the total number of bull trout likely to be impacted by these activities as shown Table 43, which is 916 bull trout in the Stibnite project area and 680 bull trout in the Lemhi restoration project area. We will also use the following assumptions from (USFWS 2012a, p. 56):

- 95% capture rate with electrofishing
- 25% electroshocking injury rate
- 1% electroshocking mortality rate
- 3.5% block net impingement mortality rate
- 5% stranding fish rate

If any bull trout are present when electrofishing begins, we anticipate some will be "herded" and volitionally moved out of the immediate work area in response to the electric field and crew presence. Partial dewatering will also take place to passively move fish out of the channel prior to electrofishing if appropriate. For bull trout that remain in the area, all fish will be exposed to electrical current, and we expect that associated handling with nets and buckets will disrupt normal behavior and cause short-term stress for all handled bull trout.

In the Stibnite project area, 916 bull trout are estimated to be present and affected as presented in Table 43. An assumed 95% of these bull trout will be captured by electrofishing, giving a total of 871 bull trout (916 fish x 0.95 capture rate = 870.2 rounded up to the nearest whole fish) that will be subject to sublethal harm from capture and handling. We anticipate take in the form of injury or mortality of 25% of the electroshocked bull trout, which equates to 218 fish (871 fish x 0.25 injury rate = 217.8). We anticipate take in the form of mortality of 1% of the electroshocked bull trout, which equates to 9 fish (871 fish x 0.01 mortality rate = 8.71 rounded up to nearest whole fish).

In the Lemhi restoration project area, the Service anticipates take from capturing and handling of 680 bull trout. An assumed 95% of these bull trout will be captured by electrofishing, giving a total of 646 bull trout (680 fish x 0.95 capture rate = 646 fish) that will be subject to sublethal harm from capture and handling. We anticipate take in the form of injury or mortality of 25% of the electroshocked bull trout, which equates to 162 fish (646 fish x 0.25 injury rate = 161.5 rounded up to the nearest whole fish). We anticipate take in the form of mortality of 1% of the electroshocked bull trout, which equates to 7 fish (646 fish x 0.01 mortality rate = 6.46 rounded up to nearest whole fish).

Block nets will be used to isolate the site and prevent bull trout from re-entering the work area. Although designed to minimize potential effects to bull trout, block nets present a temporary barrier and may delay bull trout movements past the site. Bull trout could also become impinged on the nets and suffer injury or mortality. If nets are deployed, project design features ensure that the nets will be regularly monitored to remove bull trout promptly. For injurious effects associated with block nets the Service assumes that a small percentage (3.5%) of bull trout would die due to impingement (USFWS 2012, p. 57). In the Stibnite project area, based on the estimated 916 bull trout, the number of bull trout subject to take in the form of mortality from impingement is 33 fish (916 fish x 0.035 impingement rate = 32.1, rounded up to the nearest whole fish). In the Lemhi restoration project area, 24 bull trout will be killed from impingement (680 fish x 0.035 = 23.8 fish, rounded up the nearest whole fish).

During stream dewatering, the Service estimates that the proposed capture methods will remove approximately 95% of the fish prior to stream dewatering. A small percentage, up to 5% (USFWS 2012, p. 56), of bull trout may avoid being captured and relocated and thus may die from being stranded in the dewatered work area. In the Stibnite project area, the Service estimates that 46 bull trout may be harmed, injured, or killed by being stranded during dewatering (916 fish x 0.05 = 45.8 fish, rounded up to the nearest whole fish). In the Lemhi restoration project area, 34 bull trout will be harmed, injured, or killed by being stranded (680 fish x 0.05 = 34 fish).

In the Stibnite project area, between Mine Years minus 1 to 11, trap and haul at the downstream end of the EFSFSR fishway tunnel will involve the use of sanctuary dipnets to capture and transport up to 100 bull trout per year for 12 years to upstream release locations if they do not volitionally move upstream through the tunnel. To calculate the number of bull trout likely to be killed during trap and haul operations, we will use an 8% mortality rate as determined by Kock et al. (2018, p. 24, Table 6). The Fishway Operations and Management Plan states that up to 100 adult and subadult bull trout could be at the fishway annually and require the use of trap and haul to relocate them upstream of the fishway if they do not volitionally enter the tunnel (Brown and Caldwell 2021a, Appendix C, Table 1). Using the 8% mortality rate, 8 bull trout could be killed annually during trap and haul operations; this equates to 96 bull trout that will be killed during the 12 years that trap and haul will be used.

Also the Stibnite project area, decommissioning and maintenance of the fishway will occur in Mine Years 11 – 17 with final decommissioning and activation of the new EFSFSR channel occurring in Mine Year 17. Bull trout are likely to be stranded in the tunnel and require salvage as the tunnel is dewatered. To estimate the potential number of bull trout that may be salvaged we will use an estimated density of 10 bull trout 100 m as described in USFWS (2012a, p. 56). For the 1,448 m long tunnel this equates to 145 bull trout (1,448 / 100 x 10 = 144.8, rounded up to the nearest fish) that may be captured and handled. If electrofishing is used, 138 bull trout (95%) could be affected, 35 fish (25%) will be injured, and 2 (1%) fish will be killed. These 145 bull trout are included in the 916 total bull trout in the Stibnite project area.

Take Exceedance Summary for Fish Handling

<u>Stibnite Project Area</u>

Authorized take will be exceeded during project implementation (i.e., during the construction, operations, and closure/post-closure phases) if:

- Fish capture efforts result in more than
    - 871 bull trout being electrofished/handled for Stibnite project actions

    - 1200 bull trout captured and handled during 12 years of trap and haul at the fishway
- Direct injury or mortality is observed beyond the thresholds described in this Opinion:
    - 218 bull trout injured during electrofishing,
    - 9 bull trout killed during electrofishing
    - 33 bull trout injured or killed by impingement on block nets,
    - 46 bull trout injured or killed by stranding during dewatering, or
    - 96 bull trout killed during trap and haul operations

<u>Lemhi Restoration Project Area</u>

Authorized take will be exceeded during project implementation if:

- Fish capture efforts result in more than 646 bull trout being electrofished/handled; or
- Direct injury or mortality is observed beyond the thresholds described in this Opinion:
    - 162 bull trout injured during electrofishing,
    - 7 bull trout killed during electrofishing,
    - 24 bull trout injured or killed by impingement on block nets, or
    - 34 bull trout injured or killed by stranding during dewatering.

Table 43. Summary of fish handling and salvage showing the number of bull trout likely to be affected (adapted from Table 38).

Mine Phase	Mine Year	Action	Fish Handling	Frequency/Duration	Number of Bull Trout Affected
Pre-Production	Minus 2 to Minus 1	Temporary Fish Barrier on lower EFSFSR. In the FOMP Appendix D provides additional details on fish barrier.	Work area isolation and fish salvage protocols established in (Brown and Caldwell. Rio ASE, BioAnalysts 2021; BPA 2016; NMFS 2000; USFWS 2012).	One-time event to install fish barrier. Installation of the fish barrier would occur several months prior to dewatering YPP lake. The barrier may be erected for 1-6 months prior to fish salvage event in YPP. Set up would likely occur either in the fall or early spring prior to any adult migrations.	1
Pre-Production	Minus 1	Yellow Pine pit dewatering and fish salvage operations. In the FMP, Table 5-10 provides additional information on fish capture methods for YPP Fish salvage.	Fish would be relocated downstream of the development area. Fish capture and handling protocols would follow (BPA 2023; NMFS 2000; USFWS 2012). Fish capture methods (Table 5-10) and relocation areas for fish salvaged (Table 5-11) (Brown and Caldwell, Rio ASE, and BioAnalysts 2021	One-time fish salvage event. See FMP Appendix D Table 5-10 for timing considerations that would apply to YPP fish salvage operations (BC et al. 2021a). Fish salvage may take up to a week not including prior equipment staging and coordination.	104
Mine Operations	Minus 1 to 11	Trap and Haul- Trap and haul would only be used if fish arrive volitionally at the downstream end of the tunnel, but do not ascend the fishway (see FOMP Appendix C Table 1). The table provides the conditions under which trap and haul would be initiated.	Trap and haul fish handling protocols would follow information summarized in FMP (Table 5-10) and FOMP (Appendix C).	Trap and haul could occur each year the EFSFSR tunnel fishway is operational. Trap and haul frequency each year is only expected to occur 1-2 times per day depending on multi-species presence (see FOMP Appendix C Table 1). The period that trap and haul would occur coincides with 1-week prior to the spawning period (all species). See spawning periods noted in FOMP Appendix C Table 2. Trap and haul could occur each year during the operational phase of the fishway (from -1 to 11).	1200

Mine Phase	Mine Year	Action	Fish Handling	Frequency/Duration	Number of Bull Trout Affected
Mine Operations	11-17	Tunnel Decommissioning and Channel maintenance period- However, the tunnel may be used for a period of time for channel maintenance and protection (see FOMP-Section 3.10).	Establish fish salvage protocols summarized in the FMP (see Section 5.3).	The channel maintenance and protection period expected to last two years but may continue for up to five more years (see FOMP Table 1-1 Timeline). The tunnel would be decommissioned only once for permanent closure. Final tunnel decommissioning would occur in Year 17.	145
Pre-Production	Minus 3 to Minus 1	Burntlog Route Culverts; Road-stream crossings would be accomplished during the pre-production phase as the alternate route is used (Perpetua 2021)	Fish salvage and temporary displacement at road-stream crossings (Perpetua 2021). Fish would be temporarily displaced following protocols established in (Brown and Caldwell, Rio ASE, and BioAnalysts 2021; BPA 2023; NMFS 2000; USFWS 2012).	2-years: Multi-year activity: Once during pre-production and again once after final mine closure/reclamation work has been completed (Perpetua 2021). More detail provided in RFAI-146 on road-stream crossings.	279
Pre-Production	Minus 3 and Minus 2	Lemhi Off-site mitigation Little Spring Creek completed	Fish salvage and temporary displacement at replacement road-stream crossings. Fish would be temporarily displaced following protocols established in (Brown and Caldwell, Rio ASE, and BioAnalysts 2021; BPA 2023; NMFS 2000; USFWS 2012).	2-years 1st year off-channel construction activity with no fish handling or salvage needed. 2nd Channel activation and mainstem in-water work requires fish handling and salvage.	680
Pre-Production	Minus 2	Diversion of upper Meadow Creek and tributaries around TSF/DRSF. Preparation of roads, ditches, and pipelines to divert water around development area.	Fish salvage and relocation event. Fish would be relocated downstream of the development area. Fish capture and handling protocols would follow (BPA 2023; NMFS 2000; USFWS 2012	1-year: One time event to prepare upper Meadow Creek for TSF/DRSF development.	12

Mine Phase	Mine Year	Action	Fish Handling	Frequency/Duration	Number of Bull Trout Affected
Pre-Production	Minus 1	EFSFSR Barrier elimination-Box culvert	Fish salvage and temporary displacement. Fish would be relocated upstream of current barrier. Fish capture and handling protocols would follow (BPA 2023; NMFS 2000; USFWS 2012).	1-year: One time event to improve fish access to upper EFSFSR and Meadow Creek	1
Pre-Production	Minus 1	EFSFSR Enhancement-Stream enhancement with LWD (single piece), boulders, wood jams (multiple pieces) and pool excavation to enhance instream conditions (RioASE 2021).	Temporary displacement of fish during placement of boulders and single LWD placement. Fish salvage and relocation for wood jams and pool excavation. Fish capture and handling protocols would follow (Brown and Caldwell, Rio ASE, and BioAnalysts 2021; BPA 2023; NMFS 2000; USFWS 2012).	1-year: One-time event to improve stream habitat in EFSFSR	91
Mine Operations	3	Lower Meadow Creek (i.e., MC4b.2, MC5, and MC6a) diverted into a restored channel around Hangar Flats pit footprint while reach MC6b channel alignment would remain intact with only stream enhancement features (RioASE 2021).	Fish salvage and relocation event. Fish would be relocated downstream of these reaches in Meadow Creek or EFSFSR. Fish handling protocols (BPA 2023; NMFS 2000; USFWS 2012)	1-year: One-time event for in-water work to activate new stream.	3

Mine Phase	Mine Year	Action	Fish Handling	Frequency/Duration	Number of Bull Trout Affected
Closure and Post-Closure	18	Lower Meadow Creek restored from toe of TSF buttress to previously restored channel around Hangar Flats footprint	Fish salvage and relocation event. Fish would be relocated downstream TSF/DRSF in Meadow Creek or EFSFSR. (Brown and Caldwell, Rio ASE, and BioAnalysts 2021; BPA 2023; NMFS 2000; USFWS 2012)	1-year: One-time event for in-water work to activate new stream.	1
Closure and Post-Closure	23+	Burntlog Route Decommissioning (Perpetua 2021)	Fish salvage and temporary displacement for removal of road-stream crossings (Perpetua 2021). Fish would be temporarily displaced following protocols established in Brown and Caldwell, Rio ASE, and BioAnalysts 2021; BPA 2023; NMFS 2000; USFWS 2012).	2-years: Multi-year event occurring once during pre-production and once again after final mine closure/reclamation work has been completed (Perpetua 2021).	279

Source: BPA (2023, entire); Brown and Caldwell, Rio ASE, and BioAnalysts (2021, entire); Brown and Caldwell, McMillen Jacobs, and BioAnalysts (2021, entire); NMFS (2000, entire); MWH (2017, entire); Perpetua (2021c, entire); Rio ASE (2021, entire); USFWS (2012, entire)

4.6.2 Effect of the Take

In the accompanying Opinion, the Service determined that this level of anticipated take is not likely to jeopardize the continued existence of bull trout across its range. In the Stibnite project area, because adverse effects are localized and limited to individual foraging, migrating, overwintering, spawning, and early rearing bull trout in the Upper EFSFSR, Sugar Creek, Burntlog Creek, Trapper Creek, and Riordan Creek local populations, which represent 5 out of 27 local populations (18.5%) in the South Fork Salmon River core area, and the proposed action is expected to maintain population size and growth and survival (Assessment Appendix C, Tables C-3 and C-4), the Service does not anticipate effects to the South Fork Salmon River core area, Upper Snake recovery unit, or the coterminous rangewide scales.

Because adverse effects in the Lemhi restoration project area are localized and limited to individual foraging, migrating, and overwintering bull trout in the mainstem Lemhi River and project actions will not occur in any local populations the Service does not expect effects at the Lemhi River core area, Upper Snake recovery unit, or rangewide levels.

The proposed action is expected to result in injury and mortality of 629 bull trout (402 in the Stibnite project area and 227 in the Lemhi restoration project area). In Idaho, it is estimated that there are 1.13 million bull trout within all recovery units (High et al. 2008, p. 1687). The potential loss of 629 bull trout represents 0.06% of bull trout in the State. This makes adverse effects to bull trout negligible at the population scale and range wide. Furthermore, the calculated estimates were rounded up to the nearest whole fish before totaling for the project and are thus expected to be high estimates. The Service does not expect the loss of 629 bull trout in Idaho to measurably affect South Fork Salmon and Lemhi core areas, or the Upper Snake River recovery unit in the short- or long-term timescale. The Service also does not expect any injuries or deaths associated with this proposed action to have measurable effects to the conservation or recovery of the species.

4.6.3 Reasonable and Prudent Measures

The Service finds that compliance with the proposed action outlined in the Assessment, including proposed conservation measures, is essential to minimizing the impacts of incidental take of the bull trout. If the proposed action, including conservation measures, is not implemented as described in the Assessment and this Opinion, there may be effects of the action that were not considered in this Opinion and reinitiation of consultation may be warranted.

The Service also finds that the following reasonable and prudent measures are necessary and appropriate to minimize the impacts of the take of bull trout reasonably certain to be caused by the proposed action.

1. Minimize the potential for incidental take resulting from habitat loss due to stream baseflow reductions and increases in stream temperatures.
2. Minimize the potential for incidental take resulting from sediment delivery.
3. Minimize the potential for incidental take from exposure to chemical contaminants (copper, arsenic, antimony, and mercury).

4. Minimize the potential for incidental take from physical barriers.
5. Minimize the potential for incidental take from electrofishing and fish handling.
6. Minimize the potential for incidental take resulting from dewatering, block nets, and rewatering.
7. Minimize the potential for incidental take resulting from the use of trap and haul operations.
8. Minimize the potential for incidental take resulting from stranding during decommissioning and dewatering of the fishway tunnel.
9. Ensure activity compliance through implementation of the Environmental Design Features and BMPs detailed in USFS 2024, Appendix B.

4.6.4 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Forest must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1. A. Develop, in coordination with the Service, and implement a monitoring plan to ensure that baseflow depletions do not exceed the predicted baseflow depletions described for each affected stream reach during the construction, operations, and post-closure mine phases as shown in Table 35.

1. B. Develop, in coordination with the Service, and implement a monitoring plan to ensure that stream temperatures do not exceed the predicted temperatures described for each affected stream reach during the construction, operations, and post-closure mine phases as shown in Table 24.

2. Develop, in coordination with the Service, and implement a monitoring plan to ensure that sediment delivery does not exceed the predicted changes in sediment delivery during the construction mine phase as shown in Table 28, Table 29, Table 30, and Table 31.

3. A. Develop, in coordination with the Service, and implement a monitoring plan to ensure that concentrations of copper do not exceed the predicted copper concentrations shown in Assessment Table 4.1-30a-d.

3. B. Develop, in coordination with the Service, and implement a monitoring plan to ensure that concentrations of arsenic do not exceed the predicted arsenic concentrations shown in Assessment Table 4.1-31a-d.

3. C. Develop, in coordination with the Service, and implement a monitoring plan to ensure that concentrations of antimony do not exceed the predicted antimony concentrations shown in Assessment Table 4.1-32a-d.

3. D. Develop, in coordination with the Service, and implement a monitoring plan to ensure that concentrations of mercury do not exceed the predicted mercury concentrations shown in Assessment Table 4.1-33a-d.

4. Take all appropriate measures to ensure that no more than the predicted 8,500 m of bull trout habitat is lost in upper Meadow Creek.
5. A. The NMFS electrofishing guidelines (NMFS 2000, entire) and the electrofishing unit operation manual are understood and followed.
5. B. Select the minimum electrofishing frequency setting required to move bull trout away from an immediate work area (less than 30 hertz).
5. C. Any bull trout incidentally stunned should be monitored until its equilibrium is restored and it swims away unassisted.
5. D. Any captured bull trout shall be tallied, visually examined for condition, and immediately released into the stream at a suitable, safe location as near the collection site as possible.
6. A. Nets should be inspected regularly at least every 4 hours for bull trout impinged on the outside or trapped on the inside. Any living fish found should be released.
6. B. Block nets will be cleaned during checks during checks for impinged fish to reduce the chance of failure, more frequent checks and cleaning will be done if debris is building up in the block nets.
7. A. As applicable, follow the NMFS (2022b, Chapter 7) guidance for trapping, handling, hauling, and releasing listed salmonids.
8. A. Gradually reduce flows in the tunnel prior to ceasing all flow to encourage bull trout movement out of the tunnel.
8. B. Prior to decommissioning and ceasing flow through the fishway, the fishway will be inspected for any remaining fish, and all fish will be salvaged. Tunnel inspections will continue through decommissioning (Brown and Caldwell 2021a, p. 3-12).
9. A. The Forest shall submit annual project status/completion reports to the Service within 6 weeks of project completion for activities completed under the proposed action. At a minimum reports shall identify:

    i. Starting and ending dates for completed work.

    ii. Results of turbidity monitoring demonstrating compliance with Idaho water quality standards.

    iii. Post-construction revegetation reports, confirming targeted goal of 70% ground cover within three years of planting. Reports shall be provided annually for 5 years or until planting is successful.

9. B. Reports must be submitted electronically to fw1idahoconsultationrequests@fws.gov. The electronic submittal shall include the FWS biological opinion consultation number: 2024-0084691-001

4.6.5 Reporting and Monitoring Requirement

In order to monitor the impacts of incidental take, the Federal agency or any applicant must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement per 50 CFR 402.14 (i)(3).

1. The Forest or applicant shall annually provide a summary report of the number and estimated sizes of bull trout observed during electrofishing activities for the proposed action.
2. During project implementation, the Forest or applicant shall notify the Service within 24 hours of any emergency or unanticipated situations arising that may be detrimental to bull trout, relative to the proposed activity.
3. Disposition of Individuals Taken: In the course of implementing the proposed action addressed in this Opinion and the monitoring and reporting requirements addressed in this ITS, if dead, injured, or sick endangered or threatened species are detected and/or salvaged, the Service's Ecological Services' office in Boise, Idaho shall be notified within three working days by phone (208-378-5243) or by electronic mail (fw1idahoconsultationrequests@fws.gov). Notification should include the date, time, and precise location of the detection, a photograph, and the species involved and shall distinguish between injured and killed animals. If the listed species detected is not covered under this ITS, do not disturb the site and immediately contact the Service's Office of Law Enforcement in Marsing, Idaho (208-442-9551). Additional protective measures may be developed through discussions with the Service if needed.

5. BULL TROUT CRITICAL HABITAT

5.1 Status of Critical Habitat – Bull Trout

This section summarizes information found in Appendix B, regarding the regulatory, biological and ecological status of bull trout critical habitat at a range-wide scale.

The Service published a final critical habitat designation for the coterminous United States population of the bull trout on October 18, 2010 (75 FR 63898). Critical habitat is defined as the specific geographic area(s) that contain features essential for the conservation of a threatened or endangered species and that may require special management and protection (16 USC 1532(5)). The rule designated critical habitat in 36 critical habitat units (CHU) in the states of: Washington, Oregon, Nevada, Idaho, and Montana throughout the coterminous range. All of the critical habitat in Nevada, Idaho, and Montana is within the Columbia River Basin. Designated bull trout critical habitat includes certain: lakes, reservoirs, streams, and marine shorelines that are either occupied by listed bull trout, or they are unoccupied, but they are needed for bull trout recovery.

The conservation role of bull trout critical habitat is to support viable core area populations (75 FR 63898:63943). The core areas reflect the genetic and demographic structure of bull trout populations. Core areas are the closest approximation of a biologically functioning unit for the purposes of recovery planning and risk analyses. Critical habitat units represent a group of interconnected populations that include at least one core area. The primary function of individual CHUs is to maintain and support core areas that:

(1) contain bull trout populations with the demographic characteristics needed to ensure their persistence and contain the habitat needed to sustain those characteristics,

(2) provide for persistence of strong local populations, in part, by providing habitat conditions that encourage movement of migratory fish,

(3) are large enough to incorporate genetic and phenotypic diversity, but small enough to ensure connectivity between populations,

(4) that are distributed throughout the historical range of the species to preserve both genetic and phenotypic adaptations.

Within the designated critical habitat areas, nine physical or biological features (PBF) of critical habitat essential for the primary biological needs of bull trout are recognized (75 FR 63931–63932):

(1) Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia.

(2) Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.

(3) An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.

(4) Complex river, stream, lake, reservoir, and marine shoreline aquatic environments, and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure.

(5) Water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence.

(6) In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine sediment, generally ranging in size from silt to coarse sand, embedded in larger substrates, is characteristic of these conditions. The size and amounts of fine sediment suitable to bull trout will likely vary from system to system.

(7) A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departure from a natural hydrograph.

(8) Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.

(9) Sufficiently low levels of occurrence of nonnative predatory (e.g., lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g., brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.

The PBFs describe features that are necessary to support foraging, reproducing, rearing of young, dispersal, genetic exchange, or sheltering. All nine PBFs are not necessarily present in all areas designated as critical habitat. Some streams are used primary for spawning and rearing (SR), and many larger streams, rivers, and lakes are used primarily for foraging, migration, and overwintering (FMO). Some of the PBFs found in these two types of critical habitats differ.

The condition of bull trout critical habitat varies across its range. In general, many PBFs are significantly altered in drainage basins with extensive agriculture, timber harvest, mining, or urbanization; and PBFs most closely resemble natural conditions at high elevations and in drainage basins that are largely undeveloped. Some of the more significant threats to critical habitat include habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, past fisheries management practices, impoundments, dams, water diversions, and introduction of nonnative species (75 FR 63898).).

5.2 Environmental Baseline of the Action Area

The term “environmental baseline” is defined in the regulations implementing the Act as “the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The impacts to listed species or designated critical habitat from Federal agency activities or existing Federal agency facilities that are not within the agency’s discretion to modify are part of the environmental baseline” (50 CFR 402.02).

5.2.1 Status of Bull Trout Critical Habitat in the Action Area

The proposed action is located in the EFSFSR in the South Fork Salmon River critical habitat subunit (CHSU) within the Salmon River Basin Critical Habitat Unit (USFWS 2010, p. 673). In addition, the proposed action includes restoration in the Lemhi River in the Lemhi River CHSU, which is also within the Salmon River Basin CHU.

The Salmon River Basin CHU, Unit 27, extends across portions of Adams, Blaine, Custer, Idaho, Lemhi, Nez Perce, and Valley Counties in Idaho. This CHU includes 4,584 miles of streams and 4,161 acres of lakes and reservoirs designated as critical habitat. This CHU is the largest in the Upper Snake RU and contains the largest populations of bull trout in the RU. It supports adfluvial, fluvial, and resident bull trout. Large portions of this CHU occur within the Frank Church—River of No Return Wilderness (USFWS 2010, p. 673)

The South Fork Salmon River CHSU is located in Idaho and Valley counties in central Idaho and includes 758 mi of streams and 640 acres of lake surface area. It contains many bull trout individuals, contains few threats, and supports fluvial populations that are essential for long-term recovery (USFWS 2010, p. 679). This CHSU includes designated spawning and rearing habitat in the South Fork Salmon River, from its confluence with the Salmon River upstream 80 mi, and spawning and rearing habitat from its confluence with Tyndall Creek upstream to its headwaters.

Bull trout are currently known to use spawning and rearing habitat in at least 27 streams or stream complexes (local populations) within the South Fork Salmon River CHSU, including Upper EFSFSR, Sugar Creek, Burntlog Creek, Trapper Creek/Lake, and Riordan Creek/Lake, (USFWS 2015b, p. E89), which are all designated critical habitat within the Stibnite project area (Figure 18).

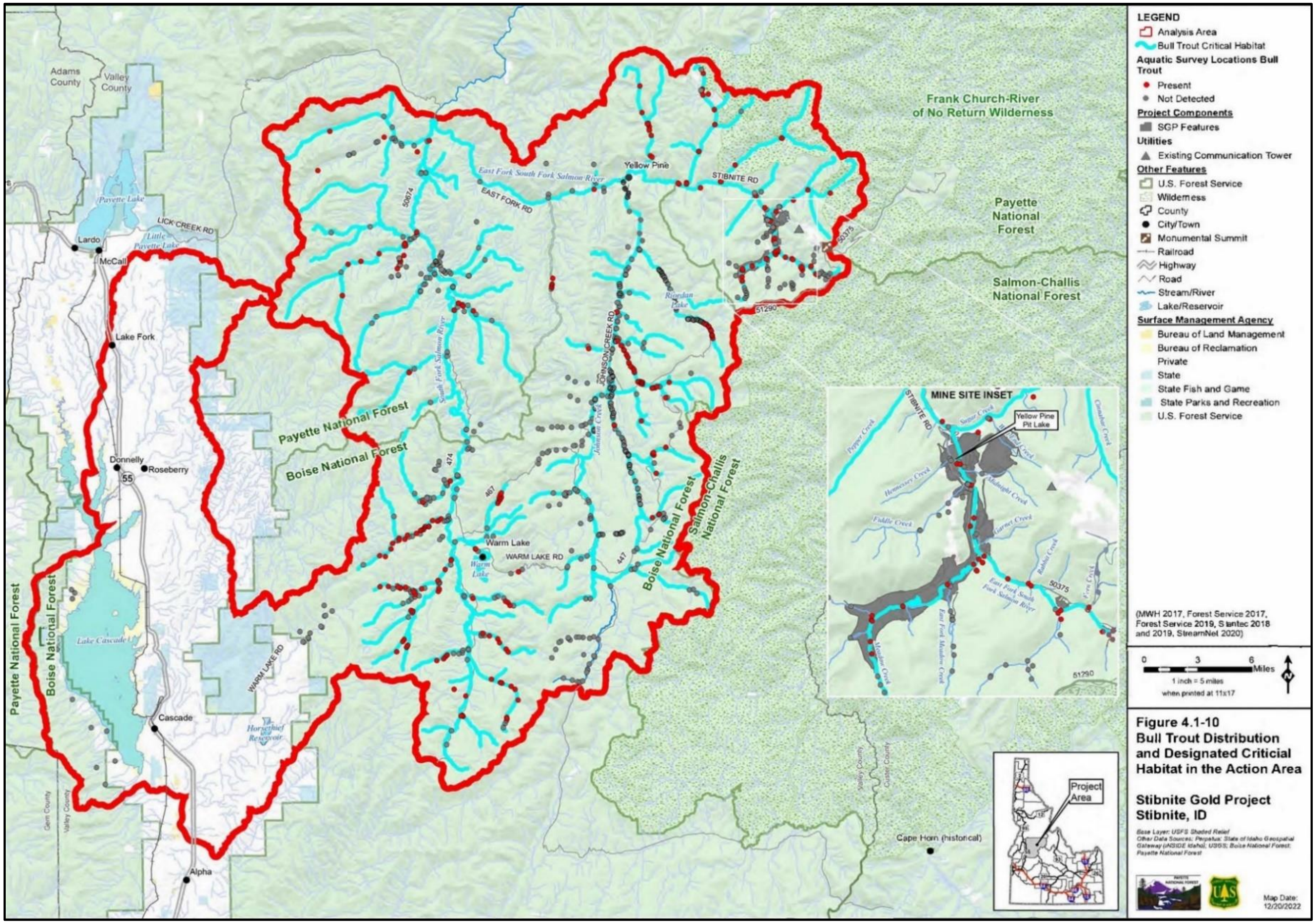

Figure 18. Bull trout designated critical habitat in the Stibnite project area (USFS 2024, Figure 4.1-10).

