FINAL

Fisheries and Aquatic Resources Mitigation Plan

Prepared for

Midas Gold Idaho, Inc.

Valley County, Idaho

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List of Abbreviations

ADF&G	Alaska Department of Fish and Game
BA	biological assessment
BNF	Boise National Forest
BMP	best management practice
BC	Brown and Caldwell
bull trout	Columbia River bull trout
CFR	Code of Federal Regulations
Chinook salmon	Snake River spring/summer Chinook salmon
CMP	Conceptual Stream and Wetland Mitigation Plan
CWA	Clean Water Act
DA	Department of the Army
DRSF	development rock storage facility
EFH	essential fish habitat
EFSFSR	East Fork of the South Fork of the Salmon River
EIS	environmental impact statement
EMMP	Environmental Monitoring and Management Program
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FMP	Fisheries and Aquatic Resources Mitigation Plan
GIS	geographic information system
HIP	Habitat Improvement Program
IDEQ	Idaho Department of Environmental Quality
IDFG	Idaho Department of Fish and Game
IDL	Idaho Department of Lands
IPDES	Idaho Pollutant Discharge Elimination System
Midas Gold	Midas Gold Idaho, Inc.
MWH	MWH Americas, Inc.
NOAA Fisheries	National Oceanic and Atmospheric Administration, National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
PNF	Payette National Forest
PIT	passive integrated transponder
PRO	Plan of Restoration and Operations
QA/QA	quality assurance/quality control
RFAI	request for additional information
Rio ASE	Rio Applied Science and Engineering
SFA	stream functional assessment
SGMP	Stibnite Gold Mitigation Plan
SGP	Stibnite Gold Project
SODA	Spent Ore Disposal Area

SRK	SRK Consulting, Inc.
steelhead	Snake River Basin steelhead trout
the Services	USFWS and NOAA Fisheries
TSF	tailings storage facility
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
WHMP	Wildlife Habitat Mitigation Plan
YPP	Yellow Pine pit

Section 1

Purpose

The purpose of this Fisheries and Aquatic Resources Mitigation Plan (FMP) is to describe the measures proposed by Midas Gold Idaho, Inc. (Midas Gold) to protect fish and aquatic resources during mine operation, site reclamation, closure, and post-closure at the proposed Stibnite Gold Project (SGP or Project). The FMP provides information on how Midas Gold plans to:

- Avoid and minimize impacts to fish species and aquatic resources during Project construction and operation.
- Implement ongoing protection and mitigation measures such as stream habitat enhancement, fishway operations, fish protection during mining and stream diversions, stream restoration, water quality management, and other protective best management practices (BMPs).
- Monitor mitigation actions to ensure they are implemented correctly and have met established success criteria.

The FMP focuses specific attention on how Midas Gold proposes to minimize and mitigate adverse impacts on the following fish species listed as threatened under the Endangered Species Act (ESA) (ESA-listed species):

- Columbia River bull trout (bull trout; *Salvelinus confluentus*)
- Snake River spring/summer Chinook salmon (Chinook salmon; *Oncorhynchus tshawytscha*)
- Snake River Basin steelhead (steelhead; *Oncorhynchus mykiss*).

The FMP also considers westslope cutthroat trout (*Oncorhynchus clarki lewisi*), as it is designated by the U.S. Department of Agriculture (USDA) U.S. Forest Service (USFS) Northern and Intermountain Regions and Idaho Department of Fish and Game (IDFG) as a "sensitive" species.

The FMP will be used to inform both the Draft Environmental Impact Statement (EIS) being prepared by the USFS and the ESA Section 7 consultation process, especially during the informal consultation process that will be completed with the United States Fish and Wildlife Service (USFWS) and the National Ocean and Atmospheric Administration, National Marine Fisheries Service (NOAA Fisheries).

The mitigation measures described in the FMP supplement and are in addition to those described in the Conceptual Stream and Wetland Mitigation Plan (CMP; Tetra Tech 2019a) and the Wildlife Habitat Mitigation Plan (WHMP; Tetra Tech 2019b). Each of these component plans to the Stibnite Gold Mitigation Plan (SGMP; Brown and Caldwell [BC] 2019a) will also contribute to the improvement of fish and aquatic habitat by creating and re-establishing streams and riparian areas, improving overall watershed health, and creating upland habitats on mine reclamation areas.