The EFSFSR from its confluence with South Fork Salmon River upstream 52.3 km (32.5 mi) to its headwaters provides spawning and rearing habitat (USFWS 2010, p. 680). Although YPP is included in this reach of spawning and rearing habitat, the lake itself is used for foraging, migrating, and overwintering, not for spawning. Meadow Creek from its confluence with East Fork South Fork Salmon River upstream 2.4 km (1.5 mi) to the outlet of Meadow Creek Lake provides spawning and rearing habitat; Meadow Creek Lake 10.7 ha (26.5 acres) used to contain FMO habitat, but this lake is no longer present; and Meadow Creek from the inlet to Meadow Creek Lake upstream 4.7 km (2.9 mi) to its headwaters provides spawning and rearing habitat (USFWS 2010, p. 680)

Sugar Creek from its confluence with East Fork South Fork Salmon River upstream 11.5 km (7.1 mi) to its headwaters provides spawning and rearing habitat; an unnamed tributary to Sugar Creek from its confluence with Sugar Creek upstream 11.5 km (7.1 mi) to its headwaters provides spawning and rearing habitat; Cinnabar Creek from its confluence with Sugar Creek upstream 5.5 km (3.4 mi) to its headwaters provides spawning and rearing habitat; and Cane Creek from its confluence with Sugar Creek upstream 4.2 km (2.6 mi) to its headwaters provides spawning and rearing habitat (USFWS 2010, p. 681)

Burntlog Creek from its confluence with Johnson Creek (FMO habitat) upstream 22.7 km (14.1 mi) to its headwaters provides spawning and rearing habitat; East Fork Burntlog Creek from its confluence with Burntlog Creek upstream 7.3 km (4.5 mi) to its headwaters provides spawning and rearing habitat; Peanut Creek from its confluence with Burntlog Creek upstream 7.6 km (4.8 mi) to its headwaters contains FMO habitat; Trapper Creek from its confluence with Johnson Creek upstream 14.4 km (9.0 mi) to its headwaters provides spawning and rearing habitat; Riordan Creek from its confluence with Johnson Creek upstream 4.3 km (2.7 mi) to the potential barriers contains FMO habitat; Riordan Creek from the potential barriers upstream 3.2 km (2.0 mi) to Riordan Lake outlet provides spawning and rearing habitat; Riordan Lake (29.6 ha, (73.1 ac)) contains FMO habitat; Riordan Creek from Riordan Lake inlet upstream 6.5 km (4.1 mi) to its headwaters provides spawning and rearing habitat; and North Fork Riordan Creek from its confluence with Riordan Creek upstream 5.5 km (3.4 mi) to its headwaters contains FMO habitat (USFWS 2010, pp. 681–682)

The Lemhi River CHSU is located within Lemhi County immediately southeast of Salmon, Idaho and includes 413.8 km (234.3 mi) of streams designated as critical habitat. The Lemhi River from its confluence with the Salmon river upstream 91.9 km (57.1 mi) to the confluence of Texas Creek and Eighteenmile Creek contains FMO habitat (USFWS 2010, p. 767). The Lemhi restoration project area is located in this section of river within FMO habitat (Figure 2).

5.2.2 Factors Affecting Bull Trout Critical Habitat in the Action Area

The same factors described above for bull trout in Section 4.2.2 also apply to bull trout critical habitat.

5.2.3 Consultations Affecting Bull Trout Critical Habitat in the Action Area

The Service has formally consulted on the effects to bull trout critical habitat throughout its range. Section 7 consultations include actions that continue to degrade the environmental baseline in many cases. However, long-term restoration efforts are also proposed and have been implemented, which provide some stability or improvement in the existing functions within some of the CHUs. For an analysis of prior consulted-on effects in the action area, see Section 4.2.3.

5.3 Effects of the Proposed Action

Implementing regulations define "effects of the action" as "all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action but that are not part of the action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action" (50 CFR 402.02).

In this section, the effects to critical habitat are determined by analyzing the effects to each of the PBFs below. The Opinion assesses the expected impacts from the proposed action at the stream and watershed scales using a crosswalk between effects to Watershed Condition Indicators (WCIs; USFS 2024, Appendix C Tables C-3 and C-4) and bull trout critical habitat PBFs. The watershed condition indicators WCIs are used as a metric to compare baseline conditions to estimated changes that might be caused by projects or other events (USFS 2024, p. 246). It should be noted that adverse effects to many of the PBFs result from expected increases in water temperature associated with reductions in stream flow and removal of riparian vegetation. These effects are anticipated to be temporary (less than 1 year), short-term (0-3 years), long-term (3-20 years), or permanent (20 plus years), and approximately correspond to the construction, exploration, operations, or closure/reclamation phases of the proposed action. For example, water temperature within the mine site area is expected to be degraded during the construction and operations phases, but will improve during the closure and post-closure phases (USFS 2024, Appendix C Table C-4).

Bull trout designated critical habitat will be affected by construction and exploration activities, including the Burntlog geophysical investigation activities; EFSFSR flow diversion into the tunnel/fishway; diversion of Meadow Creek and its tributaries around the TSF and TSF Buttress area into low flow pipes; dewatering the YPP lake; stream enhancements; construction of access roads, including the Burntlog Route; and construction of the transmission line.

PBF 1: ***Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flow) to contribute to water quality and quantity and provide thermal refugia***.

The clearing of some trees in RCAs from geophysical investigation could alter peak and base flows. However, with only small areas where this may occur (0.6 acres), minimal tree removal, and retention of any felled trees within RCAs, effects to PBF 1 will be insignificant. Water drafting from Johnson Creek for geophysical investigation could decrease flows. Because only

0.4% of the flow will be withdrawn and pumping will be intermittent, effects from water drafting will be insignificant to bull trout critical habitat.

The analysis of *floodplain connectivity* considers the hydrologic linkage of off-channel areas with the main channel and overbank-flow maintenance of wetland function and riparian vegetation and succession. Floodplain and riparian areas provide hydrologic connectivity for springs, seeps, groundwater upwelling, and wetlands and contribute to the maintenance of the water table. The *interstitial sediment*/*embeddedness* indicators describe the level of fine sediment in the gravel that affects hyporheic flow. Fine sediment fills interstitial spaces making the movement of water through the substrate less efficient. The *chemical contamination/nutrients* and *temperature* indicators evaluate the water quality of groundwater.

The *off-channel habitat* indicator suggests how much off-channel habitat is available, and generally off-channels are connected to adjacent channels via subsurface water. The *change in peak/base flows* indicator considers whether or not peak flow, base flow, and flow timing are comparable to an undisturbed watershed of similar size, geology, and geography. Peak flows, base flows, and flow timing are directly related to subsurface water connectivity and the degree to which soil compaction has decreased infiltration and increased surface runoff. The *drainage network increase* and *road density and location* indicators assess the influence of the road and trail networks on subsurface water connectivity. If there is an increase in drainage network and roads are located in riparian areas, it is likely that subsurface water is being intercepted before it reaches a stream. If groundwater is being intercepted, then it is likely that water quality is being degraded through increased temperatures, fine sediment, and possibly chemical contamination. *Streambank condition* addresses groundwater influence through an assessment of stability. The *disturbance history* indicator evaluates disturbance across the watershed and provides a picture of how management may be affecting hydrology. The *riparian conservation areas* indicator determines whether riparian areas are intact and providing connectivity. If riparian areas are intact, it is much more likely that springs, seeps, and groundwater sources are able to positively affect water quality and quantity (USFWS 2011, entire).

USFS (2024, Appendix C Table C-4) indicates that the proposed action is expected to degrade the baseline condition of the *temperature, change in drainage network, road density and location, and riparian conservation areas* WCIs (the proposed action will maintain, improve, or have no influence on the other associated indicators discussed above). Mining operations may reduce groundwater and subsurface water connectivity, which can be exacerbated during dry periods. Groundwater pumping for mine dewatering and consumptive use occurs during mine years 1 through 15 with the peak rates occurring in mine years 4 through 8. Groundwater pumping lowers groundwater levels in the area of the Yellow Pine Pit, Hangar Flats Pit, and West End Pit between 10 feet (away from the immediate pit areas) up to several hundred feet (at the pit bottoms). Lowering groundwater levels has the potential to reduce groundwater discharges to streams, thereby reducing overall stream flow. Because of the mine site hydrogeology, groundwater discharges in the mine site are a relatively small component of total stream flows. In the upper segments of the EFSFSR above its confluence with Meadow Creek, monitoring data indicate that the EFSFSR gains approximately 0.5 cfs (375 acre-feet annually) from groundwater inflow. Monitoring indicates alternating zones of groundwater discharge to streams and infiltration from streams to groundwater in Meadow Creek and in the EFSFSR with most of the groundwater discharge occurring in the EFSFSR between the Fiddle Creek confluence and the Yellow Pine Pit. The net effect of those discharge and infiltration zones balance over those stream segments with approximately 3 cfs (2,250 acre-feet annually) of groundwater discharge balanced by that amount of infiltration. Effects of lowered groundwater levels will occur throughout the groundwater pumping period (i.e., mine years 1 through 15) and for approximately another 10 years following the end of pumping as groundwater levels take time to recover to their pre-pumping water levels. Peak dewatering operations during Mine Year 6 will result in the lowest groundwater elevations and groundwater discharge to streams, which will have adverse effects to PBF 1.

These impacts continue through the operations phase, but the condition of some indicators (*temperature* and *riparian conservation areas*) are expected to improve in the closure/reclamation phase. In particular, the *change in peak/base flows* indicator returns to baseline condition in the closure/reclamation phase. Adverse effects to the *chemical contaminants/ nutrients* and *change in drainage network* indicators will continue through the closure/reclamation phase. Given these long-term negative changes in habitat conditions, the Service concludes that the proposed action is likely to result in localized (within the mine site), long-term (20 plus years) adverse effects to PBF 1. Because effects will be localized, effects to PBF 1 at the larger scales of the South Fork Salmon River CHSU and Salmon River Basin CHU will be insignificant.

There will be a change in localized flow within the Lemhi restoration project area because of the increase in the number of active channels; however, there will be no change in regional flow (flows throughout the subbasin). While there will be a temporary overall reduction in flow in the main channel compared to baseline conditions during construction, there will be increased floodplain connectivity and a greater area of connection to the underlying aquifer, thus increasing the groundwater-surface water exchange and improving the hyporheic connection. Overall, effects to PBF 1 from Lemhi restoration activities are expected to be insignificant.

PBF 2: ***Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.***

The *physical barriers* indicator provides the most direct assessment of this PBF. Analysis of this indicator includes consideration of whether human-made barriers within the watershed allow upstream and downstream passage of all life stages at all flows. However, some indicators further evaluate physical impediments and others evaluate the biological or water quality impediments that may be present. The *temperature*, *interstitial sediment deposition/embeddedness,* and *chemical contaminants/nutrients* indicators assess whether other barriers may be created, at least seasonally, by conditions such as high temperatures, high concentrations of sediment, or contaminants. The *width/depth ratio* indicator can help identify situations in which water depth for adult passage may be a problem. A very high average wetted width/depth value may indicate a situation where low flows, when adults migrate, are so spread out that water depth is insufficient to pass adults. The *change in peak/base flows* indicator can help determine if change in base flows have been sufficient to prevent adult passage during the spawning migration. The *persistence and genetic integrity* indicator addresses biological impediments by evaluating negative interactions (e.g., predation, hybridization, and competition) with other species (USFWS 2011, entire).

USFS (2024, Appendix C Table C-4) indicates that the proposed action will degrade the baseline condition of the *temperature*, *chemical contaminants/nutrients*, and *change in peak/base flows* indicators (the proposed action will maintain, improve, or have no influence on the other associated WCIs). These impacts continue through the operations phase, but the condition of the *temperature* indicator will improve in the closure/reclamation phases. The *change in peak/base flows* indicator returns to baseline condition in the closure/reclamation phase. Adverse impacts to the *chemical contaminants nutrients* indicators will continue through the closure/reclamation phase.

Project activities include the replacement of culverts and bridges. The associated work may create temporary passage barriers when block nets are placed and due to electrofishing and salvage to exclude bull trout from instream work, thereby resulting in short-term, localized adverse effects to PBF 2. These nets could restrict bull trout movement up or downstream and, therefore, adversely affect this PBF for the extent of construction. Once the block nets are removed, the culvert and bridge replacements will not result in any new, natural or artificial, barriers within the action area. Therefore, this PBF will be temporarily impacted in localized areas. These replacements will improve migration habitat of the species as individual bull trout may have access to critical habitat that was previously obstructed. Thus, the proposed action will have temporary short-term adverse effects on migration habitat but have insignificant effects at the subwatershed scale. The condition of the *physical barriers* indicator in the EFSFSR will improve because of the removal of the YPP cascade barrier and improvements to the box culvert downstream from Meadow Creek. Similarly, stream crossings for the Burntlog Route will result in improved fish passage.

However, based on the current known extent of bull trout occupancy, bull trout may be extirpated from the reaches in Meadow Creek upstream from the TSF when the reaches within the footprint will be dewatered and flow will be diverted into the diversions that route water around the facilities. With the gradient barrier that will be created along the TSF, there will be no mechanism by which bull trout will be able to volitionally (i.e., naturally) recolonize the reaches upstream from or on top of the TSF resulting in the permanent loss of around 8,500 m of critical habitat. An existing barrier to bull trout in Meadow Creek upstream from EF Meadow Creek will be removed but will be replaced by a pipeline along the TSF during operations and then a gradient barrier post-closure. This barrier will block bull trout passage to the headwaters of Meadow Creek.

An analysis of critical habitat currently blocked due to passage barriers indicates that the largest impacts to critical habitat for bull trout will come from barrier removal (USFS 2024, p. 445). Nearly 20 km of critical habitat are blocked for migratory bull trout above the YPP under baseline conditions. However, this segment of critical habitat is occupied by non-migratory, resident bull trout. This barrier will be removed before mine operations begin (Mine Year minus 1) to allow access for fluvial and adfluvial bull trout above these barriers (USFS 2024, p. 445).

There will be a significant decrease in access to migration habitats in the Lemhi restoration project area in the short-term because of channel dewatering, construction, and fish salvage. There will be long-term benefits to PBF 2 through improved riparian habitat conditions in the Lemhi restoration project area, increased habitat complexity, and increased hyporheic exchange.

Given these short- and long-term negative changes in habitat conditions, the Service concludes that the proposed action is likely to result in temporary short-term (during construction and operations in the Stibnite project area and during restoration at the Lemhi restoration project area) and long-term (through the closure/reclamation phase and in perpetuity) adverse effects to

PBF 2. There are 8,500 m of critical habitat that will be permanently lost, but this effect to PBF 2 will not be adverse at the larger scale of the South Fork Salmon River CHSU or Salmon River Basin CHU.

PBF 3: *An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.*

Effects of chemical contamination from geophysical investigation and exploratory drilling to the food base will be discountable due to the low probability of an accidental spill occurring during transportation and fueling and the avoidance measures (USFS 2024, Appendix B) in place such as refueling occurring outside of RCAs, equipment inspections, and fuel spill kits being available on site.

None of the WCIs directly address this PBF, but a number of them address it indirectly. The *chemical contaminant/nutrients* indicator evaluates the level to which a stream is contaminated by chemicals or has a high level of nutrients. Chemicals and nutrients greatly affect the type and diversity of aquatic invertebrate communities present in a water body. The *riparian conservation areas* indicator sheds light on the very basis of the food base of a stream. Vegetation along streambanks and in riparian areas provide important habitat for terrestrial macroinvertebrates that can fall into the water as well as sources of nutrient inputs that support aquatic invertebrate production (USFWS 2011, entire).

The *interstitial sediment/embeddedness* indicator documents the extent to which substrate interstitial spaces are filled with fine sediment. Interstitial spaces provide important habitat for aquatic macroinvertebrates, sculpin, and other substrate-oriented prey which are important food sources for bull trout. Construction and operations have the potential to deliver sediment to water and cause turbidity plumes in critical habitat. These increases in sediment could adversely affect the bull trout prey base. Increased turbidity and filling of interstitial spaces can kill or injure macroinvertebrates or small fish and will also prompt bull trout to move away from the affected area, potentially reducing their foraging opportunities. However, sediment plumes, especially those associated with culvert and bridge removals and installations, are expected to be temporary and return to baseline conditions within hours.

Riparian vegetation removal could negatively reduce plant matter and invertebrates in streams; however, the extent of this activity in any given year is of such a small scale or infrequent enough that it will not have any measurable effect. Therefore, adverse effects to the food base are expected to occur on a small scale and will be insignificant at the watershed scale.

USFS (2024, Appendix C Table C-4) indicates that the proposed action will degrade the baseline condition of the *interstitial sediment/embeddedness*, *chemical contaminant/nutrients*, and *riparian conservation areas* indicators (the proposed action will maintain, improve, or have no influence on the other associated WCIs). These impacts continue through the operations phase (Mine Years 1-15), but the condition of *interstitial sediment/embeddedness* and *riparian conservation areas* are expected to improve over baseline conditions in the closure/reclamation phase (starting at Mine Year 16). Adverse effects to the *chemical contaminants/ nutrients* indicator will continue through the closure/reclamation phase.

There will be beneficial effects to PBF 3 from the Lemhi restoration project because of improvements made to spawning and rearing habitat, including improved riparian habitat increased habitat complexity, and increased hyporheic exchange. Insignificant and short-term effects to PBF 3 are also expected from sedimentation created during restoration activities.

For these reasons, the Service concludes that the proposed action is likely to have temporary, short-term adverse effects to PBF 3 throughout portions of the action area, which will be insignificant to PBF 3 at the larger scale of the South Fork Salmon River CHSU or Salmon River Basin CHU.

PBF 4: ***Complex river, stream, lake, reservoir, and marine shoreline aquatic environments, and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks, and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure.***

Several WCIs address this PBF directly. The *interstitial sediment/embeddedness* indicator provides insight into how complex substrates are within a stream by documenting percent fines and embeddedness. As percent fines and embeddedness increase, substrate complexity decreases. The *large woody debris* indicator provides an excellent picture of habitat complexity (Krupka et al. 2011, p. 3). The indicator rates the stream based on the amount of in-channel large woody debris. Habitat complexity increases as large wood increases. The *pool frequency and quality* indicator addresses habitat complexity by rating the stream based on the frequency of pools and their quality. Habitat complexity increases as the number of pools and their quality increase. The *off-channel habitat* indicator directly addresses complexity associated with side channels. The indicator is rated based on the amount of off-channel habitat, cover associated with off-channels, and flow energy levels. The *width/depth ratio* is an indicator of channel shape and pool quality. Low ratios suggest deeper, higher quality pools. The *streambank condition* and *riparian conservation areas* indicators both shed light on the complexity of river and stream shorelines. Vegetation along streambanks and in riparian areas provides important habitat complexity and channel roughness. The *streambank condition* indicator also provides information about the capacity of an area to produce undercut banks, which can be an important habitat feature for bull trout. The *floodplain connectivity* indicator addresses complexity added by side channels and the ability of floodwaters to spread across the floodplain to dissipate energy and provide access to high-flow refugia for fish. The *road density and location* indicator addresses complexity by identifying if roads are located in valley bottoms. Roads located in valley bottoms reduce complexity by eliminating vegetation and replacing complex habitats with riprap or fill, and often confine the floodplain. The *disturbance regime* indicator documents the frequency, duration, and size of environmental disturbance within the watershed. If scour events, debris torrents, or catastrophic fires are frequent, long in duration, and large, then habitat complexity will be greatly reduced (USFWS 2011, entire).

USFS (2024, Appendix C Table C-4) indicates that the proposed action will degrade the baseline condition of the *interstitial sediment/embeddedness*, *road density and location*, *riparian conservation areas*, and *disturbance regime* indicators (the proposed action will maintain, improve, or have no influence on the other associated WCIs). These impacts will continue through the operations phase but the condition of the *interstitial sediment/embeddedness*, *riparian conservation areas*, and *disturbance regime* indicators will improve over baseline conditions in the closure/reclamation phase after all reclamation projects have been completed. The condition of *road density and location* indicator returns to baseline condition in the closure/reclamation phase.

The clearing of some trees in RCAs for geophysical investigation could alter large woody debris (LWD), which provides cover, and pool frequency and pool formation are highly correlated to LWD. Due to tree clearing only occurring within a 0.6-acre area in RCAs, minimal tree removal, and retention of any felled trees within RCAs, effects to PBF 4 will be insignificant. Water drafting from Johnson Creek for the Burntlog geophysical investigation could reduce habitat availability due to decreasing the amount of water in the creek. Because only 6,050 gallons will be withdrawn and pumping will be intermittent, effects from water drafting are expected be insignificant to PBF 4.

The proposed action will increase turbidity and substrate embeddedness within parts of the action area via culvert and bridge removal and installation, geophysical investigation and exploratory drilling, installation of transmission lines, and road building and use. These activities will create temporary adverse impacts to this PBF as added sediment enters streams but then settles out. Erosion control will be installed where necessary and appropriate to minimize sediment delivery to streams. Erosion control may include, but is not limited to, the use of straw wattles or hay bales and pressure reducing mats (USFS 2024, pp. 187-190, Table 3.6.1).

While there will be temporary adverse effects to PBF 4 from increased turbidity and substrate embeddedness during Lemhi restoration project activities, there will be long-term benefits to habitat complexity in the restoration area through the creation of multi-threaded channels and connected off-channel habitat; increased floodplain connection; increased instream structure and hydraulic diversity; increased pool quantity, frequency, and complexity; increased hyporheic exchange; and creation of a riparian corridor.

The Service therefore concludes that the proposed action is likely to result in temporary, localized adverse effects to PBF 4 within portions of the action area, while effects to PBF 4 in the South Fork Salmon River CHSU or Salmon River Basin CHU will be insignificant.

PBF 5: ***Water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence.***

The *temperature* indicator addresses this PBF directly. The indicator rates streams according to how well temperatures meet bull trout requirements. Other matrix WCIs address temperature indirectly. The *off-channel habitat* and *floodplain connectivity* indicators address how well stream channels are hydrologically connected to off-channel areas. Floodplains and off-channels are important to maintaining the water table and providing connectivity to the channel for springs, seeps, and groundwater sources which contribute cool water to channels. The *width/depth ratio* indicator also corresponds to temperature. Low width to depth ratios indicate that channels are narrow and deep with little surface area to absorb heat. The *streambank condition* indicator documents bank stability. If the streambanks are stabilized by vegetation rather than substrate then it is likely that the vegetation provides shade which helps prevent increases in temperature. The *change in peak/base flows* indicator evaluates flows and flow timing characteristics relative to what would be expected in an undisturbed watershed. If base flow has been reduced, it is likely that water temperature during base flow has increased since the amount of water to heat has decreased. The *road density and location* and *change in drainage network* indicators documents where roads are located. If roads are located adjacent to a stream, then shade is reduced and temperature is likely increased. Roads also intercept groundwater and can reduce this cooling influence, as well as discharge typically warmer stormwater. The *disturbance history* indicator describes how much of the watershed has been altered by vegetation management and, therefore, indicates how much shade has been removed. The *riparian conservation areas* indicator addresses stream shade which keeps stream temperatures cool. The presence of *large pools* may provide thermal refugia when temperatures are high (USFWS 2011, entire).

USFS (2024, Appendix C Table C-4) indicates that the proposed action will degrade the baseline condition of the *temperature, change in peak/base flows*, *change in drainage network, road density and location*, and *riparian conservation areas* indicators (the proposed action will maintain, improve, or have no influence on the other associated WCIs). These impacts will continue through the operations phase, but the condition of the *temperature* and *riparian conservation areas* indicators will improve over baseline conditions in the closure/reclamation phase. The *change in peak/base flows* and *road density and location* indicators return to baseline conditions in the closure/reclamation phase. Adverse impacts to the *change in drainage network* indicator will continue through the closure/reclamation phase.

Mining operations will increase stream temperatures by increasing the surface to volume ratio via decreased water depth, potentially introducing thermal barriers to a cold-water species such as bull trout. Streams naturally have low flow during the hottest summer months (July – September) when stream temperatures are already elevated. By removing water from the stream during this period, diversion operations may further exacerbate elevated temperatures. For species, such as bull trout, that require colder water temperatures to survive and reproduce, warmer temperatures could lead to decreases in available suitable habitat and increased metabolic costs. Because mining operations will lower water depth, the width to depth ratio of streams will be increased as well. By reducing water depth, access to cold water refugia could be reduced during summer base flows in streams with diversions.

Activities that remove or alter vegetation that provide shade to streams have the potential to increase solar radiation and in turn increase stream temperatures. The construction of the road crossings as well as some tree trimming for the transmission line may result in a loss of riparian vegetation, as well as reduced vegetation overhead cover and stream shade until riparian vegetation can be reestablished. Stream shade will also be provided from the road crossings, even though this is an unnatural condition. It is anticipated that there will be limited, if any, effects to water temperature along the Burntlog Route and the transmission line due to the minimal reduction of trees within RCAs.

Predicted future temperature increases from the proposed action were evaluated using a SPLNT model (Brown and Caldwell 2021c, Section 3), which calculated a MWMT. See (USFS 2023e, entire) for additional information on the modeling results. A summary of predicted water temperatures under the proposed action is presented in Table 24. The periods evaluated include the baseline conditions, those within mine operations (Mine Years 6, 12 and 18), and several in the post-closure period (Mine Years 22, 27, 32, 52 and 112). Temperatures were simulated for the years selected for the table because they correspond to peak temperature years and changes in the operational period (Mine Years 6, 12, and 18) followed by intervals of 5-, 10-, 30-, and 90-years post-closure. The SPLNT model assumes revegetation success per the Reclamation Closure Plan and Stream Restoration Design. Sensitivity analyses regarding the establishment of vegetation have been conducted and indicate that attaining more than 70% revegetation success is achievable. The post-closure period represents how the mine site will function after the facilities and permitted discharges have been removed, dewatering and mining have been discontinued, and the channels and vegetation have been fully reclaimed.

The EFSFSR between YPP and Sugar Creek, and the EFSFSR roughly 1 km downstream from Sugar Creek, experience an increase in summer and fall maximum water temperatures at Mine Year 6 caused primarily by the draining of the YPP lake followed by active mining and mine dewatering that removes cooling influences of upstream shading and groundwater discharge to surface water (Table 24). By Mine Year 12, water temperatures start to drop as the YPP is backfilled, the EFSFSR stream channel is restored, and Stibnite Lake is developed (USFS 2024, p. 377). As riparian vegetation is re-established and begins to provide stream shade, water temperatures will continue to drop. By Mine Year 112, summer maximum water temperatures in the EFSFSR between YPP and Sugar Creek are about 0.2 °C higher than baseline conditions, but fall maximum temperatures, and summer maximum and fall maximum temperatures below Sugar Creek are predicted to be between 0.2 and 0.6 °C below baseline conditions (Table 24).

In the Lemhi restoration project area, there may be short-term, localized effects to water temperature due to removal of riparian vegetation. The width:depth ratio in the mainstem will be reduced from the restoration project, which will provide long-term improvements to water temperature by creating a deeper, narrower (but not channelized) stream channel and creating a condition that is more conducive to stream shading over a larger percentage of the channel width. Hyporheic exchange often increases with increasing channel complexity in a floodplain, which will result in reduced water temperatures. There will be long-term benefits to PBF 5 through improved riparian habitat conditions in the Lemhi restoration project area, increased habitat complexity, and increased hyporheic exchange which will reduce water temperatures.

The Service therefore concludes that the proposed action is likely to result in localized adverse effects to PBF 5 within portions of the action area, but effects to PBF 5 at the larger scale of the South Fork Salmon River CHSU or Salmon River Basin CHU are expected to be insignificant.

PBF 6. ***In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine sediment, generally ranging in size from silt to coarse sand, embedded in larger substrates, is characteristic of these conditions. The size and amounts of fine sediment suitable to bull trout will likely vary from system to system.***

The *interstitial sediment/embeddedness* indicators directly address this PBF. These indicators evaluate the percent fines within spawning areas and the percent embeddedness within rearing areas. The *streambank condition* and *riparian conservation areas* indicators indirectly address this PBF by documenting the presence or lack of potential fine sediment sources. If streambanks are stable and riparian conservation areas are intact then there is a low risk of introducing fine sediment from bank erosion. Also, the *floodplain connectivity* indicator indirectly addresses this PBF. If the stream channel is connected to its floodplain, then there is less risk of bank erosion during high flows because stream energy is reduced as water spreads across the floodplain. The *change in drainage network* and *road density and location* indicators assess the effects of roads on the channel network and hydrology. If the drainage network has significantly increased as a result of human-caused disturbance or road density is high within a watershed and roads are located adjacent to streams, then it is likely that in-channel fine sediment levels will be elevated above natural levels. The *disturbance regime* indicator documents the nature of environmental disturbance within the watershed. If the disturbance regime includes frequent and unpredictable scour events, debris torrents, and catastrophic fire, then it is likely that fine sediment levels will be elevated above background levels. A consideration for all WCIs directly or indirectly influencing this PBF is that it is desirable to achieve an appropriate balance of stable areas to provide undercut banks and eroding areas that are sources for recruiting new spawning gravels. Too little sediment in a stream can also be detrimental (USFWS 2011, entire).

USFS (2024, Appendix C Table C-4) indicates that the proposed action will degrade the baseline condition of the *interstitial sediment/embeddedness*, *change in drainage network, road density and location, riparian conservation areas, and disturbance regime* indicators (the proposed action will maintain, improve, or have no influence on the other associated WCIs). These impacts will continue through the operations phase, but the condition of the *interstitial sediment/embeddedness, riparian conservation areas,* and *disturbance regime* indicators will improve over baseline conditions in the closure/reclamation phase. The *road density and location* indicator returns to baseline condition in the closure/reclamation phase. Adverse impacts to the *change in drainage network* indicator will continue through the closure/reclamation phase.

The proposed action will increase turbidity and substrate embeddedness within parts of the action area via culvert and bridge removal and installation, geophysical investigation and exploratory drilling, installation of transmission lines, and road building and use. Activity-associated turbidity plumes may temporarily increase substrate embeddedness downstream of culvert and bridge sites, drilling locations, and roads; however, any aggregated sediment will likely be flushed each year during spring melt-off and peak discharge. Erosion control will be installed where necessary and appropriate to minimize sediment delivery to streams. Erosion control may include, but is not limited to, the use of straw wattles or hay bales and pressure reducing mats (USFS 2024, pp. 187-190, Table 3.6.1).

There are no Lemhi restoration actions in bull trout spawning and early rearing areas (i.e., local populations); therefore, there is no effect to PBF 6 in the Lemhi restoration project area.

These activities may create temporary adverse impacts to this PBF at project locations, but it is unlikely that sediment-related impacts to spawning will be measurable at the subwatershed scale. Because effects will be localized, there will be insignificant effects to PBF 6 at the larger scale of the South Fork Salmon River CHSU or Salmon River Basin CHU.