The FMP divides proposed mitigation actions into phases. The initial phase occurs prior to and during mine operations with the enhancement of existing stream habitats to address existing disturbances and construction of diversions around proposed mine facilities to minimize and avoid potential harm to aquatic species and minimize impacts to habitat and water quality. One example of these efforts is the proposed fishway in the diversion tunnel allowing the East Fork of the South Fork of the Salmon River (EFSFSR) to flow around Yellow Pine pit (YPP) during mine operations (Section 5.1).

The later phase includes restoration of streams impacted by the proposed mining by creating new stream channels designed to maximize habitat potential based on species-specific intrinsic potential

(Cooney and Holzer 2006) and geomorphic suitability (Rio ASE 2019a). Restoration would occur prior to the end of overall mining, as individual facilities are completed.

The amount of mitigation resulting from stream restoration and enhancement projects will be quantified using a tracking system, the Stream Functional Assessment (SFA) (Rio ASE 2019a). The SFA includes a ledger in which debits (impacts) and credits (mitigation) are quantified using known and agreed upon ecological functional assessment models (Rio ASE 2019a). The SFA will also be used to address compensatory mitigation requirements under Section 404 of the Clean Water Act (CWA).

During the SGP planning and design stage, the principles of avoidance and minimization were applied to potential stream and aquatic resource impacts to the degree practicable. Proposed mitigation measures were developed to address unavoidable impacts that would occur during mining. This report summarizes the approach used to evaluate and develop these proposed mitigation measures. Details of the baseline conditions, SFA methodology, and stream design are found in the Aquatic Resources Baseline Study (MWH Americas, Inc. [MWH] 2017), Stream Design Report (Rio ASE 2019b), and Stream Functional Assessment Report (Rio ASE 2019a).

This FMP was specifically developed for the for the Project as described in the Plan of Restoration and Operations (PRO; Midas Gold 2016) and is intended to be included in the USFS EIS for the Project. However, the concepts, plans, and designs included here would be applicable to other alternatives examined in the EIS. Midas Gold anticipates that the SGMP and its component plans may change and be updated or revised as the USFS proceeds through the EIS process and develops the draft and final EIS for the SGP, as part of Department of the Army (DA) permit review process under Section 404 of the CWA, and through the ESA Section 7 informal consultation process. For this reason, some of the elements of the SGMP and component plans are conceptual now and will be refined or completed at the point at which the specifics of the final mitigation plan are known.

Section 2

Project Background

Midas Gold proposes to redevelop a historical mining area within the historic Stibnite Mining District of central Idaho. Large portions of the proposed mining area have been subject to more than a century of prior mining activity, leading to degraded and highly-disturbed ecosystems. Midas Gold proposes to conduct open-pit mining on unpatented and patented mining claims to produce gold, silver, and antimony, and in the process, restore significant existing environmental impacts from prior mine operators (Midas Gold 2016). The Project is in Valley County approximately 92 air miles (144 miles by road) northeast of Boise, Idaho; 44 air miles northeast of Cascade, Idaho; and 10 air miles east of Yellow Pine, Idaho. The following terms are used throughout the FMP:

- **Project area** includes all Project features, including both the mine area (Project site) and offsite infrastructure (Figure 2-1).
- **Project site** includes the mine area (Figure 2-2).
- **Offsite infrastructure** includes all infrastructure and facilities outside of the mine area, including roads, transmission lines and line upgrades, and support facilities.

The Project site includes Midas Gold's private lands (patented claims) and unpatented mining (lode) and mill site claims located on Boise National Forest (BNF) and Payette National Forest (PNF) land that is administered by the USFS Payette National Forest Krassel Ranger District. The broader Project area includes the Project site as well as additional USFS and private land on which related activities and offsite infrastructure and facilities will occur.

The Project site occurs primarily within the EFSFSR drainage basin. The EFSFSR is joined by Johnson Creek 16 miles downstream near Yellow Pine and flows into the South Fork of the Salmon River approximately 14.5 miles downstream of the Johnson Creek confluence. Major tributaries in the EFSFSR basin include Sugar Creek, Meadow Creek, Johnson Creek, Riordan Creek, Burntlog Creek, Trout Creek, Hennessy Creek, Midnight Creek, Fiddle Creek, Garnet Creek, and Rabbit Creek, with West End Creek a tributary of Sugar Creek. The Project area also includes the Cabin Creek and Warm Lake Creek drainage basins, which drain to the South Fork of the Salmon River.