PBF 7. ***A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departure from a natural hydrograph.***

The *change in peak/base flows* indicator addresses this PBF directly by documenting the condition of the watershed hydrograph relative to an undisturbed watershed of similar size, geology, and geography. There are several WCIs that address this PBF indirectly. The *streambank condition* indicator documents bank stability. If the streambanks are stabilized by vegetation rather than substrate, then it is likely that the streambank can store water during moist periods and releases that water during dry periods, which contributes to water quality and quantity. The *floodplain connectivity* indicator is relevant to water storage within the floodplain, which directly affects base flow. Floodplains are important to maintaining the water table and providing connectivity to the channel for springs, seeps, and groundwater sources that contribute to water quality and quantity. The *change in drainage network* and *road density and location* indicators assess the influence of the road and trail networks on hydrology. If there is an increase in drainage network and roads are located in riparian areas, it is likely is being intercepted and quickly routed to a stream which can increase peak flow. The *disturbance history* indicator evaluates disturbance across the watershed and provides a picture of how management may be affecting hydrology; for example, it may suggest the degree to which soil compaction has decreased infiltration and increased surface runoff. The *riparian conservation areas* indicator determines whether riparian areas are intact, functioning, and providing connectivity. If riparian areas are intact, it is much more likely that springs, seeps, and groundwater sources are able to positively affect water quality and quantity (USFWS 2011, entire).

USFS (2024, Appendix C Table C-4) indicates that the proposed action will degrade the baseline condition of the *change in peak/base flows, change in drainage network, road density and location*, and *riparian conservation areas* indicators (the proposed action will maintain, improve, or have no influence on the other associated WCIs). These impacts will continue through the operations phase, but the condition of the *riparian conservation areas* indicators will improve over baseline conditions in the closure/reclamation phase. The *change in peak/base flows* and *road density and location* indicators return to baseline condition in the closure/reclamation phase. Adverse impacts to the *change in drainage network* will continue through the closure/reclamation phase.

The proposed action may create temporary adverse effects to the natural hydrograph from an increased disturbance regime. Tree removal during proposed action activities could slightly degrade peak/base flows from a reduction in the amount of watershed tree canopy. Reduction of canopy decreases the amount of potential evapotranspiration from trees, which can alter water yield. Because limited removal of trees within RCAs is proposed, detectable changes in water yield are not anticipated, and effects to peak/base flows are expected to be insignificant.

Water diversions during mining operations may affect the natural hydrograph in critical habitat by removing water from the EFSFSR. The rate of water removal varies during the operations phase. Predicted removal rates are largest during the early mining period (i.e., typically average 1 to 2.5 cfs [750 to 1,875 acre-feet annually] during mine years 1, 2, and 3) because there is limited groundwater pumping during those years for mine dewatering, and the TSF is building its water inventory during that period. During the period when dewatering is at its highest pumping rates, there will be no removal of water from the stream (i.e., mine years 4 through 8). When the need for mine dewatering decreases after mine year 8, removal of water from the EFSFSR resumes through the end of operations (i.e., mine years 9 through 15) with predicted intermittent stream withdrawals up to 2 cfs (1,500 acre-feet annually) during periods when reclaim water from the TSF is not expected to meet process demand (i.e., summer periods when TSF water is lost to evaporation). Water withdrawal will periodically affect peak flows which will likely be exacerbated during low flows periods. Flow and percent change in stream flow from baseline stream flow for the low-flow period (August through April) over the construction through post-closure mine phases is shown in Table 35. This will result in adverse effects to PBF 7 in the EFSFSR but not measurably affect the natural hydrograph at the watershed level.

Water levels in the Lemhi restoration project will be temporarily reduced through isolating and dewatering instream work areas, pre-washing new channels, and using staged rewatering of dewatered areas and newly constructed channels. All EDFs and BMPs described in USFS 2024,

Appendix B will be adhered to and all permit requirements will be followed; therefore, effects to PBF 7 will be insignificant.

The Service concludes that the proposed action is likely to result in adverse effects to PBF 7. Because effects will be localized within portions of the action area, there will be insignificant effects to PBF 7 at the larger scale of the South Fork Salmon River CHSU or Salmon River Basin CHU.

PBF 8. *Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.*

Effects from chemical contamination to water quality due to geophysical investigation will be discountable because the proposed action will entail a low probability of an accident occurrence during vehicle and equipment use, and EDFs will be in place, including equipment inspections, refueling occurring outside of RCAs, and fuel spill kits will be available on site. Effects from sediment delivery from geophysical investigation to water quality is expected to be insignificant, with the negligible increase of vehicles over baseline traffic levels and implementation of erosion control measures, including the use of straw wattles or hay bales and pressure reducing mats (USFS 2024, pp. 187-190, Table 3.6.1).

The *temperature* and *chemical contaminants/nutrients* indicators directly address water quality by comparing water temperatures to bull trout water temperature requirements, and documenting 303(d) designated stream reaches. Several other WCIs indirectly address this PBF by evaluating the risk of fine sediment being introduced that would result in decreased water quality through increased turbidity. The *streambank condition* and *riparian conservation areas* indicators indirectly address this PBF by documenting the presence or lack of potential fine sediment sources. If streambanks are stable and riparian conservation areas are intact, then there is a low risk of introducing fine sediment from bank erosion. Also, the *floodplain connectivity* indicator indirectly addresses this PBF. If the stream channel is connected to its floodplain, then there is less risk of bank erosion during high flows because stream energy is reduced as water spreads across the floodplain. *Width/depth ratio* is an indication of water volume, which indirectly indicates water temperature, (i.e., low ratios indicate deeper water, which in turn indicates possible high-flow refugia). This indicator in conjunction with *change in peak/base flows* is an indicator of potential water quality and quantity deficiencies, particularly during low flow periods. The *change in drainage network* and *road density and location* indicators assess the effects of roads on the channel network and hydrology. If the drainage network has significantly increased as a result of human-caused disturbance or road density is high within a watershed and roads are located adjacent to streams, then it is likely that suspended fine sediment levels will be elevated above natural levels. If roads are located adjacent to a stream then shade is reduced and temperature is likely increased. Roads also intercept groundwater and can reduce this cooling influence, as well as discharge typically warmer stormwater. The *disturbance regime* indicator documents the nature of environmental disturbance within the watershed. If the disturbance regime includes frequent and unpredictable scour events, debris torrents, and catastrophic fire, then it is likely that turbidity levels will be elevated above background levels (USFWS 2011, entire).

USFS (2024, Appendix C Table C-4) indicates that the proposed action will degrade the baseline condition of the *temperature*, *chemical contaminants/nutrients, change in peak/base flows, change in drainage network*, *road density and location*, *riparian conservation areas,* and *disturbance regime* indicators (the proposed action will maintain, improve, or have no influence on the other associated WCIs). These impacts will continue through the operations phase, but the condition of the *temperature*, *riparian conservation areas*, and *disturbance regime* indicators will improve over baseline conditions in the closure/reclamation phase. The *change in peak/base flows* and *road density and location* indicators return to baseline conditions in the closure/reclamation phase. Adverse impacts to the *change in drainage network* and *chemical contaminants/nutrients indicators* will continue through the closure/reclamation phase.

The proposed action is expected to cause localized, adverse effects to streambank conditions and sediment and turbidity, which may increase erosion rates and sediment delivery to streams within designated bull trout critical habitat. Sediment inputs will vary in magnitude and impact depending on the activity and the type of erosion control measures employed. Sediment delivery is likely to increase following culvert and bridge removal and installation, geophysical investigation and exploratory drilling, installation of transmission lines, and road building and use. Erosion control measures will be used to minimize sediment inputs. In general, elevated turbidity within critical habitat is expected; however, the Service expects that effects to this PBF will be temporary and only measurable at the stream scale. This is because project activities will be spread out through time, and sediment concentrations are not anticipated to reach adverse levels for extended periods of time.

Water diversions during mining operations may affect the natural hydrograph in critical habitat by removing water from the EFSFSR. The rate of water removal varies during the operations phase. Predicted removal rates are largest during the early mining period (i.e., typically average 1 to 2.5 cfs [750 to 1,875 acre-feet annually] during mine years 1, 2, and 3) because there is limited groundwater pumping during those years for mine dewatering and the TSF is building its water inventory during that period. During the period when dewatering is at its highest pumping rates, there will be no removal of water from the stream (i.e., mine years 4 through 8). When the need for mine dewatering decreases after mine year 8, removal of water from the EFSFSR resumes through the end of operations (i.e., mine years 9 through 15) with predicted intermittent stream withdrawals up to 2 cfs (1,500 acre-feet annually) during periods when reclaim water from the TSF is not expected to meet process demand (i.e., summer periods when TSF water is lost to evaporation). Effects to PBF 8 and water quantity are expected to be adverse during operations when already warmer, lower flow months of the summer exist. Adverse effects will be localized to the EFSFSR and are expected to be insignificant at the watershed scale.

Sediment effects during the Lemhi restoration project will be reduced through isolating and dewatering instream work areas, pre-washing new channels, using staged rewatering of dewatered areas and newly constructed channels, and adhering to EDFs and BMPs described in USFS 2024, Appendix B and following all permit requirements. There is the potential for an accidental spill or equipment leaks to introduce hazardous contaminants to critical habitat and affect PBF 8. However, given the low risk of a spill, implementation of the SPCCP and BMPs, effects to PBF 8 will be discountable.

The Service concludes that the proposed action is likely to result in localized adverse effects to PBF 8 within the action area but will be insignificant at the larger scale of the South Fork Salmon River CHSU or Salmon River Basin CHU.

PBF 9. ***Sufficiently low levels of occurrence of nonnative predatory (e.g., lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g., brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.***

The only WCI that directly addresses this PBF is the *persistence and genetic integrity* indicator. This indicator addresses the likelihood of predation, hybridization, or displacement of bull trout by competitive species. The *physical barriers* indicator is likely to influence the distribution and presence of competitive species such as brook trout if barriers are removed and allow competitive nonnative species to access occupied bull trout habitat. The USFS (2024, Appendix C Table C-4) indicates that the proposed action will improve the *physical barriers i*ndicator by removing barriers to improve fish passage, which is likely to increase the risk of brook trout accessing bull trout habitat. However, (USFS 2024, p. Table 4.1-60) indicates that there are no nonnative predatory, interbreeding, or competing fish species present in the Stibnite project area. Furthermore, the proposed action will maintain the condition of *the persistence and genetic* integrity indicator through improved access to upstream habitat for migratory bull trout.

Brook trout are a threat to bull trout because of competition and hybridization (USFWS 2002, p. 21). Brook trout are not known to occur in or near the action area (USFS 2024, p. 450). Brook trout and brook trout-bull trout hybrids increase the risk of bull trout population decline in areas with low connectivity to other local populations. However, the proposed action will not increase brook trout populations or introduce new species of predators or competitors to bull trout populations. For these reasons, the proposed action will have discountable effects to PBF 9 in the Stibnite project area.

The Lemhi restoration project will not affect PBF 9 because it will not increase the ability of nonnative fish to access bull trout critical habitat.

5.3.1 Summary of Effects

The proposed action will adversely affect designated bull trout critical habitat in the action area through localized significant effects to PBFs 1 (springs, seeps, and groundwater sources), 2 (migration habitats), 3 (abundant food base), 4 (complex habitats), 5 (water temperatures), 6 (natural hydrograph), 7 (water temperature), and 8 (water quality). The proposed action will have insignificant effects on PBF 9 (non-native fish species). These effects to PBFs will occur due to project construction and exploration activities, including the Burntlog geophysical investigation activities; EFSFSR flow diversion into the tunnel/fishway; diversion of Meadow Creek and its tributaries around the TSF and TSF Buttress area into low flow pipes; dewatering the YPP lake; stream enhancements; construction of access roads, including the Burntlog Route; and construction of the transmission line.

The Service concludes that the proposed action is likely to result in localized adverse effects to PBFs 1-8 within the Stibnite project area (including short-term, long-term, and permanent effects), with EDFs and BMPs implemented to minimize effects. Moreover, these impacts to PBFs will be distributed throughout the 20- to over 40-year term of the action and not act in a way to synergistically affect critical habitat to the point of adverse modification. Effects to PBFs 1-8 will be insignificant at the larger scale of the South Fork Salmon River CHSU or Salmon River Basin CHU. Effects to PBF 9 are expected to be discountable within the Stibnite project area with no effect within large CHU or rangewide scales.

In the Lemhi restoration project area, restoration activities will adversely affect bull trout FMO critical habitat in the Lemhi River through significant effects to PBF 2 (migration habitats). The restoration will have insignificant or discountable effects to PBFs 1, 3, 4, 5, 7, and 8 and no effect to PBFs 6 and 9. Long-term effects to PBFs 1, 3, 4 , and 5 will be beneficial. Because adverse effects are localized within the restoration area, there will be no measurable effect to critical habitat in Lemhi River CHSU or Salmon River Basin CHU.

5.4 Cumulative Effects

The implementing regulations for section 7 define cumulative effects as " those effects of future State or private activities, not involving federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation." (50 CFR 402.02). Future Federal actions are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

On-going activities on 3,046 acres of private (16.1% of the action area) and state (3.2% of the action area) lands that may impact bull trout critical habitat include recreational activities (e.g., fishing), projects associated with timber sales, wildland fuels reduction, energy development (e.g., transmission lines, alternative energy), transportation route improvements and maintenance, mining, and other special uses (USFS 2024, p. 528).

Effects from these activities will occur during approximately the same time of year as the proposed action due to the area's limited access during winter. These activities may currently create disturbance or have incremental disturbance effects on bull trout critical habitat in the future. It is unlikely that critical habitat acres or function would be reduced by cumulative effects in the action area, as any such effects would be infrequent, occur at a small scale, and occur on a small percentage of bull trout critical habitat rangewide.

5.5 Conclusion

After reviewing the current status of bull trout critical habitat, the environmental baseline in the action area, effects of the proposed action, and cumulative effects, it is the Service's biological opinion that the proposed action is not likely to destroy or adversely modify designated critical habitat for bull trout. The Service's rationale for this conclusion is presented below.

Although the proposed action is anticipated to have long-term benefits to critical habitat through the removal of passage barriers and stream restoration actions, adverse effects to PBFs 1-8 are expected within the Stibnite project area and discountable effects are expected to PBF 9. The number of miles of critical habitat affected is very small compared to the amount available in the CHSU and CHU. Within the Stibnite project area, there are approximately 8.28 mi[2] of critical habitat in the EFSFSR from below Sugar Creek (at Pepper Creek) to its headwaters. There are approximately 7.5 mi of critical habitat in Sugar Creek and 5.28 mi (8.5 km; essentially all) critical habitat in Meadow Creek that will be lost due the construction of a gradient barrier at the TSF. The total number of miles of critical habitat that will be or will potentially be affected by

[2]Measured using StreamNet Mapper (arcgis.com) (accessed August 4, 2024)

the proposed action in the EFSFSR, Meadow Creek, and Sugar Creek is approximately 21.06 mi. This total amount of critical habitat represents 2.8% of the critical habitat in the CHSU (21.06 mi / 748.4 mi x 100 = 2.8%) and 0.46% of the critical habitat in the CHU (21.06 mi / 4,583.5 mi x 100 = 0.46%).

Although the Lemhi restoration project area is anticipated to have long-term post-construction benefits to critical habitat in the action area, the restoration will adversely affect bull trout critical habitat in 7,000 ft of FMO critical habitat in the Lemhi restoration project area through significant effects to PBF 2 (migration habitat) during construction. The restoration will have insignificant or discountable effects to PBFs 1, 3, 4, 5, 7, and 8 and no effect to PBFs 6 and 9. Long-term effects to PBFs 1, 3, 4 , and 5 will be beneficial.

Because adverse effects are localized to 7,000 ft of FMO critical habitat within the restoration reach, effects to 57.1 mi (301,488 ft) of designated FMO habitat in Lemhi River CHSU will be negligible, with only 2.3% of FMO habitat affected by the restoration (7,000 ft / 301,488 ft x 100 = 2.3%). There will be no measurable effect to critical habitat at the larger scale of the Salmon River Basin CHU (4,583.5 mi of critical habitat).

Because effects are localized and the percentage of critical habitat affected or potentially affected within the action area is negligible at the CHSU of CHU scales, there will be no measurable effect to critical habitat in the South Fork Salmon River CHSU or Salmon River Basin CHU. Critical habitat rangewide will remain functional to serve its intended recovery role without direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of bull trout.

6. WHITEBARK PINE

6.1 Status of Whitebark Pine

This section presents a summary of information about the regulatory, biological, and ecological status of whitebark pine at a rangewide scale that provides context for evaluating the significance of probable effects caused by the proposed action, for the full status of the species see Appendix C. Whitebark pine was listed as threatened under the Act on January 17, 2023 (87 FR 76882). No critical habitat has been designated for whitebark pine. The four primary threats identified in the listing and described in the Species Status Assessment (SSA) were altered fire regimes, white pine blister rust (a disease caused by an introduced fungus), mountain pine beetle, and climate change (USFWS 2021, pp. 34-63). The final rule for whitebark pine examined these threats and determined that white pine blister rust is the main driver of the species’ current and future condition (87 FR 76882).

Whitebark pine is a wide-ranging five-needle pine species found at cold and windy high elevations across western North America. The range of whitebark pine encompasses an estimated 80,596,935 acres in western North America, where roughly 70% of its range occurs in the United States, and the remaining 30% occurs in British Columbia and Alberta, Canada (USFWS 2021, p. 15). In the U.S., an estimated 74% of whitebark pine range occurs on United States Forest Service (USFS), 10% on National Park Service (NPS), 4% on Bureau of Land

Management (BLM) lands, and the remaining 12% occurs on non-Federal ownership lands (State, private, or Tribal lands; USFWS 2021, pp. 15-16). It is estimated that 29% of whitebark pine range in the U.S. is designated as wilderness under the Wilderness Act of 1964 (16 U.S.C. 1131 1136).

Whitebark pine is a long-lived conifer that may occur as a climax or codominant tree species in early to mid-successional seral stages. Although it occasionally exists in pure or nearly pure stands at high elevations, whitebark pine more typically occurs in stands of mixed species in a variety of forest community types. Whitebark pine has four life stages: seed, seedling (between 1-29 years of age and less than 4.5ft tall), sapling (between 29-40 years of age, non-reproductive, and greater than 4.5 ft tall), and mature tree (USFWS 2021, pp. 26-27, 90-91). Whitebark pine resource needs include: 1) seed dispersers (specifically Clark's nutcracker), 2) cold temperatures for seed stratification and at least two warm summers for germination, 3) moderate soil moisture for germination and growth, 4) well-drained soils with sufficient nitrogen and phosphorous for germination and growth, and 5) open canopies with limited shading for germination and growth. The whitebark pine SSA provides a full account of the life history, ecology, range, distribution, stressors, current condition, conservation needs, and projected future conditions for whitebark pine in the U.S. (USFWS 2021, entire), summarized in Appendix C.

The impacts of white pine blister rust combined with other stressors will reduce the ability of whitebark pine stands to regenerate following disturbances, such as wildfire and mountain pine beetle outbreaks. Dead whitebark pine trees now outnumber live trees and mortality has exceeded gross growth in all but the smallest size-classes (USFWS 2021, pp. 86-87) Current management efforts focus on propagating and planting whitebark pine with inherited (genetic) resistance to white pine blister rust, protecting high value trees from wildfire damage, and reducing the likelihood of mountain pine beetle infestation through pheromone application (USFWS 2021c, pp. 56, 125). Conservation measures for whitebark pine can generally be categorized as either protection (of existing healthy trees and stands) or restoration (of damaged, unhealthy, or extirpated trees and stands). Inventory, monitoring, and mapping of whitebark pine stands are critical for guiding conservation and restoration efforts (USFWS 2021c, p. 126).

6.2 Environmental Baseline of the Action Area

The term "environmental baseline" is defined in the regulations implementing the Act as "the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The impacts to listed species or designated critical habitat from Federal agency activities or existing Federal agency facilities that are not within the agency's discretion to modify are part of the environmental baseline" (50 CFR 402.02).

6.2.1 Status of Whitebark Pine in the Action Area

The action area intersects the Idaho Batholith Analysis Unit (AU), which contains approximately 11,420,917 acres (4,621,881 ha) of the range of whitebark pine, and it has the highest percentage of recently burned whitebark pine habitat of all AUs. Approximately 4,869,496 acres (1,970,615 ha) of whitebark pine habitat burned from 1984-2016, amounting 42.64% of the whitebark pine range within this AU (USFWS 2021c, p. 69). Additionally, 24% of these fires were classified as high severity (USFWS 2021c, p. 69). White pine blister rust is estimated to infect 2,568,122 acres (1,039,282 ha) or 22.49%of the range of whitebark pine within the Idaho Batholith AU. The most recent blister rust epidemic (2000-2016) was estimated to have impacted 2,402,749 acres (972,358 ha) or 21.04% of the range of whitebark pine within this AU (USFWS 2021c, pp. 78–81).

The U.S. Forest Service Forest Inventory and Analysis (FIA) data and estimates, while likely underrepresenting ridge and mountain top occurrences, give a view of whitebark pine occurrences and trends on national forests in Idaho. The FIA data from 2006–2015 were analyzed by Witt et al. (2018, p. 25), which showed the whitebark pine forest type covers approximately 242,558 acres, and forests with a whitebark pine component cover nearly 2.1 million acres in the state. Subalpine fir (*Abies lasiocarpa*), Douglas-fir (*Pseudotsuga menziesii*), lodgepole pine (*P. contorta* var. *latifolia),* and Engelmann spruce (*Picea engelmannii*) / subalpine fir forest types all had a greater area of whitebark pine occurrence than the whitebark pine forest type, though this area was comprised of smaller diameter classes of whitebark pine (Witt et al. 2018, pp. 24–26). Witt et al. (2018) estimated there are around 99 million live whitebark pines smaller than 5 inches in diameter at breast height (dbh) and more than 43 million live trees at least 5 inches dbh. Roughly 62 million standing dead whitebark pine of at least 5 inches dbh were also estimated (Witt et al. 2018, p. 27). Dead whitebark pine was found to outnumber live whitebark pine, except in the smallest diameter class (5-6.9 inches dbh; Witt et al. 2018, p. 27). This aligns with the prior FIA analysis, which found that 2- and 4-inch dbh whitebark pine make up approximately 70% of all live whitebark pine in Idaho (Witt et al. 2012, p. 44).

Trends described in the SSA for the Idaho Batholith AU likely apply broadly to the action area, though quantitative assessment is lacking. On the Forest, suitable whitebark pine habitat is known or predicted across more than 466,768 acres, or about 19% of the Forest. On the BNF, estimated suitable and modeled occupied habitat for whitebark pine is 95,283 acres. Whitebark pine occurs as a co-dominant and occasionally dominant tree species on exposed ridges and mountain tops. Whitebark pine is commonly co-dominant with subalpine fir and lodgepole pine and occasionally, depending on aspect and geographic location, is intermixed with Douglas fir (USFWS 2021c, pp. 83–84). Incidental whitebark pine occasionally occur at lower elevations (below 6,800 feet) in mixed conifer cover types due to caching by Clark's nutcrackers or dispersal by squirrels, black bears, and gophers (USFS 2023b, p. 16). Whitebark pine that occur in the lower elevations often only persist as an understory component and do not typically reach reproductive maturity due to competition (USFS 2023b, p. 16).

To capture all potential effects to whitebark pine, the action area includes a 300-foot buffer for analyses (Figure 19, Figure 20, Figure 21). The action area includes 17,397 total acres: 9,062 acres (52%) on the Boise National Forest, 4,942 acres (28%) on the Forest, 347 acres (2%) on the Salmon-Challis National Forest, and 3,046 acres (18%) on private and state lands. The Lemhi restoration project area is unlikely to have occurrences of whitebark pine due to not being located on high elevation, dry, and windy slopes or within vegetation communities commonly associated with this species (USFS 2024, p. 525).

Plant surveys were performed in 2012, 2013, and 2014 in portions of the action area, and whitebark pine was among the target species (HDR, Inc. 2017a, entire). These surveys documented approximately 164 acres of whitebark pine at the mine site; along Burntlog Road (FR 447), Horse Heaven Road (FR 416w), Meadow Creek Lookout Road (FR 51290), and the existing Old Thunder Mountain Road (FR 440); and within the transmission line corridor between Johnson Creek Road (CR 10-413) and the mine site (HDR, Inc. 2017a, entire).

The 2012, 2013, and 2014 whitebark pine surveys were not conducted throughout all suitable habitat within the action area, and data were not collected in a manner that is useful for a comprehensive and meaningful effects analysis for this species. Therefore, in 2019, known habitat parameters, existing vegetation (specifically lodgepole pine, burned sparse vegetation, burned herblands, burned forest shrublands, subalpine fir, whitebark pine mix, and Douglas-fir), lithogy (excluding “metamorphic rocks-undivided” and “alluvial, landslide, and glacial deposits”), and elevation (above 6,500 feet amsl) were used to model suitable habitat for whitebark pine in the action area (AECOM 2019, entire). Approximately 6,130 acres of suitable habitat for this species was modeled along Warm Lake Road (CR 10-579), Cabin Creek Road (FR 50467), the Burntlog Route, Meadow Creek Lookout Road (FR 51290), the transmission line right-of-way, and the mine site (AECOM 2019, entire). However, due to revisions in the action area between 2019 and 2023, approximately 4,259 acres of modeled suitable habitat currently occurs within the action area.

Surveys for whitebark pine were performed in all but 78 acres of suitable habitat in the action area in spring, summer, and fall of 2019 (Tetra Tech 2020, entire). The 78 acres of unsurveyed modeled suitable habitat, which are in and around the mine site, are assumed to be occupied by whitebark pine. Within the surveyed areas, approximately 2,069 acres of occupied whitebark pine habitat were identified during field surveys (i.e., Tetra Tech 2019 field survey data within a 300-foot buffer of the action area boundary). As part of the geophysical investigation for the Burntlog Route, surveys were conducted in 2021, and a total of 8 whitebark pine were documented in three locations (USFS 2021, p. 6). Based on the results of the species-specific surveys conducted in 2019, the proposed action will remove an estimated 1,278 individual whitebark pine trees (of all age classes), 27 of which were individuals observed with cones (USFS 2024, p. 519).

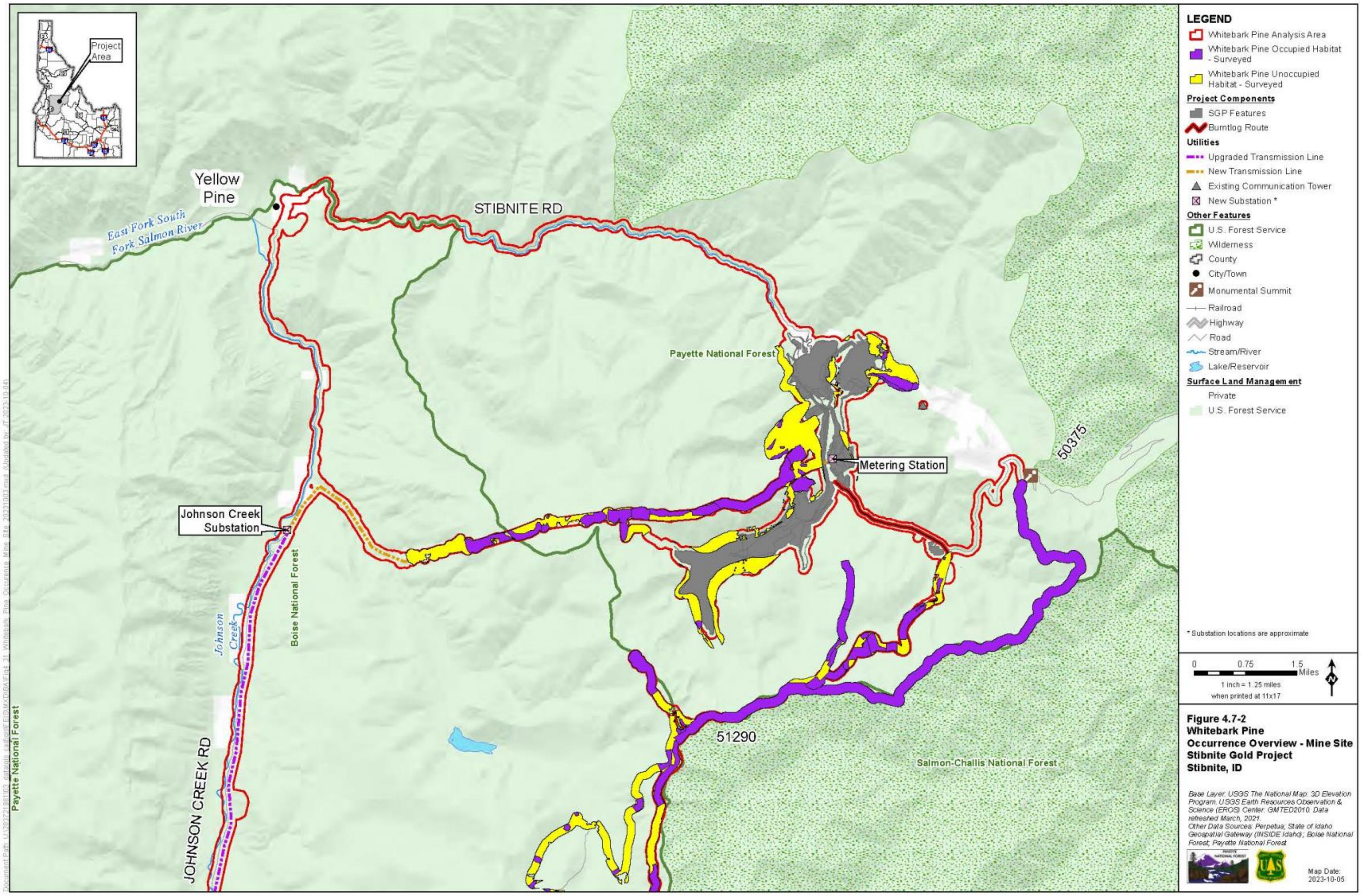

Figure 19. Whitebark pine surveys at the mine site. Purple is surveyed occupied habitat and yellow is surveyed unoccupied habitat (USFS 2024, Figure 4.7-2).

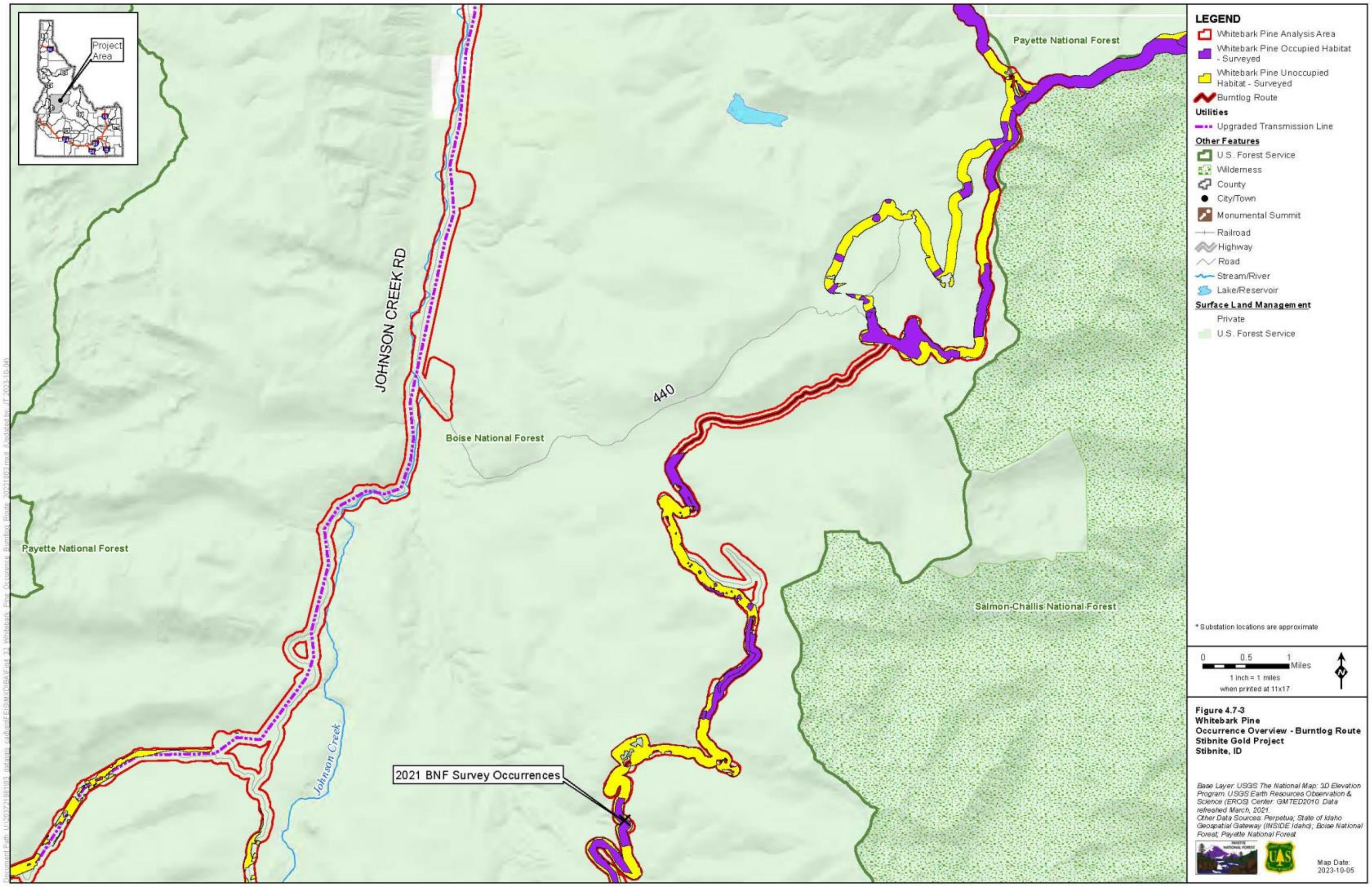

Figure 20. Whitebark pine surveys along northern Burntlog Route. Purple is surveyed occupied habitat and yellow is surveyed unoccupied habitat (USFS 2024, Figure 4.7-3).

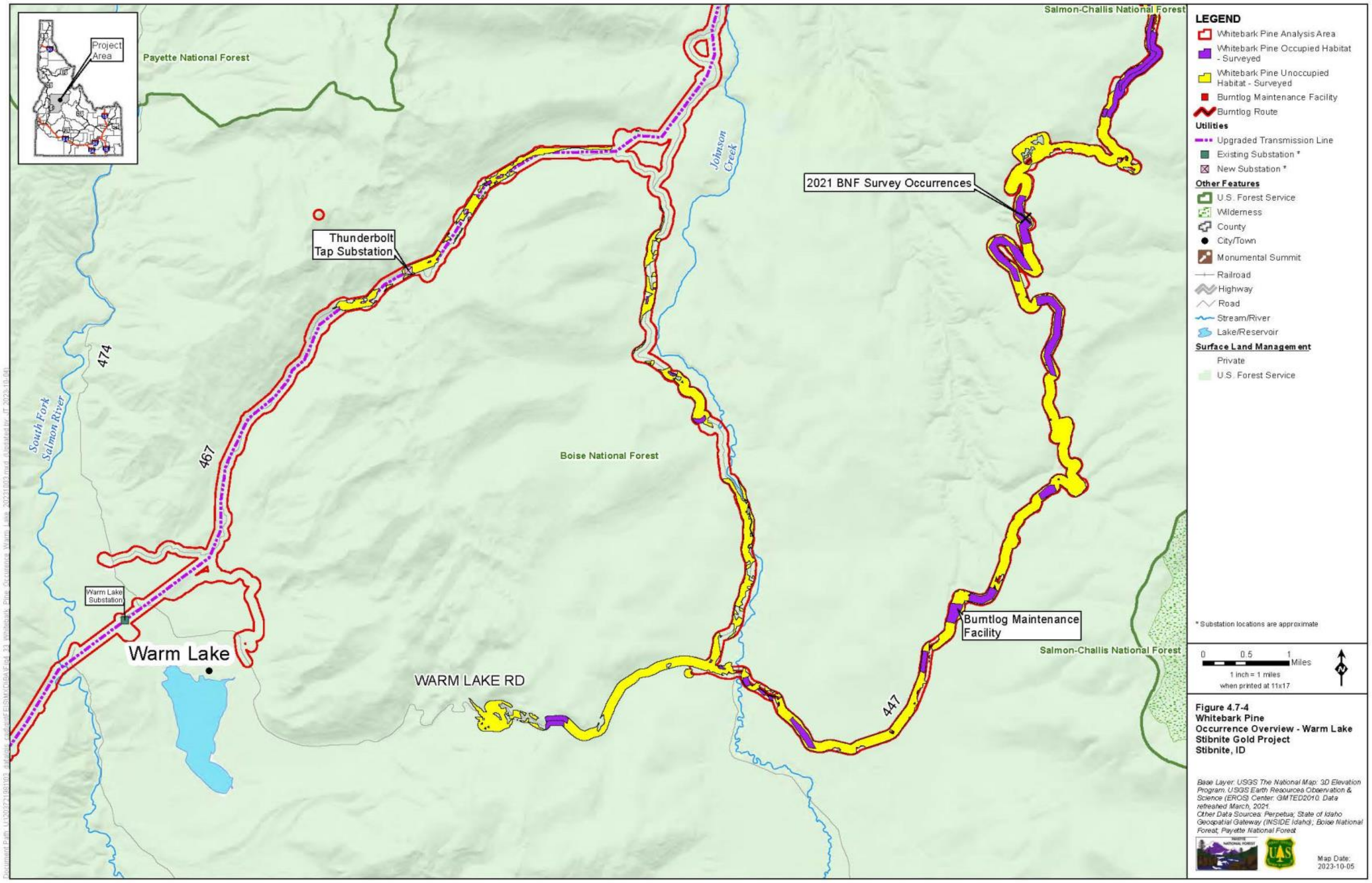

Figure 21. Whitebark pine surveys along southern Burntlog Route and Warm Lake road. Purple is surveyed occupied habitat and yellow is surveyed unoccupied habitat (USFS 2024, Figure 4.7-4).

6.2.2 Factors Affecting Whitebark Pine in the Action Area

Federal actions within the action area that influence the environmental baseline of whitebark pine include management of recreation sites such as campgrounds and trail networks; permitting and management of recreational activities such as hiking, biking, skiing, snowmobiling, and ATV/UTV usage; management of infrastructure such as roads and bridges; vegetation and wildlife surveying and management; invasive species management involving mechanical and chemical removal; wildland-urban interface projects; and fire suppression, among other activities. Impacts from recreation activities may affect less than 1% of whitebark pine wide range (USFWS 2021c, p. 152) and are not considered a major threat to the species. Habitat conditions influenced by past natural modifications include insect and disease and wildfire.

Approximately 1,902 acres of the 2,069 acres of surveyed occupied whitebark pine habitat in the action area have been affected by either wildfire (92%), mountain pine beetles (27%), or white pine blister rust (42%; (Tetra Tech 2020, entire). The 167 acres of occupied whitebark pine habitat that has not been affected by either wildfire, mountain pine beetles, or white pine blister rust consists mainly of younger trees without female cones, and these areas occur near the mine site (4.2 acres), along access roads (7.5 acres), and near utilities, primarily along the new transmission line (155.0 acres; USFS 2024, p. 512).

Whitebark pine is most common in remote, high elevation areas where federal actions do not often take place. The Final Biological and Conference Opinion on the Nationwide Aerial Application of Fire Retardant on National Forest System Land (USFWS 2023a, pp. 39–55) discusses effects to whitebark pine from aerial fire retardant applications, which may affect whitebark pine in the action area through stimulating growth of competing plant species or have effects on plant growth and health as a result of over-fertilization or toxicity. Actions covered under the Programmatic biological opinion and conference opinion for Fire Suppression Actions on the Boise National Forest (USFWS 2023c, pp. 87–93) such as fireline construction, water drafting, burnout and firing operations, mop-up, road reconstruction, and suppression repair activities may cause physical damage or death to whitebark pine individuals. None of these consulted upon actions are anticipated to result in the decline of whitebark pine populations.

6.3 Effects of the Proposed Action

Implementing regulations define “effects of the action” as “all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action but that are not part of the action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action” (50 CFR 402.02).

6.3.1 Site Preparation

Construction and Habitat Loss

The proposed action may impact an estimated 259.5 acres of occupied whitebark pine habitat, 78 acres of assumed occupied habitat (the acres of unsurveyed modeled suitable habitat, in and around the mine site, that are assumed to be occupied by whitebark pine), and an estimated 1,278 individual trees. Of the 1,278 individual trees that may be affected, 27 were individuals observed with cones during 2019 field surveys. There will also be effects to an estimated 287.4 acres of modeled suitable habitat, which may impact existing seedbanks. Approximately 4,259 acres of modeled suitable habitat and 2,147 acres of occupied whitebark pine habitat occur within the action area.

Mine Site

Construction at the mine site will result in removal of 5.7 acres of occupied whitebark pine habitat and 78 acres of assumed occupied habitat and the subsequent mortality of all whitebark pine individuals. Most of the construction affecting whitebark pine occurs in areas that have not been recently disturbed or heavily affected by previous mining. Construction and exploration drilling activities will also result in the removal of 71.5 acres of modeled suitable habitat and the potential disturbance of existing seedbanks.

Clearing of trees may require heavy machinery, which will cause intentional and accidental physical damage, soil disturbance, and soil compaction. Individual whitebark pine trees may be harmed if they come into contact with vehicles, tools, or heavy machinery, which may damage boles or branches. It is possible that roots, shoots, and meristematic tissues of seedlings, saplings, and trees may also be mechanically damaged from such contact. Tree clearing could also crush nearby whitebark pine seedlings, saplings, or seedbanks, or cause injury when these cleared trees are dragged to areas for lop and scatter or piling and burning. This may result in root exposure, reduced germination rates, or physical damage to undetected seeds, seedlings, saplings, and trees. Surveys did not assess the suitability of investigation sites as seed caching habitat for whitebark pine dispersers such as Clark’s nutcracker. The exact distribution and abundance of seeds in the area at investigation sites that are susceptible to ground disturbance is not known. However, the presence of reproductive individuals within caching distance of such sites suggests that effects to cached seeds may occur via ground disturbance in occupied and modeled suitable habitat.

The majority of habitat loss and tree mortality will occur from construction of the West End pit that intersects the north-facing ridges above West End Creek where a large concentration of mature trees occurs along the ridgetop to the east of the pit (USFS 2024, p. 523). Construction of other facilities at the mine site such as the YPP, the Blowout Creek Access Road, the Plant Site stockpile, and diversion will also result in the removal of occupied whitebark pine habitat.

The proposed action’s EDFs will minimize some effects to whitebark pine individuals. In particular, ground disturbance from heavy equipment will be adjusted within whitebark pine stands and avoided within 10 m (33 ft) of known whitebark pine trees, removal or damage of whitebark pine trees will be avoided, and project personnel will be trained to identify whitebark pine (USFS 2024, pp. 525–528). However, effects to undetected individuals, such as physical damage and soil compaction, may still occur despite the implementation of these design features.

Roads

Ground disturbing activities associated with geophysical investigation along the proposed Burntlog route, including pit excavation and auger/core drilling, may adversely affect whitebark pine. Whitebark pine individuals have been documented within 25-foot disturbance areas for three investigation sites, with the closest individual located approximately 10 feet from the proposed drill point. These individuals may be affected during construction of platforms for drilling equipment, excavation of boreholes, and excavation of test pits. Soil removal, piling, and ground leveling activities may increase erosion, exposure, or burial of individuals. This may result in root exposure, reduced germination rates, or physical damage to undetected seeds, seedlings, saplings, and trees. New ground disturbance is estimated to impact 0.6 acres from all geophysical investigation activities (USFS 2024, p. 185). Brush clearing and minimal tree cutting will be required to clear areas for the drill platforms and to provide a safety zone around the drill rig and ancillary equipment, potentially harming undetected individuals. Likewise, vehicle travel in whitebark pine habitat to and from off-road investigation sites may result in crushing and potential mortality of individuals. The following EDFs will minimize effects to whitebark pine individuals: borehole and test pit locations and access will be adjusted as needed, ground disturbance from heavy equipment within whitebark pine stands and within 10 m (33 ft) of known whitebark pine trees will be avoided, removal or damage of whitebark pine trees will be avoided, and project personnel will be trained to identify whitebark pine to further avoid impacts (USFS 2024, pp. 525–528). Effects to undetected individuals may still occur despite the implementation of these design features.

Water and drilling fluids have the potential to migrate from drill pads, which may result in erosion and exposure of roots or other physical damage to undetected seeds, seedlings, saplings, and trees. Drilling will use a closed system that recirculates fluids in addition to sediment and water management control procedures, such as silt fences and weed-free and plastic-free waddles, to reduce the risk of effects to whitebark pine individuals. Whitebark pine individuals may also be affected by petroleum products if they are unintentionally spilled in whitebark pine habitat. Exposure to spillage of petroleum products may result in damage to plant tissues, root death, alteration of obligate micro-organisms, soil contamination, habitat degradation, loss of individuals, and destruction of seeds. The extent of damage to individuals from spillage would depend on variables such as quantity of petroleum product spilled; properties of the chemical; and the physical, chemical, and biological composition of the soil. All geophysical investigation will be conducted under standard operating procedures (USFS 2024, pp. 187–190) and follow the spill prevention, control, and countermeasure plan (SPCC), which will control runoff, erosion, sedimentation, and potential discharges (USFS 2024, p. 125). Implementing standard operating procedures including (1) having silt fences, straw wattles, portable sumps, pumps, and hoses pre-staged for emergency use; (2) materials and tools will be used to quickly construct temporary sumps to capture drilling fluid and return it to the drill rig; and (3) fuel will be stored in sealed 55-gallon steel drums, approved double-walled fuel tanks, or in approved single-walled tanks within secondary containment will make a fuel spill unlikely and reduce potential spillage effects to whitebark pine to a discountable level.

Construction of access roads will result in the removal of 167.6 acres of occupied habitat. Most of the surveyed trees along access roads were in the seedling and sapling stage during the 2019 field surveys, and no female cones were observed. Construction will also result in the removal of 150 acres of modeled suitable habitat and the potential disturbance of existing seedbanks.

The majority of occupied whitebark pine habitat and individual tree removal will occur at three of the six Burntlog route borrow sources and along the Burntlog route itself (USFS 2024, p. 523). A small amount of whitebark pine occupied habitat and individual trees will be removed along Johnson Creek Road and the public OSV route. Removal of occupied whitebark pine habitat and individual trees will occur as heavy equipment and machinery excavate pits at the borrow sources and cut new roadways along the Burntlog route.

Heavy equipment used during road construction and temporary road use may compact soil near seeds, seedlings, and saplings(Adams and Froehlich 1981, p. 1) . Soil compaction will reduce root penetration and growth, decrease germination, affect water uptake and infiltration, affect nutrient availability, reduce available oxygen, and reduce growth, affecting successful germination and survival of all whitebark pine life stages(Adams and Froehlich 1981, p. 5; Quesnel and Curran 2000, p. 92)). The adverse effects of compaction can last for years or even decades depending on soil type, amount of machine activity (Han et al. 2009, p. 986), and soil moisture at the time of harvest(Quesnel and Curran 2000, p. 91). Road construction will use existing landings and skid trails and locate temporary roads over existing road templates, wherever possible, and restrict heavy equipment to existing trails to minimize impacts from soil compaction.

Environmental design features will be implemented to minimize effects to whitebark pine (USFS 2024, pp. 525–528). Such features include conducting pre-construction surveys within whitebark pine modeled suitable habitat that overlaps proposed action components and along the entirety of the Burntlog route. Surveys will also be conducted in unsurveyed areas (e.g., not included in Tetra Tech's 2019 survey effort) and in occupied habitat to identify whitebark pine individuals within the disturbance footprint and estimate the number of individuals within 300 feet of the planned proposed action disturbance footprint. To protect from accidental removal or damage, all identifiable whitebark pine trees, particularly mature, healthy trees in a disturbance area will be marked either individually or collectively by stand perimeter marking and buffered by 33 feet, in a manner that does not cause damage to the tree or introduce disease, regardless of their age class (seedling, sapling, and mature trees). In addition, in areas infested with white pine blister rust or mountain pine beetle, vegetation will not be moved off site, thereby avoiding potential spread to healthy trees.

Utilities and Facilities

Construction of utilities, facilities, and associated tree clearing along transmission lines will result in the removal of 86.2 acres of occupied habitat that was confirmed by surveys performed by Tetra Tech in 2020. A small proportion of the estimated trees removed (5 acres out of 63 [8%]) were individuals observed with cones during the 2019 field surveys. Construction will also result in the removal of 65.9 acres of modeled suitable habitat and the potential disturbance of existing seedbanks.

Disturbance to occupied whitebark pine habitat will occur during construction of the new 9.1-mile transmission line located along the ridge above Meadow Creek. Mature trees are common at this location. Removal of occupied whitebark pine habitat in this area will include the use of heavy machinery to install the transmission line poles and hang the conductors. Disturbance to occupied whitebark pine habitat will also occur when upgrading the 63.7 miles of existing transmission line (e.g., expanding substations, installing new, larger poles, and stringing wire) that is currently located along Trout Creek. However, the majority of whitebark pine trees in this area are not able to reach maturity due to ongoing tall tree clearing to safely maintain the current transmission line ROW (USFS 2024, p. 524). Therefore, predominantly immature trees will be affected by upgrading the transmission line along Trout Creek. These activities will also affect adjacent occupied and suitable whitebark pine habitat, as disturbance may reduce the overall health and rejuvenation or colonization potential of nearby areas.

Construction of the off-site facilities and VHF tower will result in the removal of seedlings and saplings, with no mature trees with female cones observed. The Burntlog maintenance facility is the only support facility where construction will result in the direct mortality of whitebark pine trees through occupied habitat removal (USFS 2024, p. 525). At this location, primary disturbance will occur through the utilization of heavy machinery and hand tools including razing and grading the land surface.

If damage or removal of any live whitebark pine trees cannot be avoided, every reasonable effort will be made to collect the cones, scion, pollen, or other genetic material from live mature trees (particularly "plus" trees) within the same seed zone for future restoration efforts before the live whitebark pine is damaged or killed (USFS 2024, p. 528).

6.3.2 Mining Operations

Construction and Habitat Loss

<u>Mine Site</u>

During the life of the mine, approximately 20 years, mining operations in previously occupied whitebark pine habitat will prevent the establishment of whitebark pine. Most effects from removal and ground disturbance will have occurred during the construction phase. Temporary surface disturbance from surface and underground exploration will occur during the operations phase. Approximately 65 acres of modeled suitable habitat are identified within the mine site boundary for exploration. There are 25 acres identified for placement of temporary roads, but only 5 acres will actually be disturbed by creating temporary roads. An additional 40 acres are identified for potential placement of drill pads, but only 8 acres (140 pads) will be disturbed from actual active drill pad placement. These acres of disturbance are included in the total acres analyzed for the mine site during the construction phase in section 6.3.1. All geophysical investigation will be conducted under standard operating procedures (USFS 2024, pp. 187-190) and follow the spill prevention, control, and countermeasure plan (SPCC), which will control runoff, erosion, sedimentation, and potential discharges (USFS 2024, p. 125).

Disturbance from noise as a result of machinery use and increased human presence in the action area is not anticipated to effect whitebark pine individuals directly. However, noise from machinery use and increased human presence may indirectly impact seed dispersal through creating disturbance to other species such as Clark's nutcracker and pine squirrels. Noise disturbance may cause said species to avoid locations in the action area while proposed action activities are taking place. Clark's nutcrackers disperse whitebark pine seeds and may cache seeds many miles from a cone bearing tree (Lorenz et al. 2011, p. 242). Disturbance of Clark's nutcrackers may therefore reduce or prevent the caching or harvesting of seeds in the action area by seed dispersers. However, Clark's nutcrackers are remarkably tolerant of human disturbance, frequenting recreation sites in national parks for food handouts and remaining in nests when humans are nearby (Tomback et al. 2020, accessed July 3, 2023, website, accessed 3 July 2023). More research is needed to fully understand effects of human disturbance on Clark's nutcrackers' caching, harvesting, and nesting behaviors (Tomback et al. 2020, accessed July 3, 2023).

Roads

Removal of whitebark pine during the construction phase and from building temporary roads for exploration is discussed in section 6.3.1. Whitebark pine will be prevented from establishing while operations occur and as long as temporary roadways remain operational during the approximately 20 years of construction and operations. Seeds and seedlings may be crushed or destroyed through maintenance on existing roadways from improvements or blading.

Airborne dust may be generated from vehicle travel on roads and trails during mining operations. Once airborne, this dust may settle on whitebark pine individuals. When dust settles on the leaf surface, plants can experience stress through reduction in critical metabolic processes, including photosynthesis, respiration, and transpiration (Farmer 1993, pp. 64–69; Padgett et al. 2007, pp. 281–284). Additionally, dust on conifers may result in reduced terminal bud growth and chlorosis of second-year needles (Manning 1971, pp. 72–75). In areas known to be occupied by whitebark pine, dust management strategies will avoid the use of dust suppressants known to have negative effects on conifers (USFS 2024, p. 520). Water or conifer-safe dust suppression chemicals will be used to control dust (if necessary) in these areas, and effects from dust are anticipated to be insignificant.

Whitebark pine individuals may also be affected by petroleum products or chemicals if they are unintentionally spilled in whitebark pine habitat. Such spillage may result in damage to plant tissues, root death, alteration of obligate micro-organisms, soil contamination, habitat degradation, loss of individuals, and destruction of seeds. The extent of damage to individuals from spillage would depend on variables such as quantity of product spilled; properties of the chemical; and the physical, chemical, and biological composition of the soil. The EDF that restricts use of chemicals or hazardous substances within 100 feet of whitebark pine trees will make a fuel spill unlikely and is expected to reduce potential spill effects to whitebark pine to discountable levels (USFS 2024, p. 520).

Utilities and Facilities

Operations at the transmission lines, towers, and utility facilities will actively prevent the establishment of mature whitebark pine trees. Underneath the transmission lines, immature trees may be allowed to grow, but active tall tree clearing will likely prevent their ability to reach maturity and reproductive status as long as the facilities are in place throughout the approximately 15 years of mining operations.

Operations at support facilities may cause additional injury or mortality within modeled suitable habitat, but there will be no additional occupied habitat removal during the operations and maintenance phase. During the operations of the Burntlog Maintenance Facility, expected to occur throughout the life of the proposed action, whitebark pine will not be able to establish in the majority of the facility footprint, including that of the maintenance building, aggregate storage building, equipment shelter, and sleeping quarters.

6.3.3 Closure and Reclamation

Mine Site

Reclamation and closure at the mine site will not involve active restoration of any whitebark pine populations. After mine activities are complete, it is possible that whitebark pine may recolonize portions of the mine site not underlain by a geosynthetic or low-permeability polyethylene liner, including the West End pit and Hangar Flats area. Areas of the mine site underlain by a liner, including the TSF and pit backfill areas, will be actively targeted for woody and deeply rooted plant growth (including whitebark pine) removal and, therefore, will not support possible recolonization or restoration of whitebark pine (USFS 2024, p. 523).

Roads

Reclamation and closure of the access roads and associated work areas and borrow sources will include decommissioning newly constructed sections of the Burntlog route and returning the widened/upgraded roadways to their original conditions. Where feasible, whitebark pine stands will be restored using planting guidelines described in Perkins et al. (Perkins et al. 2016, p. 36) and as outlined in a revegetation plan. These techniques include, but are not limited to, using seedlings resistant to white pine blister rust, properly preparing the site for restoration, and following the most-up-to-date seed transfer zone guidelines. Potential restoration areas include the borrow sources along the Burntlog route, and portions of the transmission line route from Johnson Creek substation to the mine site along the ridge above Meadow Creek. Furthermore, natural recolonization of whitebark pine will likely occur along decommissioned roads and areas where the roads have returned to their original width if a source stand is nearby (USFS 2024, p. 524).

Utilities and Facilities

Reclamation within temporary disturbance areas will occur along the 9.1-mile newly constructed transmission line from the Johnson Creek substation to the mine site after the line is decommissioned and all structures removed. In areas previously occupied by whitebark pine along this transmission line, natural recolonization will likely occur from adjacent source populations that were undisturbed during the construction and operations components of the proposed action. The 63.7 miles of upgraded transmission line segments from the Johnson Creek substation to the Lake Fork substation will be left intact, and tall tree clearing as part of maintaining the ROW will prevent whitebark pine trees from reaching maturity during the approximately 20-year life of the mine (USFS 2024, p. 524).

Reclamation and closure of support facilities will include grading, addition of growth media, and reseeding. Restoration of whitebark pine could occur at the Burntlog Maintenance Facility through inclusion of whitebark pine outplants in the final revegetation plan. Specific planting strategies, a monitoring plan, and appropriate success criteria to ensure the success of the restoration efforts will be developed in conjunction with the Forest.

6.3.4 Summary of Effects

Individual whitebark pine of all age classes are expected to be injured or killed during ground disturbing activities associated with construction, exploration, operation, and restoration of the proposed mine site, roads, and facilities and utilities. Reduction in numbers and reproduction of whitebark pine from direct ground disturbance to whitebark pine habitat is expected on a localized scale. Even though some effects will be minimized by EDFs, such as avoiding damage or removal of whitebark pine when possible, effects from vehicle use, access, dust, and loss of seed dispersal may extend over 624.9 areas of occupied and suitable whitebark pine habitat within the action area. The removal of reproductively mature individuals impacts local reproduction over an extended period as the generation time of mature whitebark pine is approximately 40 to 60 years (USFWS 2021c, p. 27).

The proposed action will adversely affect whitebark pine individuals of all age classes and their habitat (259.5 acres of occupied habitat, 78 acres of assumed occupied habitat, and 287.4 acres of modeled suitable habitat). Components of the proposed action will remove whitebark pine individuals and habitat as follows:

- Mine site: 5.7 acres of occupied habitat, 78 acres of assumed occupied habitat, and 71.5 acres of modeled suitable habitat,
- Utilities and facilities: 86.2 acres of occupied habitat and 65.9 acres of modeled suitable habitat, and
- Access roads: 67.6 acres of occupied habitat and 150 acres of modeled suitable habitat

Of the 17,397 acres of whitebark pine in the action area, 2,147 acres are occupied and 4,259 acres are modeled suitable habitat. The 337.5 acres of occupied habitat that will be adversely affected represent <1.9% of occupied habitat in the action area (337.5 acres / 17,397 acres), <0.003% of habitat in the Idaho Batholith AU (337.5 acres / 11,420,917), and <0.0006% of habitat in the Unites States (337.5 acres / 56,417,855 acres). Given these small percentages, effects of the proposed action to whitebark pine will be insignificant across the species' entire range. An additional 287.4 acres of modeled suitable habitat are also likely to be adversely affected through removal of habitat or effects to the seedbank. The 624.9 acres of occupied and suitable habitat combined that will be affected represent <3.6% of habitat in the action area (624.9 acres / 17,397 acres), <0.005% of habitat in the Idaho Batholith AU (624.9 acres / 11,420,917), and <0.001% of habitat in the Unites States (624.9 acres / 56,417,855 acres).

Adverse effects are expected for approximately 1,278 individual trees, 27 of which are adults observed with cones (Tetra Tech 2020, entire). Most impacts will occur to saplings, which typically have a low potential to reach reproductive maturity. In addition, the Forest has proposed EDFs to reduce impacts to whitebark pine, including maintaining a 10-meter avoidance buffer from all whitebark pine when possible, conducting pre-construction surveys within whitebark pine modeled suitable habitat that overlaps proposed action components and along the entirety of the Burntlog route, surveys in unsurveyed areas and in occupied habitat to identify whitebark pine individuals within the disturbance footprint, and all identifiable whitebark pine trees, particularly mature, healthy trees in a disturbance area will be marked either individually or collectively by stand perimeter marking and buffered by 33 feet, in a manner that does not cause damage to the tree or introduce disease, regardless of their age class (seedling, sapling, and mature trees).

The proposed action will affect all life stages of whitebark pine resulting in localized reduction of numbers (<3.6% of all habitat in the action area), but not all habitat affected will be lost permanently, as temporary disturbance areas will either be restored through planting or allowed to regenerate naturally from surrounding mature whitebark pine trees in the action area. This localized reduction will not significantly influence population trends, distribution, or recovery in the action area, State of Idaho, or rangewide.

Whitebark pine was recently listed as a threatened species under the Act (87 FR 76882). A recovery plan has not been developed for whitebark pine. Recovery of a species involves the minimization of threats to the point where protection under the ESA is no longer warranted. The primary stressors to whitebark pine rangewide are the high incidence of white pine blister rust, altered fire regimes, mountain pine beetle, and the impacts of climate change (USFWS 2021c, entire). These primary stressors also act on whitebark pine in the Idaho Batholith Analysis Unit and within the action area and lead to reduced regeneration following disturbances. The proposed action is not anticipated to produce measurable effects on current blister rust infections or mountain pine beetle activity in the action area, and the effects of the proposed action are not considered among the primary stressors to whitebark pine and are not expected to exacerbate the species' primary stressors at the population level.

6.4 Cumulative Effects

The implementing regulations for section 7 define cumulative effects as " those effects of future State or private activities, not involving federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation." (50 CFR 402.02). Future Federal actions are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

On-going activities on 3,046 of private (16.1% of the action area) and state lands (3.2% of the action area) that may impact whitebark pine include recreational activities (e.g., snowmobiling, cross-country skiing), projects associated with timber sales, wildland fuels reduction, energy development (e.g., transmission lines, alternative energy), transportation route improvements and maintenance, mining, and other special uses (USFS 2024, p. 528).

Effects from these activities will occur during approximately the same time of year as the proposed action due to the area's limited access. These activities may currently create disturbance or have incremental disturbance effects on whitebark pine in the future. It is unlikely that whitebark pine numbers and distribution would be reduced by cumulative effects in the action area, as any such effects would be infrequent, occur at a small scale, and occur on a small percentage of whitebark pine habitat rangewide.

6.5 Conclusion

After reviewing the current status of whitebark pine, the environmental baseline in the action area, effects of the proposed action, and cumulative effects, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of whitebark pine. The Service's rationale for this conclusion is presented below.

The Service expects impacts will occur at the individual and localized scale and will not rise to a level that would impact the entire action area, Forest, AU, or rangewide population numbers, reproduction, or distribution. Many trees will remain on the landscape, including mature, cone bearing trees and trees that are resistant to white pine blister rust, the primary threat to whitebark pine. Most impacts will occur to saplings, which typically have a low potential to reach reproductive maturity. In addition, the Forest has proposed EDFs to reduce impacts to whitebark pine, including maintaining a 10-meter avoidance buffer from all whitebark pine when possible, conducting pre-construction surveys within whitebark pine modeled suitable habitat that overlaps proposed action components and along the entirety of the Burntlog route, surveys in unsurveyed areas and in occupied habitat to identify whitebark pine individuals within the disturbance footprint, and all identifiable whitebark pine trees, particularly mature, healthy trees in a disturbance area will be marked either individually or collectively by stand perimeter marking and buffered by 33 feet, in a manner that does not cause damage to the tree or introduce disease, regardless of their age class (seedling, sapling, and mature trees).

The proposed action will result in adverse effects, such as damage or death, to individual whitebark pine trees, seeds, seedlings, and saplings during ground disturbing activities associated with construction, operation, exploration, and reclamation of the mine site, roads, and utilities and facilities. The range of whitebark pine encompasses an estimated 80,596,935 acres, roughly 70% of which occurs in the United States. The action area contains approximately 2,147 acres of whitebark pine occupied habitat and 4,259 acres of modeled suitable habitat. The 624.9 acres of occupied and suitable habitat combined that may be adversely affected represent <0.005% of habitat in the Idaho Batholith AU (624.9 acres / 11,420,917) and <0.001% of habitat in the Unites States (624.9 acres / 56,417,855 acres). The anticipated level of whitebark pine affected by the proposed action will not appreciably reduce the overall population, reproduction, and distribution (or overall survival) of whitebark pine throughout its range due to the small percentage of ground disturbance versus the overall habitat rangewide and the limited effects from vehicle use, access, dust, and loss of seed dispersal. In addition, not all affected acres will be permanently lost, as blister rust resistant seedlings will be planted during reclamation at the borrow sources along the Burntlog Route and portions of the transmission line route from Johnson Creek substation to the mine site. The adverse effects caused by the proposed action are not among the primary stressors acting upon the species. Further, the effects of the proposed action will not exacerbate these stressors at the population level. It is the Service's biological opinion that the proposed action will not jeopardize the whitebark pine's recovery or continued existence.

6.6 Incidental Take Statement

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened fish and wildlife species, respectively, without specific exemption. Take is defined as “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct.” Harm is defined by the Service as an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined as “an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering" (50 CFR 17.3).

Incidental take is defined as take "that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant" (50 CFR 402.02). Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of an Incidental Take Statement.

Because the "take" prohibitions detailed under section 9(a)(1) of the Act do not apply to listed plants, those sections of the Act dealing with incidental "take," sections 7(b)(4) and 7(o)(2), generally do not apply to listed plants either. Therefore, we are not including an Incidental Take Statement for [Species] in this Opinion.

However, section 9(a)(2) of the Act prohibits, among other actions, the removal and reduction to possession of plants listed as endangered or threatened from areas under Federal jurisdiction. The Act prohibits the malicious damage of federally listed endangered plants on areas under Federal jurisdiction, or the destruction of endangered plants on non-Federal areas in violation of State law or regulations or in the course of any violation of a State criminal trespass law. These protections may apply to [Species] as well if State regulations are promulgated.

7. North American Wolverine

7.1 Status of the North American Wolverine

This section presents information about the regulatory, biological, and ecological status of the North American wolverine at a rangewide scale that provides context for evaluating the significance of probable effects caused by the proposed action. A species status assessment (SSA) was completed for the North American wolverine in March, 2018 (USFWS 2018b, entire) and an addendum was published in August, 2023 (USFWS 2023d, entire). The SSA is an in-depth review of the species' biology and threats, an evaluation of its biological status, and an assessment of the resources and conditions needed to maintain populations over time (i.e., viability). Much of the information presented in this section is derived from the SSA.

In November 2023, the Service determined that the distinct population segment (DPS) of the North American wolverine occurring in the contiguous United States met the Act's definition of a threatened species due primarily to the ongoing and increasing impacts of climate change and associated habitat degradation and fragmentation (88 FR 83726). The listing decision went into effect on January 2, 2024. Climate change has the potential to exacerbate effects from other stressors such as multi-lane roads, backcountry winter recreation, and human development, all of which could then impact genetic diversity and small population dynamics for the DPS.

In North America, wolverines were historically distributed in much of the northern portion of the continent, extending southward as far as California and Colorado, though their current range is centered in Washington, Idaho, Montana, and Wyoming (Hash 1987, p. 576; Banci 1994, p. 102; USFWS 2023d, p. 7). Wolverines occupy a variety of habitats within North America, including arctic tundra, subarctic-alpine tundra, boreal forest, mixed forest, redwood forest, and coniferous forest (Banci 1994, p. 114). In general, wolverines use areas at high elevations, with steeper terrain, more snow, fewer roads, and reduced human activity (Inman et al. 2013, pp. 280–281). Female wolverines often give birth in dens where snow cover persists at least until April, and they can den under snow-covered rocks, logs, or within snow tunnels (Committee on the Status of Endangered Wildlife in Canada 2014, p. v).

For a detailed account of North American wolverine biology, life history, threats, demography, and conservation needs, refer to Appendix D: Status of the North American Wolverine.

7.2 Environmental Baseline of the Action Area

The term "environmental baseline" is defined in the regulations implementing the Act as "the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The impacts to listed species or designated critical habitat from Federal agency activities or existing Federal agency facilities that are not within the agency's discretion to modify are part of the environmental baseline" (50 CFR 402.02).

7.2.1 Status of Wolverine in the Action Area

Wolverine habitat in the action area is based on habitat modeled using persistent spring snow cover (Copeland et al. 2010, entire) that was updated to include more recent snow cover using satellite imagery from 2009-2015 (Heinemeyer et al. 2017, pp. 53-55). The model depicts the number of years, out of seven total (2009-2015), in which snow cover was present in the spring (April 24 to May 15) in selected pixels using snow data from satellite imagery. This time frame of April 24 to May 15 generally corresponds to the period of wolverine den abandonment. Most dens were in areas that were snow covered for 5-7 years out of the total seven years studied, indicating selection for den sites in areas with the highest consistent snow coverage. Persistent spring snow cover modeling largely represents female breeding habitat, which includes all dens (years 3-7), and may not account for movements of wolverine at different times of the year within the action area or their use of varying habitat types. To capture all potential effects to wolverines, the action area includes a 5-mile buffer for analyses (Figure 22). The Lemhi restoration project area is within the known range of the wolverine in Idaho, but due to the proximity to State Highway 28 (Clevenger 2019, p. 52 wolverine occupancy is negatively related to road density and human infrastructure; see ; Mowat et al. 2020, p. 220; USFWS 2023d, p. 35) and lack of primary and denning habitat, the likelihood of occurrence for this species, particularly breeding individuals, is rare.

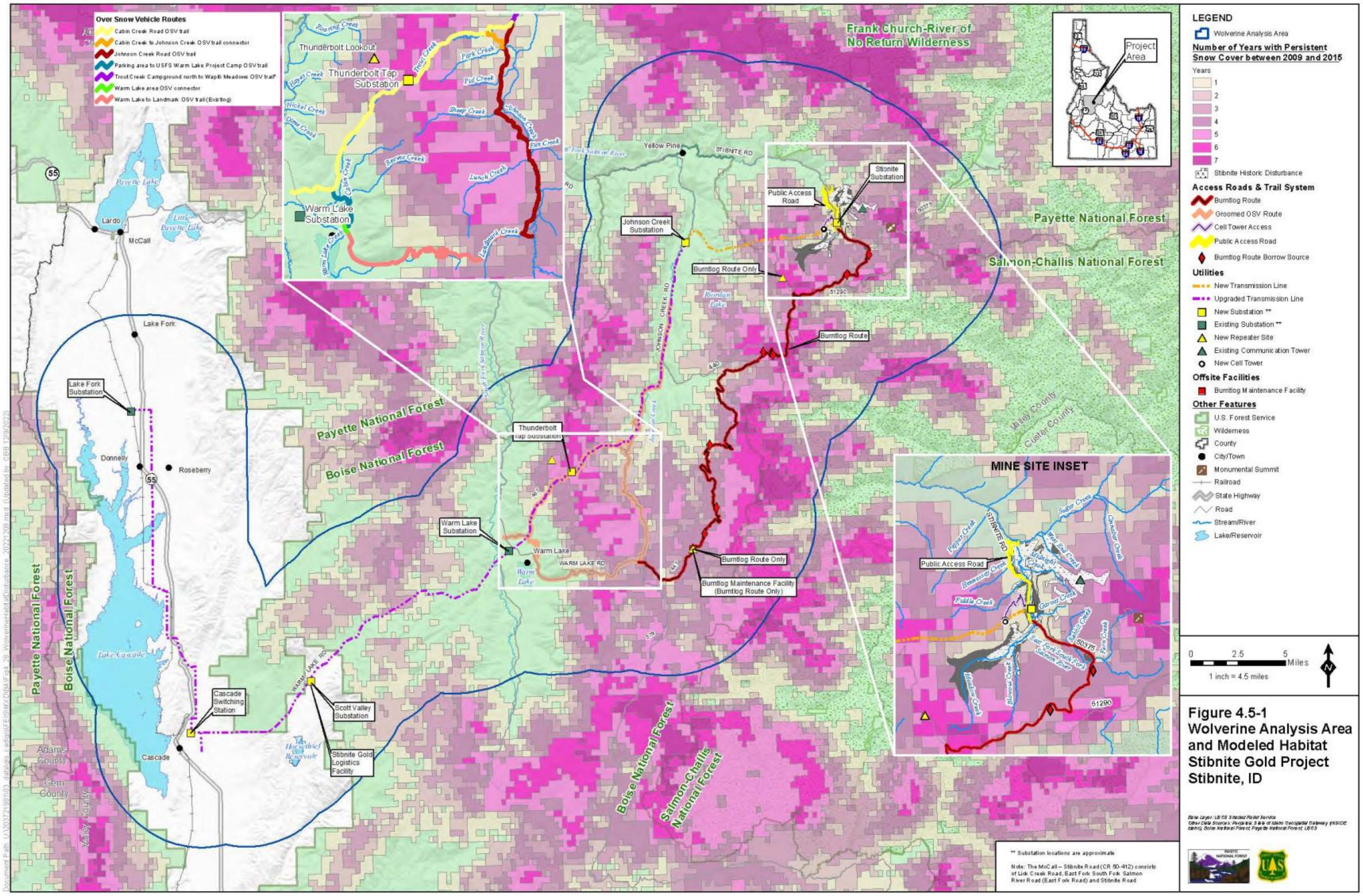

Figure 22. Modeled wolverine habitat in the action area based on number of years with persistent snow cover.

The action area includes a variety of habitats, including large areas that will typically not have persistent spring snow cover (i.e., Cascade Lake and Warm Lake Road). These are areas where wolverines are expected to travel through at different times of the year. Most dens in the contiguous United States have been in areas that were snow covered for 6 to 7 years, but denning habitat includes all areas that are snow covered for 3 to 7 years. Hence, higher elevations on the eastern side of the action area are more likely to have persistent snow, and therefore higher quality habitat, in more years, compared to western portions of the action area. This has been confirmed by regular documentation of individuals using the area and predicted winter ranges based on locations of collared animals. According to the Copeland model, there are 340,606.7 acres of modeled suitable habitat and denning habitat, with 231,053.9 of those acres being denning habitat within the action area.

Survey data indicate that suitable habitat is available in the action area, and wolverines have been both historically and recently observed and recorded. In 2010, the Forest, BNF, and Sawtooth National Forest collaborated with the Rocky Mountain Research Station, Round River Conservation Studies, IDFG, and other governmental and non-governmental organizations to assess wolverine populations and evaluate potential impacts to the species from winter recreation (Heinemeyer et al. 2017, entire) with the study results updated in 2019 (Heinemeyer et al. 2019a, entire). Six years of trapping efforts (2010-2015) in the northern Boise, McCall, and Payette study areas confirmed 14 individual wolverines: eight females (some of which were denning) and six males. The Forest and BNF contain known denning habitat, and five den sites for four individual females have been confirmed since 2010. Winter field surveys for wolverine were also conducted in 2013 by Cox (2017, entire) and Garcia and Associates (2014, entire). In 2013, baited camera station photographs and DNA samples identified two wolverines in the months of February and March within the study area. Several wolverine tracks were also observed in the area, as camera stations were deployed and serviced, and two direct observations of wolverine were also recorded. In the 2014 study, baited camera station photographs and DNA samples identified two individual wolverines; one of them from the 2013 study and the other new to the wolverine database. The study also identified wolverine tracks on Johnson Creek near the Trapper Flats trailhead, an area where tracks had been observed in the previous Cox study.

In addition, the wolverines documented in Garcia and Associates' remote camera study (2013 and 2014), identified at least 16 individual wolverines in or adjacent to the action area from 2010 to 2015. More importantly, four of these wolverines were documented within the mine site boundary, including a resident reproductive female, which likely indicates a den in the general area, although one has not been documented. The nearest documented den location was found approximately 12 miles southeast of the mine site between Sheepherder Lake and the Deadwood Summit area (USFS 2024, p. 496)

The Western States Wolverine Conservation Project's occupancy survey in the winter of 2016 to 2017 used 200 remote camera stations deployed in wolverine habitat across four states (Lukacs et al. 2020, entire). Two camera stations were within the action area, and another five were within the Forest and northern BNF study areas of the winter recreation study. Notable results from this study were (1) the continued documentation of a male and female in their presumed territories north and south of Landmark, Idaho within and adjacent to the action area, and (2) the detection of a female offspring of one of the females from the winter recreation study (Evans Mack 2018, entire).

7.2.2 Factors Affecting Wolverine in the Action Area

Mining has been a factor affecting wolverines in the action area. Two major periods of mineral exploration, development, and operations have occurred in the Stibnite Mining District (District) over the past century that left behind substantial environmental impacts that remain to this day. The first period of activity commenced in the mid-1920s and continued into the 1950s; it involved the mining of gold, silver, antimony, and tungsten mineralized materials by both underground and, later, open pit-mining methods. The second period of major activity in the District started with exploration activities in 1974 and was followed by open pit mining and seasonal on-off heap leaching and one-time heap leaching from 1982 to 1997, with ore provided by multiple operators from a number of locations, and processed in adjacent heap leaching facilities. The mining, milling, and processing activities created numerous legacy impacts including underground mine workings, multiple open pits, development rock dumps, tailings deposits, heap leach pads, spent heap leach ore piles, a mill and smelter site, three town sites, camp sites, a ruptured water dam (with its associated erosion and downstream sedimentation), haul roads, an abandoned water diversion tunnel, an airstrip, and other disturbances. Effects to wolverine from these historic activities include loss of habitat and poor water quality.

Other activities or events that influence the environmental baseline of wolverine include , vegetation management; wildlife surveying; ; invasive species management involving mechanical and chemical removal; management of infrastructure such as roads and bridges; and wildfire, wildland-urban interface projects, and fire suppression, among other activities.

Vegetation treatments, including thinning and prescribed fire, and fire suppression activities may involve the use of heavy machinery and increased human presence. These activities may temporarily disturb wolverines, causing them to alter their behavior and habitat use by avoiding the affected area; however, they are not anticipated to impede dispersing individual's movements or affect gene flow between wolverine populations. Increased human activity associated with treatment activities can cause resident wolverines to avoid otherwise suitable habitat within their home ranges, limiting their access to critical resources. Given that wolverines can travel long distances in a short period of time, individuals would be expected to move away from areas where vegetation treatments and fire suppression are occurring (Luensmann 2008, p. 14). Additionally, wolverines will be able to return to the area upon completion of the activities. .

Activities such as timber harvest and fire activities can modify wolverine habitat, but wolverines are generalist species that do not appear to be affected by changes to the vegetative characteristics of its habitat (USFWS 2023e, p. 83768). Studies of wolverines in central Idaho found that montane coniferous forests comprised two-thirds of available habitat (Copeland 1996, p. 120), but individuals within this study population also commonly crossed natural openings and those areas with little cover, including burn areas, meadows, or open mountain-top areas (Copeland 1996, p. 124). Wolverines are not thought to be dependent on specific vegetation or habitat features that might be manipulated by land management activities, nor is there evidence to suggest that land management activities are a threat to the conservation of the species (USFWS 2013, p. 7879). Habitat alteration from vegetation treatments in the action area is unlikely to negatively impact wolverine habitat selection.

Additional factors affecting wolverines include management of recreation sites such as campgrounds and trail networks and permitting and management of recreational activities such as hiking, biking, skiing, snowmobiling, and ATV/UTV usage. There are effects of new or increasing winter recreation activities on wolverine movement within their home ranges, including habitat selection and denning (USFWS 2023c, entire). Winter recreation is projected to increase in both duration and extent into areas identified as essential for wolverine. Specifically, Heinemeyer et al. (2019, p. 1) found that wolverines avoided areas of both motorized and non-motorized winter recreation. Wolverine response was stronger to off-road recreation (backcountry skiing, snowmobiling) than to road-based recreation, especially by female wolverines. Regan et al. (2020, entire) mapped motorized and non-motorized backcountry recreation in Idaho's wolverine habitat and found that both types of recreation are on the rise, both in terms of intensity and geographical coverage. Some areas are showing a decline in wolverine occupancy in areas of heavy winter recreation use, but the specific mechanisms causing this decline need further investigation (Mack and Hagen 2022, entire).

The North American wolverine has not been the subject of previous section 7 formal consultations in the action area as this species is only recently listed as threatened under the ESA.

7.3 Effects of the Proposed Action

Implementing regulations define "effects of the action" as "all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action but that are not part of the action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action" (50 CFR 402.02).

Effects to wolverines from the proposed action include the potential injury or mortality from vehicle collisions, changes to an individual or population's habitat use due to noise or light, contamination of food or water sources, loss of habitat, and encroachments into wildlife migration or travel areas, although no defined corridors have been identified. Habitat loss could be temporary (from less than 1 year to up to the full term of the project) or permanent for land use changes (i.e., pit lakes, TSF, TSF Buttress, transmission line upgrades). Other effects to wolverines include fragmentation of habitat, increased competition for resources or habitat due to displacement of individuals from the affected area into the territory of other animals, and increased human presence in the action area that can lead to reduced breeding and recruitment (i.e., den abandonment and loss of young) in future populations.

Effects of the proposed action to wolverines are analyzed within a 5-mile buffer of proposed action components to assess all potential impacts, including noise disturbance (Figure 22). This buffer distance was developed prior to the proposed action-specific noise baseline study (HDR 2017c, entire; b, entire) using best professional judgment to address impacts from anthropogenic influences and to account for potential impacts to wolverines moving through the action area. Based on the results of the proposed action's noise baseline study (HDR 2017a, 2017b) and the corresponding noise analysis presented in the Stibnite Gold Project Noise Specialist Report

(USFS 2023a, entire), the majority of noise disturbance impacts will occur within 1 to 2 miles from proposed action components.

Persistent snow cover is used to assess impacts to wolverine habitat, particularly denning habitat (Copeland et al. 2010, entire). Table 44 summarizes the areas (in acres) with persistent snow cover in numbers of years (1 through 7) impacted by the proposed action. This model depicts the number of years, out of seven, in which snow cover was present in the spring in selected pixels (April 24 – May 15). This time frame generally corresponds to the period of wolverine den abandonment. Most dens in the study areas were snow covered for 5 to 7 years out of the total 7 years studied, indicating that wolverines select den sites in areas with the highest consistent snow coverage.

To be conservative, areas with persistent snow cover for years 3 through 7 indicate higher quality habitat (particularly denning habitat) than years 1 and 2. Habitat disturbance was calculated by including all modeled habitat (years 1 through 7) within 5 miles of proposed action components.

Table 44. Acres of wolverine habitat disturbed by the proposed action.

Snow Cover Years	Mine Site Disturbance (acres)[1]	Access Roads Disturbance (acres)[2]	Utilities and Facilities Disturbance (acres)[3]	Habitat in the Action Area (acres)
1-2	1,350.8	94.4	117.1	109,552.8 (modeled suitable habitat)
3-7	289.5[4]	332.6	157.2	231,053.9 (denning habitat)
Total for 1-7	1,640.3	427	274.3	340,606.7

[1] Approximately 1,623.6 acres will be permanent disturbance and 16.7 temporary disturbance.
[2] Approximately 15.8 acres will be permanent disturbance and 411.2 temporary disturbance.
[3] Approximately 49.3 acres will be permanent disturbance and 225 temporary disturbance.
[4] Includes approximately 65 acres of exploration drilling activities.

7.3.1 Habitat Loss

Approximately 2341.6 acres of disturbance (652.9 acres of temporary disturbance and 1,688.7 acres of permanent disturbance lost through the life of the mine) to modeled suitable habitat and denning habitat will occur from proposed action activities at the mine site, access roads, and utilities and facilities during site preparation, mining operations, and closure/reclamation project phases.

Mine Site

<u>Construction</u>

Adverse effects to wolverines will likely occur in the mine site area due to habitat loss, specifically loss of denning habitat. There have been 16 wolverines documented in or near the action area, 4 of which were within the mine site, so it is likely that wolverines, and potentially denning females, will be affected through loss of suitable and denning habitat or displacement around the mine site as wolverines are sensitive to anthropogenic disturbance and development in denning habitat (Krott 1960, p. 26; Pulliainen 1968, p. 343; Copeland 1996, p. 35; Heinemeyer et al. 2019, p. 1; USFWS 2023d, p. 35).

There will be 1,640.3 acres of disturbance (1,623.6 acres of permanent disturbance through the life of the project and 16.7 acres of temporary disturbance) to denning and suitable habitat due to mine site construction activities, which will affect dispersal, foraging, and other behaviors. Of the 1,640.3 acres disturbed, 1350.8 acres are suitable habitat and 289.5 acres are denning habitat. Mine site construction and project vehicle traffic may temporarily disturb wolverines in the vicinity, causing them to flee the area or avoid affected areas and heightened human activity. Dispersing wolverines may avoid areas where humans and machinery are present while construction is taking place, although these individuals will likely move around the disturbance as they pass through the area. Therefore, construction is not anticipated to impede dispersing individual’s movements or affect gene flow between wolverine populations. Due to these reasons, and because wolverines have low population densities and large home ranges, the disturbance effects to dispersing wolverines are expected to be insignificant.

Injury or mortality from mine construction activities are not expected, because wolverines typically avoid and move away from crossing large openings, such as clear-cuts, roadways, and developed areas (Scrafford et al. 2018, entire) and are expected to leave the area of construction activity and to go nearby suitable and denning habitat. Den abandonment is also not expected during the construction phase of the mine site, since construction activities will typically occur outside of the wolverine denning period (January 15 through May 15). Construction activities may occur during the denning period, though, when little to no snow is on the ground, making such activities feasible. In these cases, the lack of snow in the action area would cause denning to occur in areas farther from the action area where more adequate snow levels are available for denning, thereby making effects to wolverines from winter construction insignificant.

Operations

An additional 65 acres of disturbance will occur within the mine site boundary from exploration drilling (40 acres for drill pads and 25 acres of temporary roads). Except for 11 planned locations, exact locations of the exploration drill pads have not been determined, although general areas for foreseeable exploration have been identified. Drilling support equipment will include helicopters, water trucks, crew trucks, portable mud tanks, pipe trucks or skids, portable toilets, light plants, portable generators, motor graders, excavators, dozers, and product storage pallets. A helipad will be maintained for exploration and medical evacuations adjacent to the administration offices and warehouse facilities. Effects to wolverines from loss of suitable and denning habitat are the same as outlined in the previous section.

Closure and Reclamation

Except for the Hangar Flats pit highwall above the valley bottom, the West End pit, and a portion of the YPP highwall, previously disturbed areas will be contoured and graded to blend into the surrounding topography and terrain. There will be growth media placed followed by revegetation. While the number of acres cannot be predicted that will be restored to modeled suitable or denning habitat for wolverine, some usable habitat it expected to return following reclamation and revegetation.

Roads

Construction

Impacts to wolverines are likely from the construction of access roads and geophysical investigation of the Burntlog Route, creating 427 acres of disturbance (15.8 acres of permanent disturbance through the life of the project and 411.2 acres of temporary disturbance) to denning and suitable habitat. Of the 427 acres of disturbance, 94.4 acres are suitable habitat and 332.6 acres are denning habitat.

Geophysical investigation along the proposed Burntlog Route will occur from June through November prior to construction of the road and does not overlap with the wolverine denning period, thus there are no anticipated effects to denning females or their young. Minor brush clearing and minimal tree cutting may occur across 0.6 acres of wolverine habitat for investigation activities, which overlaps habitat that will be disturbed from construction of the Burntlog Route.

Wolverines may be foraging, sheltering in, or otherwise using the action area during the time of construction and investigation. Wolverine home ranges are large, with male territory sizes of 610 mi^2 and female territory sizes of 148 mi^2 recorded in central Idaho and have very little overlap between same-sex adults (USFWS 2018b, p. 22). Construction of 15 miles of new road for the Burntlog Route will fragment habitat but may not act as a barrier to movement due to the road's narrow width and adjacent tree cover. When selecting home ranges, wolverines typically use remote areas that are not fragmented by roadways or other linear disturbances (Scrafford et al. 2018, p. 534). However, dispersing wolverines are able to travel through lower-quality habitat than individuals would select for their home ranges (Carroll et al. 2020, p. 9). Clearing of trees for road construction may be placed in areas for lop and scatter or for piling and burning. If pile burning will occur, it will take place outside of the denning season (not between January 15 and May 15).

Operations

No additional construction or habitat loss will occur from roads during operations.

Closure and Reclamation

Reclamation and closure of the access roads and associated work areas and borrow sources will include decommissioning the 15-mile newly constructed sections of the Burntlog route and returning the widened/upgraded roadways to their original conditions. The 21-foot-wide travel way of 19.8 miles of Burntlog Road (FR 447), 1.3 miles of Meadow Creek Lookout Road (FR 51290), and 2 miles along Thunder Mountain Road (FR 375) of the Burntlog Route will be reduced to their approximate pre-mining width. Returning this 23 miles of existing road to pre-mining condition will entail grading or scarification along the outside edges of the road followed by seeding with the species listed in the Reclamation and Closure Plan (Tetra Tech 2021, entire). Ditches, cross drains, culverts, safety berms, mile markers, guardrails, and signs on roads will be removed if no longer needed. Water bars or other erosion and sediment control structures, armored stream crossings, and stormwater crossings will be included where necessary. The reclaimed areas will be scarified, and 6 inches of growth media will be placed in upland areas, followed by seeding and certified weed-free mulching on slopes over 30 percent. While the number of acres cannot be predicted that will be restored to modeled suitable or denning habitat for wolverine, some usable habitat it expected to return following reclamation and revegetation.

Utilities and Facilities

Construction

Impacts to wolverines due to construction of utility corridors, substations, and communication towers are likely, creating 274.3 acres of disturbance (49.3 acres of permanent disturbance through the life of the project and 225 acres of temporary disturbance) to denning and suitable habitat. Of the 274.3 acres of disturbance, 117.1 acres are suitable habitat and 157.2 acres are denning habitat. Some habitat will be removed for construction along roadways, but it is not considered high quality habitat for wolverines due to their roadside location and high level of human use and disturbance. Construction habitat loss effects to wolverines are the same as described in the previous sections for the mine site and roads.

Operations

No additional construction or habitat loss will occur during operations.

Closure and Reclamation

Once there is no longer a need for active water treatment, the approximately 9-mile transmission line between the Johnson Creek and Stibnite substations will be disassembled. The 63.7 miles of upgraded transmission line segments from the Johnson Creek substation to the Lake Fork substation will be left intact since they existed prior to the proposed action. The substations, switchgear, and power line will be removed. The transmission line ROW and associated access roads will be recontoured to match surrounding topography and revegetated. As part of revegetation, the transmission line structure pads and access roads will be scarified and revegetated.

Following mine closure and reclamation, the Burntlog Maintenance Facility buildings will be removed and the sewer system and septic tanks will be decommissioned. After demolition of the buildings and facilities, the site will be graded, revegetated, and drainage restored. Reclamation and closure of support facilities will include grading, addition of growth media, and reseeding. While the number of acres cannot be predicted that will be restored to modeled suitable or denning habitat for wolverine, some usable habitat it expected to return following reclamation and revegetation.

7.3.2 Noise and Disturbance

Mine Site

Construction

Within the action area, noise and light from construction may disturb wolverine foraging or denning behavior throughout the life of the proposed action. Based on the results of the proposed action’s noise baseline study 2017c, entire) and the corresponding noise analysis (USFS 2023a, entire), most effects to wolverine from light and noise will occur within 1 to 2 miles from the mine site.

Wolverines are elusive carnivores that thrive in remote, high-elevation habitats, making them particularly sensitive to disturbances such as anthropogenic presence. One of the primary effects of human presence to wolverines is habitat displacement. Noise pollution, equipment and vehicle use, and general human presence on the landscape particularly from industrial activities like logging and mining, can cause wolverines to avoid otherwise suitable habitat, limiting their access to critical resources. Heinemeyer et al. (2019, p. 1) highlighted that wolverines show a marked decrease in activity near areas with high levels of human presence, suggesting a strong aversion to such disturbances.

Additionally, human presence on the landscape can increase stress levels, and chronic stress can weaken the immune system, reduce reproductive success, and increase vulnerability to disease and predation, further threatening wolverine populations. Creel et al. (2002, p. 809) demonstrated that human disturbance in the form of snowmobile presence on the landscape elevates glucocorticoid levels (a stress hormone) in large carnivores. This stress response can lead to negative health outcomes and lower reproductive success. Although this study focused on wolves, it is relevant to wolverines given their similar ecological niches and responses to stress.

Research by (Francis and Barber 2013, p. 306) on the ecological effects of anthropogenic noise on wildlife highlights that noise pollution can interfere with predator-prey interactions. This principle can be extended to wolverines, as noise might hinder their ability to hunt effectively or avoid predators. Additionally, Francis and Barber (2013, p. 306) note that some species may perceive anthropogenic noise as a threat, eliciting responses such as fleeing and hiding. While this and other studies may not focus exclusively on wolverines, they provide a framework for understanding the potential impacts of noise on this species by drawing parallels with similar large carnivores and general wildlife ecology principles.

The noise and light reduction EDFs employed at the mine site include sound dampening and muffling equipment utilized to minimize noise excursion; high noise activities will be scheduled at the same time when possible; and pumps, generators, and engines will be turned off when not in use to avoid unnecessary noise generation and reduce energy consumption when practicable. While implementation of EDFs will minimize noise effects to wolverines by minimizing the intensity and duration, it will not completely eliminate them.

Operations

Noise and light from operations may disturb wolverine foraging or denning behavior throughout the life of the proposed action (approximately 20-25 years for construction and mining activities, up to 40 or more for monitoring and water treatment). Effects to wolverines from noise during the operations phase are similar to effects during construction as detailed in the previous section. Operations noise will come from vehicles, machinery, blasting, and other activities and occur all year long, which means that noise disturbance will occur during the denning season. A reproductive female was documented within the mine site between 2010 and 2015, which indicates that a den may be in the general area (USFS 2024, pp. 297–299)

Females with kits are extremely sensitive to human disturbance and may abandon den sites if disturbed (Krott 1960, p. 26; Pulliainen 1968, p. 343; Copeland 1996, p. 93), though this is not always the case and appears variable at the individual level (Magoun 1985, p. 73). Wolverine females naturally shift their den sites several times throughout the denning period for reasons including changes in temperature, breeding experience, resource availability, and kit age (Heeres

2020, pp. 15–22). During the first 1.5 months of the denning period, females rarely change den sites, but begin to move outside the den in early March (Aronsson 2017, p. 45). In the later denning period (after April 15), females begin to move more frequently and at greater distances between den sites (Aronsson 2017, p. 45). Dens offer protection from predators and the environment (Aronsson 2017, p. 46). Den-shifting behavior represents a tradeoff between moving, risking potential energy loss, and vulnerability of offspring during den shifts versus staying in the original den site and risking exposure to disturbance or changed conditions that might make the original den site unsuitable (USFWS 2023d, p. 23). When females abandon their current den site for a new one due to human disturbance at a time or frequency that would not have occurred without that disturbance, they may expend additional energy during a critical life stage when environmental conditions are difficult (e.g., low temperatures and resource availability) and spend time that would otherwise be used for other activities, such as foraging (USFWS 2023d, p. 23). Also, moving kits at a time or frequency different from what would naturally occur increases the vulnerability of offspring to predation and exposure to cold temperatures during den abandonment, leading to injury or mortality. Because wolverines have low population densities and large home ranges, it expected that adverse effects of disturbance from operations to denning females and young will only occur at the individual level.

Though the effects on female physical condition, kit survival, or other reproductive fitness traits have yet to be examined, costs in the form of energy expenditure and increased offspring vulnerability are reasonably certain to occur for individuals that are sensitive to human disturbance from winter recreation. These studies focused on human disturbance from winter recreation, but similar, if not more extensive, disturbance may occur within the mine site such as machinery, human noise, traffic, and blasting. Adverse effects from mine site noise and disturbance during the denning season may affect wolverine through den abandonment and loss of young. To minimize impacts from exploratory drilling activities, a 1-mile no-disturbance buffer will be implemented around denning habitat as modeled using the persistent snow cover layer described in Copeland et al. 2010 from January 15 to May 15 (USFS 2024, p. 304). This means that people and equipment will not come within one mile of modeled denning habitat in the action area during exploratory drilling activities. As most wolverine dens will be in the interior of modeled denning habitat (represented by areas that have persistent spring snow for 6-7 years of the 7 years examined) and are unlikely to den along the edge of modeled habitat, the buffer between proposed activities and den sites is likely to be greater than one mile. This conservation measure provides even greater protection to wolverines than measures suggested in Hauslietner et al. (2024, p. 12), which suggests buffering known den sites instead of the entirety of denning habitat, as female wolverines with kits will not only be protected from human disturbance at their den site, but also have additional habitat within their home range protected from human disturbance so that they may shift den sites, hunt, and carry out essential activities during a critical time in their life history without being disturbed by proposed activities.

Closure and Reclamation

Final closure and reclamation involves removing all structures, reclamation of those areas that have not been concurrently reclaimed (such as the TSF and some backfill surfaces), recontouring and improving drainages, reconstructing various stream channels, decommissioning of the EFSFSR diversion tunnel, growth media placement, and planting and revegetation on disturbance areas.

Reclamation work will generate noise from machinery, vehicles, and human presence. Noise pollution, equipment and vehicle use, and general human presence on the landscape can cause wolverines to flee the area and avoid otherwise suitable habitat, limiting their access to critical resources. Additionally, human presence on the landscape can increase stress levels, and chronic stress can weaken the immune system, reduce reproductive success, and increase vulnerability to disease and predation, further threatening wolverine populations. Adverse effects to denning females with young are not expected during reclamation work, since this work will be completed outside of the denning season.

Roads

Construction

Proposed action activities such as geophysical investigation and construction of the Burntlog Route may affect wolverines physically in the form of habitat disturbance as well as behaviorally in the form of displacement. Wolverines will likely avoid these areas by moving away from the activities. Public use of some roadways will also encourage additional backcountry recreational activities and hunting (e.g., big game, small game), which could cause injury or mortality from vehicle collisions.

Geophysical investigation resulting in increases in traffic, helicopter operations, noise, and increased human presence may cause wolverine to avoid the action area while activities take place. The investigation implementation period (June through November of Mine Year minus 3) does not overlap with the wolverine denning period, thus there are no anticipated effects to denning females or their young. However, wolverine may be foraging, sheltering in, or otherwise using the action area during the time of implementation. Wolverine home ranges are fairly large, with male territory sizes of 610 mi^2 and female territory sizes of 148 mi^2 recorded in central Idaho, and have very little overlap between same-sex adults (USFWS 2018b, p. 22). As wolverines are mobile animals with the ability to flee from project activities and the areas where increased human presence will temporarily occur will be small relative to typical wolverine territory sizes, effects from geotechnical investigation are anticipated to be insignificant.

The Burntlog Route will used for the duration of the proposed action, but public use will be restricted. Seasonal use of the newly constructed portions of the Burntlog Route will be allowed only during the snow-free portion of the year between when the Burntlog Route has been completed and when mining begins in Mine Year 1 when there will be no other access to the Thunder Mountain Road. Public use of existing segments of the Burntlog Route will not be modified but will be subject to temporary closures for new Burntlog Route construction. During operations, public use of existing segments of the Burntlog Route (i.e., Burntlog Road [FS447], Meadow Creek Lookout Road [FR51290], and Thunder Mountain Road [FR50375]) will be unrestricted. The main road segment where public access will continue will be a 1.8-mile section of the Meadow Creek Lookout Road, coincident with the Burntlog Route. Signage will be placed at all intersections with Forest roads and trails to identify road segments with public access restrictions. A Burntlog Route access plan will be drafted to restrict public access and provide notifications to the public when the newly constructed segments of the Burntlog Route will be open.

Young, inexperienced male wolverines have greater risk of mortality in relation to roads during dispersal compared to adults or immature females that are less likely to disperse long distances

(Krebs et al. 2004, pp. 497–498). The small number of mortalities since 2018 (1 in Idaho, 2 in Washington, 1 in Montana) were biased towards dispersing males and were along two-lane highways or state routes, and an interstate (USFWS 2023d, p. 31).They were not corresponding with Forest roads that see lower density travel.

Wolverines typically use remote areas that are not fragmented by roadways or other linear disturbances (Scrafford et al. 2018, p. 534). Based on a study of eight wolverine dens in a remote boreal region of Alberta, wolverines appeared to select den sites far from roads (2.5-7.5 mi.); however, this may have been simply a function of the available habitat (Jokinen et al. 2019, pp. 8–9). Despite the lack of a clear causal relationship, these findings are consistent with previous research that found wolverines selecting den sites away from roads at the home range and landscape scales in south-central Norway (May et al. 2012, p. 202). Scrafford et al. (2018, p. 541) concluded that roads generally reduce the quality of wolverine habitat.

During the construction phase (when traffic levels will be highest), the annual average daily traffic (AADT) level will be 65 vehicles to the mine site. The slow speed limits on the Burntlog Route (posted speed limits of 20 mph or in some cases 15 mph) will minimize mortality or injury for individual wolverines by giving drivers more time to react to occurrences and avoid any wolverine on the road. Since wolverines are mobile animals with the ability to flee from road use noise, effects from road use during operations are expected to be insignificant, while the chance of collisions due to road management activities is expected to be discountable. Traffic noise will be an ongoing daily occurrence, which will likely prevent females from denning near such disturbances. Due to this, effects to denning females and young from road noise are expected to be insignificant.

Operations

Adverse effects to wolverines may occur from year-round noise disturbance and potential avoidance behavior, over-snow recreation in the winter, and plowing in winter of the Burntlog Route. During operations, the AADT level will be below 50 to the mine site, and slow speed limits on the Burntlog Route will minimize or prevent potential mortality or injury for individual wolverines by giving drivers more time to react to wildlife occurrences and avoid them.

Roads often fragment wolverine habitats, leading to isolated populations and decreased genetic diversity. Wolverines require large, contiguous areas of wilderness to thrive. Fragmented habitats can limit their ability to find food, mates, and suitable denning sites, which are essential for their reproduction and survival. A study by (Copeland et al. 2010, entire) highlighted that wolverines are highly sensitive to habitat fragmentation and that maintaining large, undisturbed areas is crucial for their conservation.

The footprint of human activities throughout the life of the proposed action may limit wolverine dispersal and population connectivity, especially for female wolverines. Research demonstrates that the amount and spatial arrangement of roads reduces the quality of wolverine habitat. For instance, in the Canadian Rockies, (Kortello et al. 2019, p. 10) observed a negative association with forest road density and wolverine occurrence, particularly females. In addition, roads also impact wolverine connectivity and gene flow, although highways allow some permeability (Sawaya et al. 2019, entire; Carroll et al. 2020, p. entire; and Bjornlie et al. 2021, p. 117). The 2023 SSA concluded that roads may be more of a stressor than previously documented (USFWS 2023d, pp. 30–32).

An increase in collision mortality along roadways may occur as the Burntlog Route segment will be new to the area and will be plowed throughout the winter. Because wolverines are largely scavengers in the winter (particularly on ungulate carrion), carrion on roads or roadsides could attract wolverines to roadways. Vehicle-wildlife collisions will likely be the largest impact to wolverines related to the proposed action. Appropriate speed limits, generally 20 mph or less, will be established for the Burntlog Route, mine site haul roads, and light vehicle access roads to minimize or prevent vehicle-wildlife collisions. Slower speed limits will be posted at known wildlife crossings and along defined migratory corridors during migration season. Additionally, all staff and contractors will be trained to prevent wildlife collisions (USFS 2024, p. 304).

(Heinemeyer et al. 2017, entire) observed that wolverines responded negatively to increasing intensity of winter recreation in Idaho, Montana, and Wyoming and that off-road or dispersed recreation triggered a stronger response than recreation concentrated on access roads. Female wolverines showed a stronger avoidance effect to motorized off-road recreation than males and, therefore, experienced higher habitat loss (Heinemeyer et al. 2019, p. 17). Kortello (et al. 2019, p. 10) also documented the negative association of forest roads and winter recreation on wolverine distribution in the southern Columbia Mountains of Canada. The existing groomed OSV trail (8.5) from Warm Lake to Landmark will be closed under the proposed action, but a new groomed trail (10.8 miles) will utilize the existing Cabin Creek Road (FR 467). This trail will cross modeled suitable habitat for wolverines, and associated increased recreational activity (e.g., snowmobiling, skiing, etc.) will likely cause impacts to wolverines due to noise from and presence of OSVs in an area where they were not previously as this will be a new winter route. As outlined in Heinemeyer et al. (2019), wolverines are expected to avoid areas of winter recreation within their home range. This new route will likely cause wolverines occupying this area to avoid otherwise suitable habitat where winter recreators are active. Additionally, increased winter recreation in this area could result in human presence near den sites that causes female wolverines to shift or abandon dens and move their kits at a time or frequency that they otherwise would not have. This may result in impacts to foraging, sheltering, and denning behaviors of reproductive females and kits during a time period when food resources are limited and environmental conditions are harsh. Though the effects on female physical condition, kit survival, or other reproductive fitness traits have yet to be examined, costs in the form of energy expenditure and increased offspring vulnerability are reasonably certain to occur for individuals that are sensitive to human disturbance from winter recreation.

Noise and increased lighting also could disturb potential wolverine foraging or denning habitat throughout the life of the proposed action, but the area disturbed will be small relative to equivalent habitat in the contiguous forest area and the extremely large home range of wolverines (from 49 to 833 square miles; Heinemeyer et al. 2017, p. 52). Construction and operation of the access roads will likely produce noise effects at farther distances than the area physically disturbed but less than 2 miles. For example, based on the results of the proposed action's noise baseline study (HDR 2017c, entire; b, entire) and corresponding noise analysis conducted for the proposed action (USFS 2023a, p. 27), noise from access road construction will attenuate to the threshold of 55 decibels on the A-weighted scale (dBA) approximately 0.57 miles from the source of activity based on distance alone. Accounting for ground and atmospheric absorption, noise will attenuate to 55 dBA approximately 0.28 mile from the source. Estimated average hourly traffic noise levels will be approximately 48 dBA at 50 feet from the roadway and will attenuate to below ambient noise levels of 40 dBA within 500 feet from the roadway (USFS 2023a, p. 48). Therefore, traffic noise may affect wolverines in the Frank Church River of No Return Wilderness within 500 feet of the roadway during operations. The noise and light reduction employed along access roads will likely reduce impacts to wolverines by minimizing the intensity and duration but may not eliminate traffic noise and light impacts entirely. Since wolverines are mobile animals with the ability to flee from road use noise, effects from road use during operations are expected to be insignificant. Traffic noise will be an ongoing daily occurrence, which will likely prevent females from denning near such disturbances. Due to this, effects to denning females and young from road noise are expected to be insignificant.

The year-round maintenance and winter plowing of the Burntlog Route, which is currently not plowed, may open new and more remote areas for other predators, such as wolves or coyotes, which could increase the competition for food resources with wolverines. Access in this area during the winter is limited to predators suited for over-snow travel (i.e., Canada lynx and wolverine). Construction and operation of the Burntlog Route will open new corridors for predators, which may affect food availability for wolverines. A new study, though, shows that while wolves compete with wolverine food sources, they are also an important supplier of winter carrion for the species (Nordli et al. 2024, p. 17). Thus, the potential increase in access of predators such as wolvers to the area is anticipated to have a mix of positive and negative effects to wolverines.

Closure and Reclamation

Reclamation and closure of the access roads and associated work areas and borrow sources will include decommissioning the 15-mile newly constructed sections of the Burntlog route and returning the widened/upgraded roadways to their original conditions. Returning this 23 miles of existing road to pre-mining condition will entail grading or scarification along the outside edges of the road followed by seeding. Final reclamation of roads could continue beyond the five-year closure and reclamation period. The Burntlog Route will be needed until the TSF is fully reclaimed, after which the newly constructed portions of the road will be decommissioned, recontoured, and reclaimed (i.e., fully obliterated), and the currently existing portions of the road will be returned to their prior use.

Reclamation work will generate noise from machinery, vehicles, and human presence. Noise pollution, equipment and vehicle use, and general human presence on the landscape can cause wolverines to flee the area and avoid otherwise suitable habitat, limiting their access to critical resources. Additionally, human presence on the landscape can increase stress levels, and chronic stress can weaken the immune system, reduce reproductive success, and increase vulnerability to disease and predation, further threatening wolverine populations. Adverse effects to denning females with young are not expected during reclamation work, since this work will be completed outside of the denning season.

Utilities and Facilities

Construction

Noise and increased lighting near utilities and facilities during construction may disturb wolverine foraging or denning habitat, but it is likely that resident or transient wolverines will avoid the off-site facilities. Noise will attenuate to the threshold of 55 dBA approximately 0.28 mile from the source of activity based on distance alone. Accounting for ground absorption and atmospheric absorption, noise from transmission line construction will attenuate to 55 dBA approximately 0.15 mile from the source of activity (HDR, 2017b, c). Noise and light from construction are similar to those detailed in previous sections (e.g., Mine Site section). These effects include disturbing wolverine foraging or denning behavior, fleeing areas where work is taking place, and avoidance of otherwise suitable habitat. The noise and light EDFs employed along utility corridors and near communication towers will reduce impacts to wolverines to insignificant levels.

Operations

Effects to wolverines from operations of utilities and facilities are possible, as wolverines will likely travel throughout the proposed action vicinity. Because wolverines typically use remote areas that are not fragmented by roadways or buildings, it is likely that resident or transient wolverines will naturally avoid the utility and facility areas. Effects to wolverines from utility and facility noise is similar to those detailed in previous sections (e.g., Mine Site section). These effects include disturbing wolverine foraging or denning behavior, fleeing areas where work is taking place, and avoidance of otherwise suitable habitat.

Human disturbance associated with increased traffic, noise, and human presence, is expected to temporarily affect the distribution of wolverine prey species. Big game animals, such as elk and mule deer, are likely to avoid areas where these activities are actively occurring, thereby reducing foraging opportunities for wolverines in the short term. However, these disruptions are anticipated to be localized and limited, with prey species expected to temporarily adjust their movements over relatively short distances. It is unlikely that these disturbances will significantly alter the availability of prey resources across the scale of a wolverine's home range. Given the large-scale movements of wolverines, they are expected to adapt to these temporary changes in prey distribution caused by proposed action activities.

Closure and Reclamation

Once there is no longer a need for active water treatment, the approximately 9-mile transmission line between the Johnson Creek and Stibnite substations will be disassembled. The 63.7 miles of upgraded transmission line segments from the Johnson Creek substation to the Lake Fork substation will be left intact since they existed prior to the proposed action. The substations, switchgear, and power line will be removed. The transmission line ROW and associated access roads will be recontoured to match surrounding topography and revegetated. As part of revegetation, the transmission line structure pads and access roads will be scarified and revegetated.

Following mine closure and reclamation, the Burntlog Maintenance Facility buildings will be removed and the sewer system and septic tanks will be decommissioned. After demolition of the buildings and facilities, the site will be graded, revegetated, and drainage restored. Reclamation and closure of support facilities will include grading, addition of growth media, and reseeding. While the number of acres cannot be predicted that will be restored to modeled suitable or denning habitat for wolverine, some usable habitat it expected to return following reclamation and revegetation.

Reclamation work will generate noise from machinery, vehicles, and human presence. Noise pollution, equipment and vehicle use, and general human presence on the landscape can cause wolverines to flee the area and avoid otherwise suitable habitat, limiting their access to critical resources. Additionally, human presence on the landscape can increase stress levels, and chronic stress can weaken the immune system, reduce reproductive success, and increase vulnerability to disease and predation, further threatening wolverine populations. Adverse effects to denning females with young are not expected during reclamation work, since this work will be completed outside of the denning season.

7.3.3 Water Quality and Contaminants

Mine Site, Roads, and Facilities and Utilities

Construction

There will be a risk of spills during transportation to construction sites as well as accidental spills of fuel, lubricants, hydraulic fluid, or similar contaminants while machinery is used. Any spills may contaminate soils and nearby waterbodies. To reduce the risk of accidental releases to streams, the following EDFs will be implemented: equipment staging, fueling, storage, and washout areas will be located at least 150 feet from aquatic areas; any waste liquids generated at the staging areas will be temporarily store under cover on an impervious surface until it can be properly transported for off-site treatment or disposal; and there will spill containment kits adequate for the types and quantity of hazardous materials present in the construction are (USFS 2024, p. 262). In addition to the above EDFs reducing the risk of an accidental spill, wolverines are land mammals and avoid noise disturbance, spatially reducing the risk of a wolverine being present near a spill in a construction area if one were to occur. Therefore, effects to wolverines from contaminant spills are expected to be discountable.

Operations

The transportation of hazardous materials on access roads and through the mine site will increase the risk of spills. Hazardous materials will be transported to work areas in USDOT-certified containers by trained personnel and will be stored in designated areas employing secondary containment measures (USFS 2024, p. 311). A Hazardous Materials Handling and Emergency Response Plan will address procedures for responding to accidental spills or releases of hazardous materials to minimize environmental effects. Used products will be stored on site in approved containers that will be separate from other trash and garbage products. As outlined above, in addition to the above EDFs reducing the risk of an accidental spill, wolverines are land mammals and avoid noise disturbance, spatially reducing the risk of a wolverine being present near a spill in a construction area if one were to occur. Therefore, effects to wolverines from exposure to hazardous materials are expected to be discountable.

Poor water quality can significantly impact wolverine populations, although the specific effects on these animals are less documented compared to other species. Wolverines are known for their resilience and adaptability, inhabiting remote and often pristine environments. However, they are not immune to environmental changes, including those related to water quality. Wolverines primarily feed on a variety of small to medium-sized mammals and carrion. Changes in food source quality from contaminants can accumulate in the food web causing bioaccumulation of these contaminants in wolverines, including mercury (I. Peraza et al. 2023, entire). Effects to wolverines from poor water quality and contaminants are expected to be insignificant because water quality in the mine site area, particularly in the EFSFSR and in Sugar Creek, has chemical constituents (arsenic, antimony, copper, and mercury) that currently exceed acceptable thresholds (USFS 2023e, Section 7; outlined in the bull trout baseline section), so effects from water quality are not expected to differ much from baseline conditions.

Potential sources of chemical contaminants during operations was the subject of a site-wide water quality assessment that is fully described in the Water Quality Specialist Report (USFS 2023e, Section 7) along with the predicted chemical concentrations. At a high level, sources of contaminants included tailings, ore stockpiles, development rock placed in the TSF embankment and buttress, development rock backfilled into open pits, treated water discharges, and runoff from mine disturbance (USFS 2024, pp. 195–196). The EDFs implemented to reduce effects to wolverines and other wildlife from chemical contamination include: (1) a wildlife exclusion fence will be installed around the TSF, process facility areas, and related process ponds to prevent wildlife from accessing contaminated fluids and (2) mud sumps used for drilling operations will have perimeter fencing to keep wildlife from accidently falling into the excavation (USFS 2024, Appendix B).

Fuel storage and handling will be conducted in accordance with a Spill Prevention, Control, and Countermeasure Plan that will utilize surface storage tanks with primary and secondary containment. There will be no uncontained or underground infrastructure associated with fuel storage. Therefore, releases from fuel storage are not expected to contact the environment. Duration of spill risk will last throughout the life of the proposed action (approximately 20-25 years for construction and mining activities, up to 40 or more for monitoring and water treatment). However, the duration of any single hazardous materials spill or release will be temporary (hours or days). A fuel or chemical spill within the action area will likely be readily contained and cleaned up without any release to the environment. In addition to EDFs reducing the risk of an accidental spill, wolverines are land mammals and avoid noise disturbance, spatially reducing the risk of a wolverine being present near a spill in a construction area if one were to occur. Therefore, effects to wolverines are expected to be discountable.

Closure and Reclamation

Long-term impacts from contaminants will include those during the reclamation period during which contact water will be treated to minimize multiple contaminants. Chemical contaminant loads were modeled under baseline, active mining, and post-reclamation conditions at multiple sites within the action area (USFS 2023e, entire). The Water Quality Specialist Report (USFS 2023e, Section 7) provides details and references regarding water treatment plans and requirements. Three water types will require management over the life of the proposed action: contact water from mine facilities, which includes dewatering water (construction through closure); consolidation water from the TSF (in closure which includes process water); and sanitary wastewater (construction through early closure).

After mine closure and final reclamation of the TSF Buttress and pit backfill surfaces which incorporate geosynthetic liners to inhibit interaction between water resources and mined materials, contact water treatment will no longer be required; but process water treatment for the TSF will continue longer, through approximately year 40 to account primarily for consolidation water from the TSF which will exhibit a diminishing flow rate over that period.

Poor water quality can significantly impact wolverine populations, although the specific effects on these animals are less documented compared to other species. Wolverines are known for their resilience and adaptability, inhabiting remote and often pristine environments. However, they are not immune to environmental changes, including those related to water quality. Wolverines primarily feed on a variety of small to medium-sized mammals and carrion. Changes in food source quality from contaminants can accumulate in the food web causing bioaccumulation of these contaminants in wolverines, including mercury (Peraza et al. 2023, pp. 19–20). Effects to wolverines from poor water quality and contaminants are expected to be insignificant because water quality in the mine site area, particularly in the EFSFSR and in Sugar Creek, has chemical constituents (arsenic, antimony, copper, and mercury) that currently exceed acceptable thresholds (USFS 2023e, Section 7; outlined in the bull trout baseline section), so effects from water quality are not expected to differ much from baseline conditions.

Duration of spill risk will last throughout the life of the proposed action (approximately 20-25 years for construction and mining activities, up to 40 or more for monitoring and water treatment). However, the duration of any single hazardous materials spill or release will be temporary (hours or days). A fuel or chemical spill within the action area will likely be readily contained and cleaned up without any release to the environment. In addition to EDFs reducing the risk of an accidental spill, wolverines are land mammals and avoid noise disturbance, spatially reducing the risk of a wolverine being present near a spill in a construction area if one were to occur. Therefore, effects to wolverines are expected to be discountable.

7.3.4 Summary of Effects

Wolverines in the action area will face adverse effects from habitat loss, especially denning habitat, and displacement due to human activities. Sixteen wolverines have been documented in or near the action area, including four within the mine site. Construction will disturb 2,341.6 acres of denning and suitable habitat, affecting dispersal, foraging, and other behaviors. Despite wolverines' persistence in high human disturbance areas, increased activity may lead them to avoid these areas. Additionally, 65 acres of disturbance will result from exploration drilling within the mine site, 427 acres from constructing access roads and geophysical investigation of the Burntlog Route, and 274.3 acres from construction of utilities and facilities. Although road construction will fragment habitat, it may not act as a barrier due to its width and adjacent tree cover. The majority of noise and light from construction and operations may disrupt wolverine behavior within 1-2 miles of the mine site, causing habitat displacement and fragmentation, interfering with communication, increasing stress, and potentially affecting reproductive success and survival rates. Continuous noise during operations, including the denning season, may cause females to abandon den sites, risking increased energy expenditure and offspring vulnerability. Increased public and proposed action use on roadways may increase vehicle collision risks, but restrictions and low-speed limits aim to minimize this. Winter plowing could attract other predators, increasing competition for food. Overall, while risks are introduced, implementation of EDFs are expected to minimize many adverse effects to wolverines. The transportation and use of hazardous materials during construction pose spill risks, but EDFs including proper storage, containment, and emergency response plans will minimize effects to wolverines to discountable levels.

There are 340,606.7 acres of modeled suitable and denning habitat within the action area; 231,053.9 acres are denning habitat. Approximately 2,341.6 acres of disturbance (652.9 acres temporary and 1,688.7 permanent) will be lost through the life of the mine to modeled suitable and denning habitat from proposed action activities at the mine site, access roads, and utilities and facilities. There are 779.3 acres of temporary and permanent disturbance that will occur within denning habitat. Proposed action activities will reduce habitat connectivity and cause displacement (primarily from increased noise and human presence) of individual wolverines and possibly denning females. However, based on the implementation of EDFs, such as those related to speed limits on access roads and noise and light reducing measures, impacts to wolverines and their habitat, including denning habitat, will be minimized. Nonetheless, adverse effects from den abandonment and loss of young may occur due to a potential den site located within one mile of the mine site and the presence of other wolverines documented within and near the action area.

The loss of modeled suitable and denning habitat from the proposed action will be 0.7% of all suitable and denning habitat in the action area (2,341.6 / 340,606.7). The loss of denning habitat from all proposed action activities will be 0.3% of denning habitat within the action area (779.3 / 231,053.9) and only 0.02% of all denning habitat in Idaho (779.3 / 3,431,818). The loss of habitat will be localized throughout the action area, with much of it being reclaimed after mine closure. Long-term effects are not expected to wolverines in the action area or statewide nor are measurable effects expected to the conservation or recovery of the species.

The primary threats to wolverine rangewide are climate change and inadequate regulatory mechanisms related to climate change, and secondary threats are harvest (trapping) and small population size (USFWS 2023d, entire). The proposed action and its effects to wolverines are not considered among the primary threats to wolverine. While the proposed action will not ameliorate threats acting on wolverine, neither will it exacerbate those threats rangewide.

7.4 Cumulative Effects

The implementing regulations for section 7 define cumulative effects to include the effects of future State or private activities that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

On-going management activities within the action area that may impact wolverines and overlap with the proposed action include hunting, trapping, fishing, hiking, snowmobiling, cross-country skiing, projects associated with timber sales, wildland fuels reduction, energy development (e.g., transmission lines, alternative energy), transportation route improvements and maintenance, mining, and other special uses (USFS 2024, p. 528). These private lands are remote and not easily accessed, especially in the winter, so most of the activities will occur outside of the wolverine denning season. Winter recreation likely occurs on private lands, but it is unknown to what extent. It may have future incremental disturbance impacts on wolverines, but due to its remoteness, winter recreation is not likely to contribute significantly in reducing the survival of the species.

7.5 Conclusion

After reviewing the current status of North American wolverine, the environmental baseline in the action area, effects of the proposed action, and cumulative effects, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of wolverine. The Service's rationale for this conclusion is presented below.

Wolverines in the action area will face adverse effects from disturbance to 2,341.6 acres of denning and suitable habitat; displacement due to human activities; noise and light from construction and operations causing habitat displacement and fragmentation and den abandonment, increased use on roadways may increase vehicle collision risks, and winter plowing may attract predators, increasing competition for food. These adverse effects may result in impairment of feeding, breeding, and sheltering activities by wolverines. The noise and light reduction EDFs employed at the mine site include sound dampening and muffling equipment utilized to minimize noise excursion; high noise activities will be scheduled at the same time when possible; and pumps, generators, and engines will be turned off when not in use to avoid unnecessary noise generation and reduce energy consumption when practicable. While implementation of EDFs will minimize noise effects to wolverines by minimizing the intensity and duration, it will not completely eliminate them. Also, if a wolverine is observed within or near the action area, coordination will occur regarding modifications to construction and operation activities to avoid potential disruption of wolverine denning activities.

Due to their low population densities and large home ranges, the number of individuals occupying the action area is expected to be small. Adverse effects will be limited to individual denning wolverines and their young, as dispersing and resident wolverines are expected to avoid increased human presence and move freely to other suitable and denning habitat in and beyond the action area. The Service expects impacts will occur at the individual and localized scale and will not rise to a level that would impact the entire action area, Forest, or rangewide population numbers, reproduction, or distribution.

The loss of modeled suitable and denning habitat from the proposed action will be 0.7% of all suitable and denning habitat acres in the action area (2,341.6 acres / 340,606.7 acres x 100 = 0.687%). The loss of denning habitat from all proposed action activities will be 0.3% of denning habitat within the action area (779.3 acres/ 231,053.9 acres x 100 = 0.337 %) and only 0.02% of all denning habitat in Idaho (779.3 acres/ 3,431,818 acres x 100 = 0.023%). The loss of habitat will be localized throughout the action area. The 2,341.6 acres of modeled suitable and denning habitat is not expected to be completely lost, though, due to reclamation activities and regeneration of disturbed areas after mine closure. Long-term effects are not expected to wolverines in the action area or statewide nor are measurable effects expected to the conservation or recovery of the species.

7.6 Incidental Take Statement

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened fish and wildlife species, respectively, without specific exemption. Take is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct." Harm is defined by the Service as an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering (50 CFR 17.3). Harass is defined as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering" (50 CFR 17.3).

Incidental take is defined as take "that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant" (50 CFR 402.02). Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of an Incidental Take Statement.

7.6.1 Form and Amount or Extent of Take Anticipated

Based on the effects analysis above, the Service finds incidental take of North American wolverine is reasonably certain to occur in the form of injury and mortality via den abandonment during the proposed action due to increased energy expenditure, reduced physical condition of adult females, and increased offspring vulnerability and loss of kits.

It is difficult to anticipate the number of dens that may be abandoned, the number of females that may be impacted, or the number of wolverine young that may be taken as a result of the proposed action. This type of reduced fitness or kit fatality cannot usually be documented, since wolverines are highly mobile, can move long distances, have well-camouflaged dens, and use multiple dens (natal and maternal). It is not practical to express the amount of this incidental take in terms of a number of individual wolverines for the following reasons:

1. Wolverines are not easily detected or observed in the wild.

2. Individual wolverines may react differently to disturbance, with some being more tolerant of human disturbance than others.

3. Not all female wolverines and kits that are exposed to disturbance will be adversely impacted to an extent where take is likely to occur.

Pursuant to 50 CFR 402.14(i)(1)(i), a surrogate can be used to express the anticipated level of take in an Incidental Take Statement, provided that the Service meets three criteria: (1) a causal link is established between the effects of the action on the surrogate and take of the listed species, (2) measuring take impacts to a listed species is not practical, and (3) a clear standard is set for determining when the level of anticipated take based on the surrogate has been exceeded.

The discussion above explains why it is not practical to express the amount or extent of take in terms of individual wolverines. Instead, the Service is using a habitat-based surrogate to express take of wolverines. The surrogate uses the acreage of wolverine denning habitat in the action area. Modeled suitable habitat and denning habitat is available on some portions, but not all of, the action area. Because denning habitat is what female wolverines depend on for reproduction, food, and shelter, denning habitat is more appropriate as an incidental take surrogate than suitable modeled habitat.

Some females with kits are reasonably certain to be harmed by the proposed action. Based on the documentation of only one female wolverine near the mine site (despite multiple studies and surveys between 2010 and 2017) and the amount of denning habitat available throughout (231,053.9) and outside of the action area (Figure *22*), the Service assumes very few adult females with kits will be affected in the action area but that incidental take is reasonably certain to occur. Using denning habitat as a surrogate, the Service anticipates incidental take will occur in the form of injury or mortality to wolverines via disturbance of 779.3 acres of denning habitat within the action area.

Take Exceedance Summary

Using the surrogate measure for incidental take, the Service assumes that the proposed action will result in incidental take of North American wolverine in the form of:

1. Disturbance of a total of 779.3 acres of denning habitat within the action area during all phases of the proposed action (construction, operation, and closure and reclamation).

If the proposed action exceeds the level of incidental take provided above, the Forest will be required to reinitiate consultation under 50 CFR 402.16(1).

7.6.2 Effect of the Take

In the accompanying Opinion, the Service determined that this level of anticipated take is not likely to jeopardize the continued existence of North American wolverine across its range. The loss of denning habitat from all proposed action activities will be 0.3% of denning habitat acres within the action area (779.3 / 231,053.9) and only 0.02% of all denning habitat in Idaho (779.3 / 3,431,818). The loss of habitat will be localized throughout the action area, with much of it being reclaimed after mine closure. Long-term effects are not expected to wolverines in the action area or statewide nor are measurable effects expected to the conservation or recovery of the species.

7.6.3 Reasonable and Prudent Measures

The Service finds that compliance with the proposed action outlined in the Assessment, including proposed environmental design features, is essential to minimizing the impact of incidental take of wolverines. If the proposed action, including EDFs, is not implemented as described in the Assessment and this Opinion, there may be effects of the action that were not considered in this Opinion, and reinitiation of consultation may be warranted.

The Service believes the measures proposed by the Forest are sufficient to minimize potential impacts to North American wolverine caused by the proposed action.

7.6.5 Reporting and Monitoring Requirement

In order to monitor the impacts of incidental take, the Federal agency or any applicant must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement per 50 CFR 402.14 (i)(3).

1. The Forest shall provide notify the Service if any wolverine is observed within the action area.
2. Disposition of Individuals Taken: In the course of implementing the proposed action addressed in this Opinion and the monitoring and reporting requirements addressed in this ITS, if dead, injured, or sick endangered or threatened species are detected and/or salvaged, the Service’s Office of Law Enforcement in Marsing, Idaho (208-442-9551)

and the Service's Ecological Services' office in Boise, Idaho (208-378-5243) shall be notified during normal business hours within three working days. Notification shall include the date, time, and precise location of the detection, and the species involved, and shall distinguish between injured and killed animals. If the listed species detected is not covered under this ITS, do not disturb the site and immediately contact the Service's Office of Law Enforcement referenced above.

3. During project implementation, the Forest shall promptly notify the Service of any emergency or unanticipated situations arising that may be detrimental to wolverine, relative to the proposed activity.

8. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery programs, or to develop new information on listed species.

1. Plant white pine blister rust resistant whitebark pine seedlings in appropriate habitat.
2. Identify, map, and monitor whitebark pine occurrences as well as mountain pine beetle or blister rust damage or death.
3. Apply mountain pine beetle control measures such as verbenone to whitebark pine plus trees and mature trees where appropriate.
4. Maintain and, where appropriate, increase efforts to prevent invasive plant introductions.
5. Lethally remove any brook trout captured while electrofishing and implement further brook trout removal efforts whenever feasible and biologically supported.
6. Work with partners to conduct bull trout redd surveys in the Upper EFSFSR local population to better determine the distribution and abundance of bull trout.
7. Coordinate bull trout recovery with listed anadromous fish species recovery in the South Fork Salmon River and Lemhi River core areas.
8. Continue ongoing bull trout population monitoring efforts within the South Fork Salmon River and Lemhi River core areas. Maintain current long term datasets assessing abundance and distribution of bull trout. Continue to coordinate surveys among partner agencies.
9. In the Lemhi River core area, implement actions necessary to accelerate recovery of riparian vegetation and streambanks and reduce negative effects in identified problem areas (Hayden watershed, Little Eightmile, Canyon, Reservoir, Upper Texas, and Little Timber creeks).

9. Reinitiation Notice

This concludes formal consultation on the Stibnite Gold Project. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if:

1. The amount or extent of incidental take is exceeded,
2. New information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion,
3. The agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this Opinion, or
4. A new species is listed or critical habitat designated that may be affected by the action.

10. LITERATURE CITED

10.1 Published Literature

Adams, P.W., and H.A. Froehlich. 1981. Compaction of forest soils.

AECOM. 2019. Stibnite Gold Project EIS Technical Memo: Whitebark Pine Potential Habitat Model. 24 pp.

Ainslie, B.J., J.R. Post, and A.J. Paul. 1998. Effects of Pulsed and Continuous DC Electrofishing on Juvenile Rainbow Trout. North American Journal of Fisheries Management 18: 905–918.

Alaska Department of Fish and Game. 1991. Blasting Standards for the Protection of Fish.

Aronsson, M. 2017. O Neighbour, Where Art Thou? Spatial and social dynamics in wolverine and lynx, from individual space use to population distribution. Swedish University of Agricultural Sciences, Uppsala.

ATS Consulting. 2013. Final Construction Noise and Vibration Report SR 520, I-5 to Medina: Bridge Replacement and HOV Project. Prepared for Washington State Department of Transportation. 76 pp.

Bakke, P.D. 2002. Geomorphic Controls on Sedimentation Impacts. *in American Geophysical Union, Fall Meeting 2002*.

Baldwin, A.K., and A.B. Etheridge. 2019. Arsenic, antimony, mercury, and water temperature in streams near Stibnite mining area, central Idaho, 2011–17: U.S. Geological Survey Scientific Investigations Report 2019-5072. 30 pp.

Banci, V. 1994. Wolverine. General Technical Report RM-254. U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado. 99–127 pp.

Bash, J., C. Berman, and S. Bolton. 2001. Effects of Turbidity and Suspended Solids on Salmonids. November. Center For Streamside Studies, University of Washington, 80 pp.

Beechie, T., C. Jordan, T. Hillman, T. Fisher, J. O'Neal, C. Paulsen, and P. Roni. 2013. Benefits of Tributary Habitat Improvement in the Columbia Rive Basin – Results of Research, Monitoring and Evaluation, 2007-2012. Prepared for Bonneville Power Administration and U.S. Bureau of Reclamation. July 2013. 42 pp.

Berg, L., and T.G. Northcote. 1985. Changes in territorial, gill-flaring, and feeding behavior in juvenile coho salmon (Oncorhyncus kisutch) following short-term pulses of suspended sediment. Canadian Journal of Fisheries and Aquatic Science 42: 1410–1417.

BioAnalysts. 2021. Evaluation of Upper EFSFSR Fish Passage Barriers-Technical Memorandum. Boise, Idaho. 26 pp.

Bjornlie, N.L., C.D. Atkinson, R.M. Inman, and J.T. Boulerice. 2021. Long-lived Female Wolverines (*Gulo gulo*) Documented at the Southern Edge of Recolonization. The American Midland Naturalist 185: 110–119.

Bjornn, T.C., M.A. Brusven, M.P. Molnau, J.H. Milligan, R.A. Klamt, and C. Schaye. 1977. Transport of Granitic Sediment in Streams and its Effects on Insects and Fish. University of Idaho, College of Forestry, Wildlife, and Range Sciences, Moscow, Idaho. 53 pp.

Bjornn, T.C., and D.W. Reiser. 1991. Habitat Requirements of Salmonids in Streams. Pages 83–138 *in* W. R. Meehan, editor. Influences of Forest and Rangeland Management on Salmonid Fishes and their Habitats. Special Publication 19. American Fisheries Society. Bethesda, Maryland.

BOR. 2021. West-Wide Climate and Hydrology Assessment. Technical Memorandum No. ENV-2021-001. Bureau of Reclamation, 423 pp.

BPA. 2023. HIP HANDBOOK Guidance of Programmatic Requirements and Process. FY 2023. Bonneville Power Administration, Portland, Oregon., 145 pp.

Brown and Caldwell. 2018. Final Stibnite Gold Project Stream and Pit Lake Network Temperature (SPLNT) Model Existing Conditions Report. Prepared for Midas Gold Idaho, Inc. Valley County, Idaho. March 6, 2018. 133 pp.

Brown and Caldwell. 2020. Draft Technical Memorandum: Evaluation of Aquatic Life Criteria for Copper Using the Biotic Ligand Model for the Stibnite Gold Project. 7 pp.

Brown and Caldwell. 2019. 2018 Yellow Pine Pit Lake Fish Sampling Summary Report. Prepared for Midas Gold Idaho, Inc., Valley County, Idaho. 44 pp.

Brown and Caldwell. 2020a. Stibnite Gold Project Water Quality Management Plan, Final. Prepared for Midas Gold Inc., Valley County, Idaho. March 27, 2020. 162 pp.

Brown and Caldwell. 2020b. 2019 Yellow Pine Pit Lake Fish Sampling Summary Report. Prepared for Midas Gold Idah, Inc., Vallley County, Idaho. 44 pp.

Brown and Caldwell. 2021a. Fishway Operations and Management Plan. Prepared for Perpetua Resources Idaho, Inc., Valley County, Idaho. 163 pp.

Brown and Caldwell. 2021b. Stibnite Gold Project: Environmental Monitoring and Management Program. Prepared for Perpetua Resources Idaho, Inc. 63 pp.

Brown and Caldwell. 2021c. Stream and Pit Lake Network Temperature (SPLNT) Model Refined Proposed Action (ModPRO2) Report. Prepared for Perpetua Resources Idaho, Inc. Brown and Caldwell, Boise, Idaho. 245 pp.

Brown and Caldwell. 2021d. Water Resources Monitoring Plan. Prepared for Perpetua Resources Idaho, Inc. Brown and Caldwell, 50 pp.

Brown and Caldwell. 2021e. Stibnite Gold Project: Water Management Plan. Project Number 156122. Prepared for Perpetua Resources Idaho, Inc., Valley County, Idaho. Brown and Caldwell, Boise, Idaho. 638 pp.

Brown and Caldwell. 2022. Development Rock Management Plan, Final. Prepared for Perpetua Resources Idaho, Inc. Brown and Caldwell, Boise, Idaho. 143 pp.

Brown and Caldwell, McMillen Jacobs, and BioAnalysts. 2021. Fishway Operations and Management Plan. Prepared for Perpetua Resources Idaho, Inc. 163 pp.

Brown and Caldwell, Rio ASE, and BioAnalysts. 2021. Fish and Aquatic Resources Mitigation Plan. Prepared for Perpetua Resources Idaho, Inc., Valley County, Idaho. 90 pp.

Brumbaugh, W.G., D.P. Krabbenhoft, D.R. Helsel, J.G. Wiener, and K.R. Echols. 2001. A National Pilot Study of Mercury Contamination of Aquatic Ecosystems Along Multiple Gradients: Bioaccumulation in Fish. . USGS/BRD/BSR-200 1-0009. U.S. Department of Interior, U.S. Geological Survey, 32 pp.

Burns, D., M. Faurot, D. Hogen, M. McGee, R. Nelson, D. Olson, L. Wagoner, and C. Zurstadt. 2005. Bull Trout Populations on the Payette National Forest. Payette National Forest, 97 pp.

Carroll, K.A., A.J. Hansen, R.M. Inman, R.L. Lawrence, and A.B. Hoegh. 2020. Testing landscape resistance layers and modeling connectivity for wolverines in the western United States. Global Ecology and Conservation 23: 13 pp.

Chapman, D.W. 1988. Critical review of variables used to define effects of fines in redds of large salmonids. Transactions of the American Fisheries Society 117: 1–21.

Chiaramonte, L.V., K.A. Meyer, P.R. Branigan, and J.B. Reynolds. 2020. Effect of Pulsed DC Frequency on Capture Efficiency and Spinal Injury of Trout in Small Streams. N American J Fish Manag 40: 691–699.

Clevenger, A.P. 2019. Mapping the Wolverine Way: Identifying Conservation Corridors and Transboundary Linkages in the Canadian Crown of the Continent Region. Technical report INE/AUTC 19.13. Center for Environmentally Sustainable Transportation in Cold Climates, Fairbanks, AK. 107 pp. pp.

Committee on the Status of Endangered Wildlife in Canada. 2014. COSEWIC assessment and update status report on the wolverine, Gulo gulo, in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON.

Copeland, J.P. 1996. Biology of the Wolverine in Central Idaho. Master of Science. University of Idaho, Moscow, ID. 153 pp.

Copeland, J.P., K.S. McKelvey, K.B. Aubry, A. Landa, J. Persson, R.M. Inman, J. Krebs, E. Lofroth, H. Golden, J.R. Squires, A. Magoun, M.K. Schwartz, J. Wilmot, C.L. Copeland, R.E. Yates, I. Kojola, and R. May. 2010. The bioclimatic envelope of the wolverine (*Gulo gulo*): do climatic constraints limit its geographic distribution? Canadian Journal of Zoology 88: 233–246.

Cordone, A.J., and D.W. Kelley. 1961. The Influences of Inorganic Sediment on the Aquatic Life of Streams. 47. State of California, Resources Agency, Dept. of Fish and Game,.

Coull, B.C., and G. Chandler. 1992. Pollution and meiofauna - field, laboratory, and mesocosm studies. Oceanography and Marine Biology 30: 191–271.

Cox, Stephen. 2017. Terrestrial Wildlife Baseline Study. Stibnite Gold Project. Strobilus Environmental, LLC, 136 pp.

Culioli, J.-L., A. Fouquoire, S. Calendini, C. Mori, and A. Orsini. 2009. Trophic transfer of arsenic and antimony in a freshwater ecosystem: A field study. Aquatic Toxicology 94: 286–293.

DAC. 2021. Stibnite Gold Access Roads Snow Avalanche Hazard Assessment for Access Roads. Prepared for Perpetua Resources. Dynamic Avalanche Consulting LTD, Revelstoke, British Columbia, Canada. 178 pp.

Dalbey, S.R., T.E. McMahon, and W. Fredenberg. 1996. Effect of Electrofishing Pulse Shape and Electrofishing-Induced Spinal Injury on Long-Term Growth and Survival of Wild Rainbow Trout. North American Journal of Fisheries Management 16: 560–569.

Dodds, W.K., and M.R. Whiles. 2004. Quality and Quantity of Suspended Particles in Rivers: Continent-Scale Patterns in the United States. Environmental Management 33: 355–367.

Dovick, M.A., T.R. Kulp, R.S. Arkle, and D.S. Pilliod. 2016. Bioaccumulation trends of arsenic and antimony in a freshwater ecosystem affected by mine drainage. Environmental Chemistry 13: 149.

Dwyer, W.P., and R.G. White. 1997. Management Briefs: Effect of Electroshock on Juvenile Arctic Grayling and Yellowstone Cutthroat Trout Growth, 100 Days after Treatment. North American Journal of Fisheries Management 17: 174–177.

Eagles-Smith, C., J. Wiener, C. Eckley, J. Willacker, D. Evers, M. Marvin-Dipasquale, D. Obrist, J. Fleck, G. Aiken, J. Lepak, A. Jackson, J. Webster, A. Stewart, J. Davis, C. Alpers, and J. Ackerman. 2016. Mercury in western North America: A synthesis of environmental contamination, fluxes, bioaccumulation, and risk to fish and wildlife. Science of The Total Environment 568: 1213–1226.

Elle, S., and D. Schill. 1999. Electrofishing Injury Studies: Impacts of Electrofishing Injury at the Population Scale. Subproject 3. *in* Project 3: Wild Trout Investigations. Idaho Department of Fish and Game. Boise, Idaho.

EPA. 2003. EPA Region 10 Guidance for Pacific Northwest State and Tribal Temperature Water Quality Standards. EPA 910-B-03-002. U.S. Environmental Protection Agency, Region 10 Office of Water. Seattle, Washington. 57 pp.

EPA. 2018a. Final Aquatic Life Ambient Water Quality Criteria for Aluminum. U.S. Environmental Protection Agency, Office of Water, Washington D.C. 329 pp.

EPA. 2018b. Final Aquatic Life Ambient Water Quality Criteria for Aluminum 2018. EPA-822-R-18-001. December 2018. U.S. Environmental Protection Agency, Washington D.C. 329 pp.

ESS. 2019. Fish Passage Barriers, Critical Habitat, Intrinsic Potential and Occupancy Model Impacts. Tecnical Memorandum. Stibnite Gold Project., Idaho. December 2019. Ecosystem Sciences, LLC, Boise, Idaho. 30 pp.

ESS. 2022a. 2021 Modified Mine Plan Stream Temperature Impacts Technical Memorandum, Stibnite Gold Project, Idaho. Ecosystem Sciences, LLC, Boise, Idaho. 57 pp.

ESS. 2022b. 2021 Modified Mine Plan Fish Passage Barriers Technical Memorandum, Stibnite Gold Project. Ecosystem Sciences, LLC, Boise, Idaho. 23 pp.

Essig, D.A. 2010. Arsenic, Mercury, and Selenium in Fish Tissue and Water from Idaho's Major Rivers: A Statewide Assessment. Idaho Department of Environmental Quality, Boise, Idaho. 118 pp.

Evans Mack, D. 2018. Western States Wolverine Conservation Project Baseline Camera Survey 2016–2017 Idaho Results. Idaho Department of Fish and Game, 23 pp.

FAA. 2020. Advisory Circular 70/7460-1M. Obstruction Marking and Lighting. U.S. Department of Transportation, Federal Aviation Administration, Washington, D.C. 109 pp.

Farmer, A.M. 1993. The effects of dust on vegetation—a review. Environmental Pollution 79: 63–75.

Faulkner, S.G., M. Welz, W.M. Tonn, and D.R. Schmitt. 2008. Effects of Simulated Blasting on Mortality of Rainbow Trout Eggs. Trans Am Fish Soc 137: 1–12.

Fisheries Hydroacoustic Working Group, (FHWG). 2008. Agreement in principle for interim criteria for injury to fish from pile driving activities.

Fleck, J.A., M. Marvin-DiPasquale, C.A. Eagles-Smith, J.T. Ackerman, M.A. Lutz, M. Tate, C.N. Alpers, B.D. Hall, D.P. Krabbenhoft, and C.S. Eckley. 2016. Mercury and methylmercury in aquatic sediment across western North America. Science of The Total Environment 568: 727–738.

Fraley, J.J., and B.B. Shepard. 1989. Life history, ecology and population status of migratory bull trout (*Salvelinus confluentus*) In the Flathead Lake and River system, Montana. Montana Northwest Science 63: 133–143.

Francis, C., and J. Barber. 2013. A framework for understanding noise impacts on wildlife: an urgent conservation priority. Frontiers in Ecology and the Environment 11: 305–313.

Frisch, A.J., and T.A. Anderson. 2000. The response of coral trout (Plectropomus leopardus) to capture, handling and transport and shallow water stress. Fish Physiology and Biochemistry 23: 23.

Furniss, M.J., T.D. Roelofs, and C.S. Vee. 1991. Road construction and maintenance. American Fisheries Society Special Publication 19: 297–323.

Garcia and Associates. 2014. Terrestrial Wildlife Baseline Study Addendum #1. Stibnite Gold Project. 22 pp.

Gooseff, M.N., R.O. Hall, and J.L. Tank. 2007. Relating transient storage to channel complexity in streams of varying land use in Jackson Hole, Wyoming. Water Resources Research 43: 2005WR004626.

Griffith, J.S., and R.W. Smith. 1993. Use of winter concealment cover by juvenile cutthroat and brown trout in the South Fork of the Snake River, Idaho. North American Journal of Fisheries Management 13: 823–830.

Halofsky, J.E., D.L. Peterson, S.K. Dante-Wood, L. Hoang, J.J. Ho, and L.A. Joyce (eds). 2018. Climate change vulnerability and adaptation in the Northern Rocky Mountains [Part 1]. Gen. Tech. Rep. RMRS-GTR-374. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO: 273 pp.

Han, S.-K., H.-S. Han, D.S. Page-Dumroese, and L.R. Johnson. 2009. Soil compaction associated with cut-to-length and whole-tree harvesting of a coniferous forest. Can. J. For. Res. 39: 976–989.

Hash, H.S. 1987. Wolverine. Pages 574–585 *in* Wild furbearer management and conservation in North America. M. Novak, J.A. Baker, M.E. Obbard, and B. Malloch, editors. Ontario Ministry of Natural Resources, Toronto.

Hausleitner, D., A. Kortello, M. Barrueto, W. Harrower, and J. Krebs. 2024. Guidelines for Winter Recreation near Wolverine Dens in Montane Western North America. Journal of Ecosystems and Management 24: 20 pp-20 pp.

HDR. 2017. Surface Water Quality Baseline Study. Stibnite Gold Project. Prepared for Midas Gold Idaho, Inc. by HDR, Inc. Boise, Idaho.

HDR, Inc. 2017a. Vegetation Baseline Study Stibnite Gold Project. 117 pp.

HDR, Inc. 2017b. Noise Baseline Study. Stibnite Gold Project. 112 pp.

HDR, Inc. 2017c. Noise Baseline Study Addendum. Stibnite Gold Project. 72 pp.

Heeres, R. 2020. Den shifting behaviour of female wolverines (*Gulo gulo*) in Northern Sweden. Master of Science. Swedish University of Agricultural Sciences, Grimsö Wildlife Research Station. 32 pp.

Heinemeyer, K., J. Squires, M. Hebblewhite, J.J. O'Keefe, J.D. Holbrook, and J. Copeland. 2019. Wolverines in winter: indirect habitat loss and functional responses to backcountry recreation. Ecosphere 10: e02611.

Heinemeyer, K.S., J.R. Squires, M. Hebblewhite, J.S. Smith, J.D. Holbrook, and J.P. Copeland. 2017. Wolverine – Winter recreation research project: Investigating the interactions between wolverines and winter recreation. Final report 79 pp.

Hemre, G.I., and A. Krogdahl. 1996. Effect of handling and fish size on secondary changes in carbohydrate metabolism in Atlantic salmon, *Salmo salar* L. Aquaculture Nutrition 2: 249–252.

Henley, W.F., M.A. Patterson, R.J. Neves, and D.A. Lemly. 2000. Effects of sedimentation and turbidity on lotic food webs: a concise review for natural resource managers. Reviews in Fisheries Science 8: 125–139.

Hicks, B.J., P.A. Hall, P.A. Bisson, and J.R. Sedell. 1991. Responses of Salmonids to Habitat Changes. Pages 483–518 *in* Meehan, W. R., editor. Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. American Fisheries Society Special Publication. Bethesda, Maryland.

High, B., K.A. Meyer, D.J. Schill, and E.R.J. Mamer. 2008. Distribution, abundance, and population trends of bull trout in Idaho. North American Journal of Fisheries Management 28: 1687–1701.

Hillman, T.W., J.S. Griffith, and W.S. Platts. 1987. Summer and winter habitat selection by juvenile Chinook salmon in a highly sedimented Idaho stream. Transactions of the American Fisheries Society 116: 185–195.

Hogen, D.M., and D.L. Scarnecchia. 2006. Distinct fluvial and adfluvial migration patterns of a relict charr, *Salvelinus confluentus*, stock in a mountainous watershed, Idaho, USA. Ecology of Freshwater Fish 15: 376–387.

I. Peraza, J. Chetelat, M. Richardson, T. S. Jung, M. Awan, and S. Baryluk. 2023. Diet and landscape characteristics drive spatial patterns of mercury accumulation in a high-latitude terrestrial carnivore. PLoS ONE 18: 28.

IDEQ. 2017. Implementation Guidance for the Idaho Copper Criteria for Aquatic Life Using the Biotic Ligand Model. Idaho Department of Environmental Quality, Boise, Idaho. 35 pp.

IDEQ. 2022. IDEQ Final 2022 §305(b) Status Report. Available at: https://mapcase.deq.idaho.gov/wq2022/scripts/adb2022.aspx?WBIDSEGID=ID17060204SL024_05 (Accessed June 10, 2024).

IDEQ. 2022. Idaho's 2022 Integrated Report, Appendix A: Clean Water Act Section 305(b) List and Section 303(d) List-Final. Idaho Department of Environmental Quality, Boise, Idaho. 390 pp.

IDHW. 1999. Lemhi River TMDL. An Allocation of Nonpoint Source Pollutants in the Water Quality Limited Watersheds of the Lemhi River Valley. Idaho Department of Health and Welfare, Division of Environmental Quality, Boise, Idaho. 152 pp.

IDL. 1992. Best Management Practices for Mining in Idaho. Idaho Department of Lands, Boise, Idaho. 158 pp.

IDWR. 2024. In the Matter of Application for Permit 77-14378 and Applications for Transfer 85396, 85397, 85398, and Application for Exchange 85538: Preliminary Order Approving Applications. Idaho Department of Water Resources, Boise, Idaho. 33 pp.

Inman, R.M., B.L. Brock, K.H. Inman, S.S. Sartorius, B.C. Aber, B. Giddings, S.L. Cain, M.L. Orme, J.A. Fredrick, B.J. Oakleaf, K.L. Alt, E. Odell, and G. Chapron. 2013. Developing priorities for metapopulation conservation at the landscape scale: Wolverines in the Western United States. Biological Conservation 166: 276–286.

IRMA. 2018. IRMA Standard for Responsible Mining. IRMA-STD-001. June 2018. Initiative for Responsible Mining Assurance, 202 pp.

Jensen, D.W., E.A. Steel, A.H. Fullerton, and G.R. Pess. 2009. Impact of Fine Sediment on Egg-To-Fry Survival of Pacific Salmon: A Meta-Analysis of Published Studies. Reviews in Fisheries Science 17: 348–359.

Jokinen, M.E., S.M. Webb, D.L. Manzer, and R.B. Anderson. 2019. Characteristics of Wolverine (*Gulo gulo*) dens in the lowland boreal forest of north-central Alberta. The Canadian Field-Naturalist 133: 1–15.

Jones & Stokes and Illingworth and Rodkin. 2009. Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish. Final. Prepared for Calironia Department of Transportation by ICF Jones & Stokes and Illingowrth and Rodkin, Inc. 298 pp.

Karwan, D.L., J.A. Gravelle, and J.A. Hubbart. 2007. Effects of timber harvest on suspended sediment loads in Mica Creek, Idaho. Forest science 53: 181–188.

Kock, T.J., S.D. Evans, A.C. Hansen, R.D. Perry, H.C. Hansel, P.V. Haner, and R.G. Tomka. 2018. Evaluation of Sockeye Salmon after Passage through an Innovative Upstream Fish-Passage System at Cle Elum Dam, Washington, 2017. U.S. Geological Survey Open-File Report 2017-1116. 40 pp.

Kolden, K., and C. Aimone-Martin. 2013. Blasting Effects on Salmonids. 35 pp.

Kortello, A., D. Hausleitner, and G. Mowat. 2019. Mechanisms influencing the winter distribution of wolverine Gulo gulo luscus in the southern Columbia Mountains, Canada. Wildlife Biology 2019: wlb.00480.

Krebs, J., E. Lofroth, J. Copeland, V. Banci, D. Cooley, H. Golden, A. Magoun, R. Mulders, and B. Shults. 2004. Synthesis of survival rates and causes of mortality in North American wolverines Gehrt [ed.]. Journal of Wildlife Management 68: 493–502.

Krott, P. 1960. Ways of the wolverine. Natural History 69: 16–29.

Krupka, J., K. Halupka, and J.D.L. Vergne. 2011. Crosswalk between the Bull Trout Matrix and Bull Trout Critical Habitat Primary Constituent Elements. 7 pp. pp.

LeBlanc, G.A., and J.W. Dean. 1984. Antimony and thallium toxicity to embryos and larvae of fathead minnows (Pimephales promelas). Bulletin of Environmental Contamination and Toxicology 32: 565–569.

Lloyd, D.S. 1987. Turbidity as a water quality standard for salmonid habitats in Alaska. North American Journal of Fisheries Management 7: 34–45.

Lloyd, D.S., J.P. Koenings, and J.D. LaPerriere. 1987. Effects of Turbidity in Fresh Waters of Alaska. North American Journal of Fisheries Management 72: 18–33.

Lorenz, T.J., K.A. Sullivan, A.V. Bakian, and C.A. Aubry. 2011. Cache-site selection in Clark's nutcracker (*Nucifraga columbiana*). The Auk 128: 237–247.

Luensmann, S. 2008. *Gulo gulo*. Fire Effects Information System 29.

Lukacs, P.M., D. Evans Mack, R. Inman, J.A. Gude, J.S. Ivan, R.P. Lanka, J.C. Lewis, R.A. Long, R. Sallabanks, Z. Walker, S. Courville, S. Jackson, R. Kahn, M.K. Schwartz, S.C. Torbit, J.S. Waller, and K. Carroll. 2020. Wolverine Occupancy, Spatial Distribution, and Monitoring Design. The Journal of Wildlife Management 84: 841–851.

M3. 2021. Stibnite Gold Project Feasibility Study Technical Report. Prepared for Midas Gold, Idaho, Inc. M3 Engineering and Technology, Tucson, Arizona. 675 pp.

Mack, D.E., and E. Hagen. 2022. Wolverine Persistence in an Idaho Core Population Area. Idaho Department of Fish and Game, 21 pp.

Magoun, A. 1985. Population characteristics, ecology, and management of wolverines in northwestern Alaska. PhD Dissertation. University of Alaska, Fairbanks, Alaska.

Manning, W.J. 1971. Effects of limestone dust on leaf condition, foliar disease incidence, and leaf surface microflora of native plants. Environmental Pollution (1970) 2: 69–76.

May, J.T., R.L. Hothem, C.N. Alpers, and M.A. Law. 2000. Mercury Bioaccumulation in Fish in a Region affected by Historic Gold Mining: The South Yuba River, Deer Creek, and Bear

River watersheds, California, 1999. U.S. Geological Survey Open-File Report No. 00-367). Open-File Report 35 pp.

May, R., L. Gorini, J. van Dijk, H. Brøseth, J.D.C. Linnell, and A. Landa. 2012. Habitat characteristics associated with wolverine den sites in Norwegian multiple-use landscapes. Journal of Zoology 287: 195–204.

McMichael, G.A., A.L. Fritts, and T.N. Pearsons. 1998. Electrofishing Injury to Stream Salmonids; Injury Assessment at the Sample, Reach, and Stream Scales. North American journal of fisheries management 18: 894–904.

McMillen Jacobs. 2018. CONFIDENTIAL. Stibnite Gold Project Feasibility Study: East Fork South Fork Salmon River (EFSFSR) Tunnel Design Documentation Report. Prepared for Midas Gold Idaho, Inc. 139 pp.

Megahan, W.F. 1982. Channel sediment storage behind obstructions in forested drainage basins draining the granitic bedrock of the Idaho batholith. Pages 114–121 *in* USDA Forest Service General Technical Report, PNW-141.

Meyer, K.A., E.O. Garton, and D.J. Schill. 2014. Bull Trout Trends in Abundance and Probabilities of Persistence in Idaho. North American Journal of Fisheries Management 34: 202–214.

Midas Gold. 2016a. Stibnite Gold Project Plan of Restoration and Operations, Valley County, Idaho. Midas Gold, Idaho, Inc., Donnelly, Idaho. 486 pp.

Midas Gold. 2016b. Stibnite Gold Project Plan of Restoration and Operations. Executive Summary. Midas Gold, Inc., Donnelly, Idaho. 30 pp.

Midas Gold. 2019. Stibnite Gold Project Water Quality Summary Report (Conditional), 2012-2018. 277 pp.

Mowat, G., A.P. Clevenger, A.D. Kortello, D. Hausleitner, M. Barrueto, L. Smit, C. Lamb, B. DorsEy, and P.K. Ott. 2020. The sustainability of wolverine trapping mortality in southern Canada. The Journal of Wildlife Management 84: 213–226.

Muck, J. 2010. Biological effects of sediment on bull trout and their habitat – guidance for evaluating effects. U.S. Fish and Wildlife Service Washington Fish and Wildlife Office, Lacey, Washington. 57 pp.

MWH. 2017. Aquatic Resources 2016 Baseline Study. Stibnite Gold Project, Midas Gold Idaho, Inc. MWH Americas, Inc., Boise, Idaho. 418 pp.

Myers, T.J., and S. Swanson. 1996. Long-term Aquatic Habitat Restoration: Mahogany Creek, Nevada, as a Case Study. Water Resources Bulletin 32: 241–252.

National Research Council. 1995. Science and the Endangered Species Act. National Academies Press, Washington, D.C.

Newcombe, C.P., and J.O.T. Jensen. 1996. Channel suspended sediment and fisheries: a synthesis for quantitative assessment of risk and impact. North American Journal of Fisheries Management 16: 693–727.

Newcombe, C.P., and D.D. MacDonald. 1991. Effects of suspended sediments on aquatic ecosystems. North American Journal of Fisheries Management 11: 72–82.

Nielson, J. 1998. Scientific sampling effects: electrofishing California's endangered fish populations. Fisheries 23: 6–12.

NMFS. 2000. Guidelines for Electrofishing Waters Containing Salmonids Listed Under the Endangered Species Act. NOAA,.

NMFS. 2014. Final Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for Water Quality Toxics Standards for Idaho. NMFS Consultation Number: 2000-1484. NOAA, National Marine Fisheries Service, Seattle, Washington. 528 pp.

NMFS. 2022a. NOAA Fisheries West Coast Region Guidance to Improve the Resilience of Fish Passage Facilities to Climate Change. National Marine Fisheries Service, NOAA Fisheries West Coast Regional Office, Portland, Oregon. 163 pp.

NMFS. 2022b. NOAA Fisheries West Coast Region Anadromous Salmonid Passage Design Manual. National Marine Fisheries Service West Coast Region Environmental Service Branches, Portland, Oregon. 181 pp.

Nordli, K., Z. Walton, A. Eriksen, M. Rogstad, B. Zimmermann, C. Wikenros, M. Aronsson, and P. Wabakken. 2024. Carcass provisioning and intra-guild risk avoidance between two sympatric large carnivores. Behav Ecol Sociobiol 78: 17.

Olla, B.L., M.W. Davis, and C.B. Schreck. 1995. Stress-induced impairment of predator evasion and non-predator mortality in Pacific salmon. Aquaculture research 26: 393–398.

Padgett, P.E., W.M. Dobrowolski, M.J. Arbaugh, and S.A. Eliason. 2007. Patterns of carbonate dust deposition: implications for four federally endangered plant species. madr 54: 275–285.

Peraza, I., J. Chételat, M. Richardson, T.S. Jung, M. Awan, S. Baryluk, A. Dastoor, W. Harrower, P.M. Kukka, C. McClelland, G. Mowat, N. Pelletier, C. Rodford, and A. Ryjkov. 2023. Diet and landscape characteristics drive spatial patterns of mercury accumulation in a high-latitude terrestrial carnivore. PLOS ONE 18: e0285826.

Perkins, D.L., R.E. Means, and A.C. Cochrane. 2016. Conservation and management of whitebark pine ecosystems on Bureau of Land Management lands in the western United States. Technical Reference 6711–1. Bureau of Land Management, Denver, CO. 93 pp.

Perpetua. 2021a. Environmental Legacy Management Plan. Perpetua Resources Idaho, Inc., Valley County, Idaho. 56 pp.

Perpetua. 2021b. Plan of Development Electrical Transmission Stibnite Gold Project. Perpetua Resources Idaho, Inc., Valley County, Idaho. 186 pp.

Perpetua. 2021c. Stibnite Gold Project: Refined Proposed Action ModPRO2. Perpetua Resources Idaho, Inc., Donnely, Idaho. 127 pp.

Perpetua. 2021d. Stibnite Gold Project: Site Wide Water Balance Model Refined Proposed Action (ModPRO2) Final Report. Perpetua Resources Idaho, Inc., Boise, Idaho. 107 pp.

Perpetua. 2022a. Transportation Management Plan. Perpetua Resources Idaho, Inc., Valley County, Idaho. 45 pp.

Perpetua. 2022b. Stibnite Gold Project Transportation Management Plan. Perpetua Resources Idaho, Inc., Valley County, Idaho. 45 pp.

Perpetua. 2023. Stibnite Gold Project Joint Application for Permits, U.S. Army Corps of Engineers, Idaho Department of Water Resources, and Idaho Department of Lands. Perpetua Resources Idaho, Inc., Boise, Idaho. 733 pp.

Phillips, R.W., R.L. Lantz, E.W. Claire, and J.R. Moring. 1975. Some Effects of Gravel Mixtures on Emergence of Coho Salmon and Steelhead Trout Fry. Transactions of the American Fisheries Society 104: 461–466.

Poole, G., J. Dunham, M. Hicks, D. Keenan, J. Lockwood, E. Materna, D. McCullough, C. Mebane, J. Risley, S. Sauter, S. Spalding, and D. Sturdevant. 2001. Scientific Issues Relating to Temperature Criteria for Salmon, Trout, and Char Native to the Pacific Northwest. Technical Synthesis EPA 910-R-01-007. U.S. Environmental Protection Agency, 24 pp.

Pratt, K.L. 1992. A review of bull trout life history. Pages 5–9 *in Oregon Chapter of the American Fisheries Society*. Proceedings of the Gearhart Mountain Bull Trout Workshop. Corvallis, Oregon.

Pulliainen, E. 1968. Breeding biology of the wolverine (*Gulo gulo L.*) in Finland. Annales Zoologici Fennici 5: 338–344.

Quesnel, H.J., and M.P. Curran. 2000. Shelterwood harvesting in root-disease infected stands—post-harvest soil disturbance and compaction. Forest Ecology and Management 133: 89–113.

Regan, T., J. Sauder, and C. Mosby. 2020. Mapping Winter Recreation in Idaho’s Wolverine Habitat - Interim Performance Report. Interim Performance Report Idaho Department of Fish and Game, Boise, ID. 9 pp.

Rieman, B.E., and J.D. McIntyre. 1993. Demographic and habitat requirements for conservation of bull trout. General Technical Report Rocky Mountain Research Station. 38 pp.

Rio ASE. 2021. Stibnite Gold Project: Stream Design Report. Prepared for Perpetua Resources, Idaho, Inc. Rio Applied Science and Engineering, Boise, Idaho. 489 pp.

Rio ASE. 2023. Lemhi Little Springs Habitat Restoration Project, Draft Basis of Design Report (Preliminary Design). Prepared for Perpetua Resources Idaho, Inc. Rio Applied Science and Engineering, Boise, Idaho. 58 pp.

Rio ASE and Biomark. 2021. Upper Lemhi River Multiple Reach Assessment Report. Prepared with the Idaho Governor’s Office of Species Conservation under Bureau of Reclamation Cooperative Agreement R19AC00078. Rio Applied Science and Engineering and Biomark, Inc., 172 pp.

Rowe, M., D. Essig, and B. Jessup. 2003. Guide to Selection of Sediment Targets for Use in Idaho TMDLs.

Rundle, S.D., and A.G. Hildrew. 1990. The distribution of micro-arthropods in some southern English streams: the influence of physicochemistry. Freshwater Biology 23: 411–431.

Rutherford, D.L., B.N. McGee, and M. Pribil. 2020. Hg Concentrations of Fish Tissue Samples in the Vicinity of Yellow Pine, Idaho.

S. Creel, J. Fox, A. Hardy, J. Sands, B. Garrott, and R. Peterson. 2002. Snowmobile activity and glucocorticoid stress responses in wolves and elk. Conservation Biology 16: 809–814.

Sawaya, M.A., A.P. Clevenger, and M.K. Schwartz. 2019. Demographic fragmentation of a protected wolverine population bisected by a major transportation corridor. Biological Conservation 236: 616–625.

Scheuhammer, A., B. Braune, H.M. Chan, H. Frouin, A. Krey, R. Letcher, L. Loseto, M. Noël, S. Ostertag, P. Ross, and M. Wayland. 2015. Recent progress on our understanding of the biological effects of mercury in fish and wildlife in the Canadian Arctic. Science of The Total Environment 509–510: 91–103.

Schill, D.J., and F.S. Elle. 2000. Healing of Electroshock-Induced Hemorrhages in Hatchery Rainbow Trout. North American Journal of Fisheries Management 20: 730–736.

Scrafford, M.A., T. Avgar, R. Heeres, and M.S. Boyce. 2018. Roads elicit negative movement and habitat-selection responses by wolverines (*Gulo gulo luscus*). Behavioral Ecology 29: 534–542.

Servizi, J.A., and D.W. Martens. 1987. Some effects of suspended Fraser River sediments on sockeye salmon (*Oncorhynchus nerka*), p. 254-264, In H.D. Smith, L. Margolis, and C.C. Wood (ed.). Sockeye salmon (*Oncorhynchus nerka*) population biology and future management. Canadian Special Publication of Fisheries and Aquatic Sciences 96: 254–264.

Servizi, J.A., and D.W. Martens. 1992. Sublethal responses of coho salmon (*Oncorhynchus kisutch*) to suspended sediments. Canadian Journal of Fisheries and Aquatic Sciences 49: 1389–1395.

Sharber, N.G., and S.W. Carothers. 1988. Influence of Electrofishing Pulse Shape on Spinal Injuries in Adult Rainbow Trout. North American Journal of Fisheries Management 8: 117–122.

Sigler, J.W., T.C. Bjornn, and F.H. Everest. 1984. Effects of chronic turbidity on density and growth of steelheads and coho salmon. Transactions of the American Fisheries Society 113: 142–150.

Silvestri, S., P. Orlando, F. Brugè, G. Falcioni, and L. Tiano. 2016. Effect of different metals on oxidative state and mitochondrial membrane potential in trout erythrocytes. Ecotoxicology and Environmental Safety 134: 280–285.

SRK. 2021a. Stibnite Gold Project ModPRO2 Site Wide Water Chemistry (SWWC) Modeling Report. Prepared for Perpetua Resources Idaho, Inc. SRK Consulting (U.S.), Inc., Reno, Nevada. 558 pp.

SRK. 2021b. Stibnite Gold Project ModPRO2 Site-Wide Water Chemistry (SWWC) Model Sensitivity Analysis Report. Prepared for Perpetua Resources Idaho, Inc. SRK Consulting (U.S.), Inc., Reno, Nevada. 197 pp.

Stantec. 2018. 2017 Aquatic Baseline Study Technical Memo, Appendix 1. Watershed Condition Indicators and Monitoring Results – Water Temperature. Stibnite Gold Project. Prepared for Midas Gold Idaho, Inc. 51 pp.

Stantec. 2019. 2018 Aquatic Baseline Study for the Stibnite Gold Project Technical Memorandum. Prepared for Midas Gold Idaho, Inc. 156 pp.

Stantec. 2020. 2019 Aquatic Baseline Study for the Stibnite Gold Project Technical Memorandum. Prepared for Midas Gold Idaho, Inc. 141 pp.

Suttle, K.B., M.E. Power, J.M. Levine, and C. McNeely. 2004. How fine sediment in riverbeds impairs growth and survival of juvenile salmonids. Ecological Applications 14: 969–974.

Tetra Tech. 2020. 2019 Whitebark Pine Survey Report. 54 pp.

Tetra Tech. 2021. Reclamation and Closure Plan. Prepared for Perpetua Resources Idaho, Inc. Tetra Tech, Inc., Boise, Idaho. 270 pp.

Tetra Tech. 2023. Compensatory Stream and Wetland Mitigation Plan. Stibnite Gold Project, Valley County, Idaho. Prepared for Perpetua Resources, Inc. Tetra Tech, Inc. Boise, Idaho. U.S. Army Corps of Engineers File Number: NWW-2013-0321. 308 pp.

Tetra Tech. 2024. Stibnite Gold Project GRAIP Lite Analysis (RFAI-146). Prepared for Perpetua Resources Idaho, Inc. by Tetra Tech, Inc. Bothell, Washington. 46 pp.

Thompson, K.G., E.P. Bergersen, and R.B. Nehring. 1997. Injuries to Brown Trout and Rainbow Trout Induced by Capture with Pulsed Direct Current. North American Journal of Fisheries Management 17: 141–153.

Tierra Group. 2021. Stibnite Gold Project Tailings Consolidation Technical Memorandum. Addendum. Prepared for Perpetua Resources Idaho, Inc. 9 pp.

Timothy, J. 2013. Alaska Blasting Standard for the Proper Protection of Fish. Technical Report No. 13-03. Alaska Reparatment of Fish and Game, Division of Habitat, 11 pp.

Tomback, D.F., A.F. Poole, and B.F. Gill. 2020. Clark's Nutcracker (*Nucifraga columbiana*). Available at: https://doi.org/10.2173/bow.clanut.01 (Accessed July 3, 2023).

Trombulak, S.C., and C.A. Frissell. 2000. Review of Ecological Effects of Roads on Terrestrial and Aquatic Communities. Conservation Biology 14: 18–30.

USFS. 2003. Record of Decision for the Final Environmental Impact Statement and Revised Payette National Forest Land and Resource Management Plan. Revised July 2003. 626 pp.

USFS. 2007a. Biological Assessment for the Potential Effects of Managing the Payette National Forest in the South Fork Salmon River Section 7 Watershed on Snake River Spring/Summer Chinook Salmon, Snake River Steelhead, and Columbia River Bull Trout and Biological Evaluation for Westslope Cutthroat Trout. Volume 28: Ongoing and New Actions. U.S. Forest Service, Payette National Forest, McCall, Idaho. 306 pp.

USFS. 2007b. Biological assessment for the potential effects of managing the Payette National Forest in the South Fork Salmon River section 7 watershed. Payette National Forest,.

USFS. 2009. Stabilization Selection Guide for Aggregate- and Native-Surfaced Low-Volume Roads. U.S. Department of Agriculture, Forest Service, 156 pp.

USFS. 2010. Boise National Forest Land and Resource Management Plan 2003-2010 Integration. 773 pp.

USFS. 2014. Transportation Structures Handbook. U.S. Forest Service, Washington, D.C. 92 pp.

USFS. 2016. Decision Notice and Finding of No Significant Impact , Golden Meadows Exploration Project. Krassel Ranger District, Payette National Forest, Valley County, Idaho. 97 pp.

USFS. 2021. Sensitive Plants Resouce Report Burntlog Route Geophysical Inverstigation Project. 8 pp.

USFS. 2022. Biological Assessment for Federally Listed Snake River Spring/Summer Chinook Salmon, Snake River Steelhead, Columbia River Bull Trout, Northern Idaho Ground Squirrel, Canada Lynx, and Federally Proposed Whitebark Pine Administrative Settlement and Order on Consent for Removal Actions. 109 pp.

USFS. 2023a. Stibnite Gold Project. Noise Specialist Report. 83 pp.

USFS. 2023b. Biological assessment for the potential effects from the Brundage Mountain Resort Centennial Lift replacement. Payette National Forest, 25 pp.

USFS. 2023c. Stibnite Gold Project: Access and Transportation Specialist Report. Prepared for the Payette and Boise National Forests. USDA Forest Service, Payette National Forest, McCall, Idaho. 87 pp.

USFS. 2023d. Stibnite Gold Project: Wetlands and Riparian Resources Specialist Report. Prepared for the Payette and Boise National Forests. USDA Forest Service, Payette National Forest, McCall, Idaho. 137 pp.

USFS. 2023e. Stibnite Gold Project: Water Quality Specialist Report. Prepared for the Payette and Boise National Forests. USDA Forest Service, Payette National Forest, McCall, Idaho. 212 pp.

USFS. 2024. Stibnite Gold Project Biological Assessment. Prepared for the Payette and Boise National Forests. July 2024. Stantec Consulting Services, Boise, Idaho, 710 pp.

USFWS. 1998. A Framework to Assist in Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Bull Trout Subpopulation Watershed Scale. U.S. Fish and Wildlife Service, 46 pp.

USFWS. 1999. Endangered and Threatened Wildlife and Plants; Determinations of Threatened Status for Bull Trout in the Coterminous United States. 64 FR 58910-58933 pp.

USFWS. 2002. Chapter 1, introduction. in: bull trout (*Salvelinus confluentus*) draft recovery plan. U. S. Fish and Wildlife Service,.

USFWS. 2008. Bull trout (*Salvelinus confluentus*) 5-year review: summary and evaluation. 55 pp.

USFWS. 2010. Bull Trout Final Critical Habitat Justification: Rationale for why Habitat is Essential, and Documentation of Occupancy. U.S. Fish and Wildlife Service, Idaho Fish and Wildlife Office, Boise, Idaho, Pacific Region, Portland, Oregon. 1,035 pp.

USFWS. 2011. Crosswalk between the Bull Trout Matrix and Bull Trout Critical Habitat Primary Constituent Elements. Prepared by: Jeff Krupka, Karl Halupka, and Judy De La Vergne, Central Washington Field Office, Wenatchee, Washington. March 31, 2011. 7 pp.

USFWS. 2012a. Biological opinion for the Restoration Activities at Stream Crossings.

USFWS. 2012b. Recommended Fish Exclusion, Capture, Handling, and Electroshocking Protocols and Standards. Prepared by Nancy Brennnan-Dubbs, U.S. Fish and Wildlife Service, Washington Fish and Wildlife Office, Lacey, Washington. 17 pp.

USFWS. 2013. Federal Register Part II: Department of the Interior, Fish and Wildlife Service, 50 Code of Federal Regulations Part 17, Endangered and Threatened Wildlife and Plants; Endangered and Threatened Wildlife and Plants; Threatened Status for the Distinct Population Segment of the North American Wolverine Occurring in the Contiguous United States; Establishment of a Nonessential Experimental Population of the North American Wolverine in Colorado, Wyoming, and New Mexico; Proposed Rules. Federal Register 78: 7864–7890.

USFWS. 2014. Final Biological Opinion on the Effects to Bull Trout and Bull Trout Critical Habitat from the Implementation of Proposed Actions Associated with the Plan of Operations for the Montanore Minerals Corporation Copper/Silver Mine as Proposed by the U.S. Forest Service, Kootenai National Forest. U.S. Fish and Wildlife Service, Montana Ecological Services Office, 238 pp.

USFWS. 2015a. Recovery plan for the coterminous United States population of bull trout (*Salvelinus confluentus*). U.S. Fish and Wildlife Service, Portland, Oregon. 179 pp.

USFWS. 2015b. Upper Snake recovery unit implementation plan for bull trout (*Salvelinus confluentus*). Idaho Fish and Wildlife Office, Boise, Idaho. 113 pp.

USFWS. 2015c. Biological opinion for the Idaho Habitat Restoration Programmatic. Idaho Fish and Wildlife, 117 pp.

USFWS. 2015d. Biological Opinion for the Idaho Water Quality Standards for Numeric Water Quality Criteria for Toxic Pollutants. U.S. Fish and Wildlife Service, Idaho Fish and Wildlife Office, Boise, Idaho. 363 pp.

USFWS. 2018a. Biological opinion for the Payette National Forest's authorization of the yellow pine pit lake sampling project. Idaho Fish and Wildlife Office, 72 pp.

USFWS. 2018b. Species Status Assessment Report for the North American Wolverine (*Gulo gulo luscus*). U.S. Fish and Wildlife Service, Mountain-Prairie Region, Lakewood, CO. 179 pp.

USFWS. 2021a. Biological opinion for the Outfitter and Guide Operations. 67 pp.

USFWS. 2021b. Biological opinion for the Payette National Forest Programmatic Activities. Idaho Fish and Wildlife Office, 153 pp.

USFWS. 2021c. Species status assessment report for the whitebark pine, *Pinus albicaulis*. v1.3. Wyoming Ecological Services Field Office, U.S. Fish and Wildlife Service, Cheyenne, Wyoming. 188 pp.

USFWS. 2022. Biological Opinion for the Stibnite ASAOC Removal Actions Project. Ref. No. 01EIFW00-2022-0015829-S7-001. U.S. Fish and Wildlife Service, Idaho Fish and Wildlife Office, Boise, Idaho, 102 pp.

USFWS. 2023a. The Final Biological and Conference Opinion on the Nationwide Aerial Application of Fire Retardant on National Forest System Land. U.S. Fish & Wildlife Service,.

USFWS. 2023b. Biological Opinion for the Aquatic Organism Passage Project. 2023-0067581. U.S. Fish and Wildlife Service, Idaho Fish and Wildlife Service, Chubbuck, Idaho. 69 pp.

USFWS. 2023c. Programmatic Biological Opinion and Conference Opinion for Fire Suppression Actions on the Boise National Forest.

USFWS. 2023d. Species Status Assessment Addendum for North American Wolverine (*Gulo gulo luscus*). 96 pp.

USFWS. 2023e. Federal Register: Department of the Interior, Fish and Wildlife Service, 50 Code of Federal Regulations Part 17, Endangered and Threatened Wildlife and Plants; Threatened Species Status With Section 4(d) Rule for North American Wolverine. Federal Register 88: 83726–83772.

USFWS. 2024a. Biological Opinion and Concurrence for the Burntlog Geophysical Investigation. 2023-0095258-001. U.S. Fish and Wildlife Service, Snake River Fish and Wildlife Office, Boise, Idaho. 77 pp.

USFWS. 2024b. Biological opinion for the Stibnite Road Remediation Project. Idaho Fish and Wildlife Office, 47 pp.

Uthe, P., B. Knoth, T. Copeland, A.E. Butts, B.J. Bowersox, and J. Diluccia. 2017. Intensively monitored watersheds and restoration of salmon habitat in Idaho: ten-year summary report. IDFG 17-14. 218 pp.

Valley County. 2008. Valley County Minimum Standards for Public Road Design and Construction. Valley County, Idaho. 27 pp.

Walls, C.J. 2020. The Effectiveness of Large Woody Debris Placement at Improving Freshwater Rearing Habitat and Enhancing Juvenile Salmon (Oncorhynchus spp.) Production. WWU Graduate School Collection. Western Washington University, Bellingham, Washington. 67 pp.

Washington Department of Transportation. 2019. Biological Assessment Preparation Manual, Chapter 7: Construction Noise Impact Assessment. Olympia, Washington. 94 pp.

Waters, T.F. 1995. Sediment in Streams: Sources, Biological Effects, and Control. American Fisheries Society Monograph 7: 61–117.

Watertight Solutions. 2007. Hydrologic Effects of Proposed 20-Year Harvest (2006-2025) Manning Diversified Forest Products. Report Prepared for Manning Diversified Forests

Products, Manning, Alberta. Prepared by Watertight Solutions Ltd., Edmonton, Alberta. March 2007. 54 pp.

Weaver, T.M., and J. Fraley. 1991. Fisheries Habitat and Fish Populations. Flathead Basin Forest Practices Water Quality and Fisheries Cooperative Program. Flathead Basin Commission, Kalispell, Montana.

Weaver, T.M., and R.G. White. 1985. Coal Creek Fisheries Monitoring Study Number Iii. F. S. Final Report to United States Department of Agriculture, Flathead National Forest Contract No. 53-0385-3-2685. Montana State University Cooperative Fisheries Research Unit, Bozeman, Montana.

Witt, C., J. DeRose, and J. Shaw. 2018. Idaho's forest resources, 2006–2015. Resource Bulletin RMRS-RB-29. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO. 84 pp.

Witt, C., J.D. Shaw, M.T. Thompson, S.A. Goeking, J. Menlove, M.C. Amacher, T.A. Morgan, and C. Werstak. 2012. Idaho's forest resources, 2004-2009. Resource Bulletin RMRS-RB-14. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO. 134 pp.

Wood, P.J., and P.D. Armitage. 1997. Biological Effects of Fine Sediment in the Lotic Environment. Environmental Management 21: 203–217.

Wright, D.G., and G.E. Hopky. 1998. Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters. Canadian Technical Report of Fisheries and Aquatic Sciences 2107.

Young, M.K., D.J. Isaak, K.S. McKelvey, M.K. Schwartz, K.J. Carim, W. Fredenberg, T.M. Wilcox, T.W. Franklin, G.L. Chandler, D.E. Nagel, S.L. Parkes-Payne, D.L. Horan, and S.P. Wollrab. 2017. Species occurrence data from the Range-Wide Bull Trout eDNA Project.

10.2 *In Litteris* References

U.S. Fish and Wildlife Service. 2006, *in litt.* Memorandum from Director (U.S. Fish and Wildlife Service) to Regional Directors and Manager (U.S. Fish and Wildlife Service). Subject: Recovery Units and Jeopardy Determinations under Section 7 of the Endangered Species Act.