To facilitate the Project, Midas Gold would improve access to the Project site by upgrading and extending Burntlog Road to connect to an upgraded Thunder Mountain Road (collectively known as the Burntlog Route). Establishment of the Burntlog Route as the primary mine access route would avoid the haulage of fuel and reagents alongside Johnson Creek and EFSFSR (Figure 2-1). Finally, to provide the required power for the ore processing facilities, Midas Gold would contract with Idaho Power Company to upgrade the existing transmission line and substations from Lake Fork to the Johnson Creek substation (via Cascade) and extend electrical service to the Project site from the existing Johnson Creek substation, by installing approximately 8 miles of new transmission line, mostly along the historical powerline corridor (Figure 2-1).

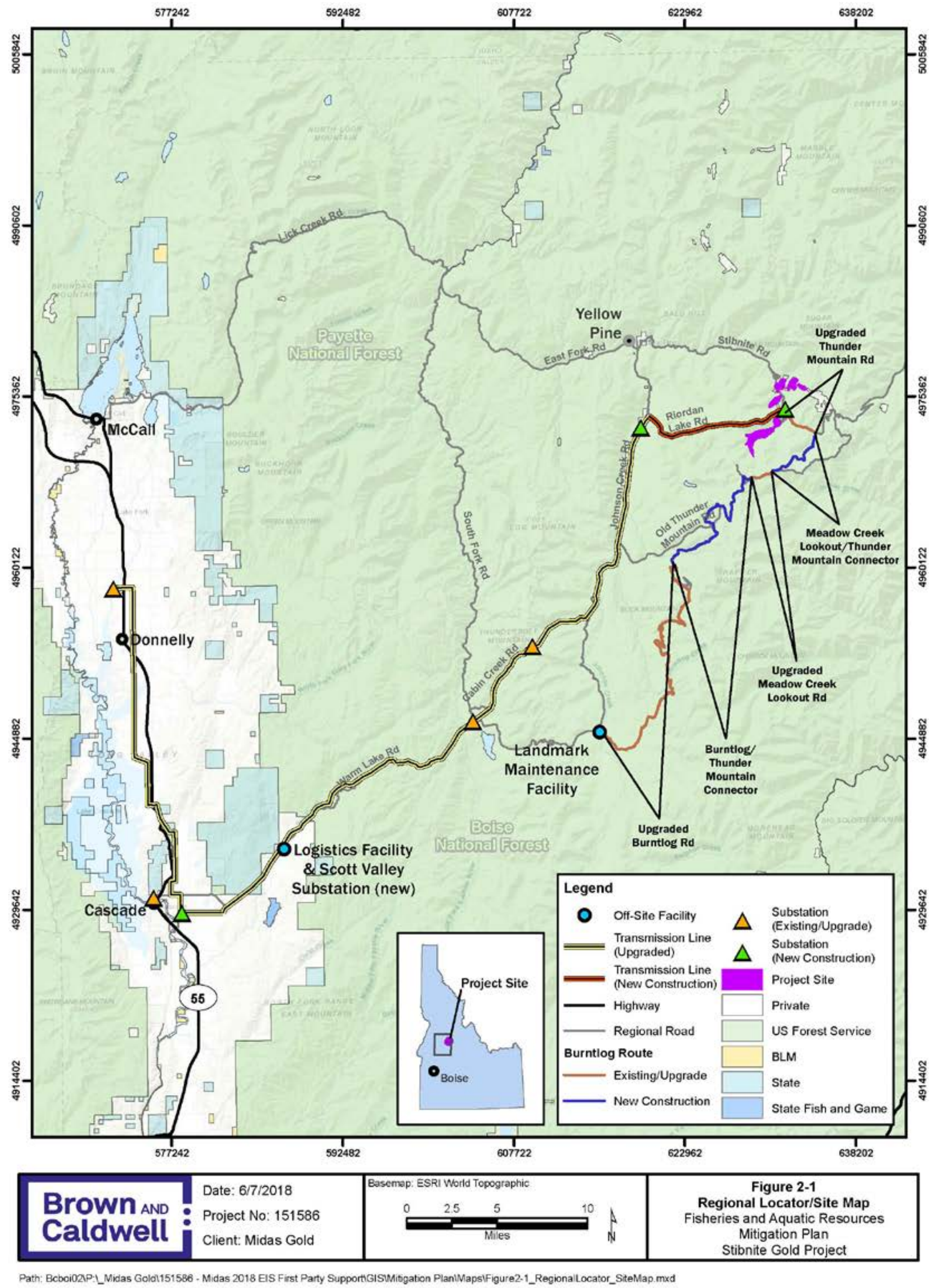

Figure 2-1. Regional Locator/Site Map

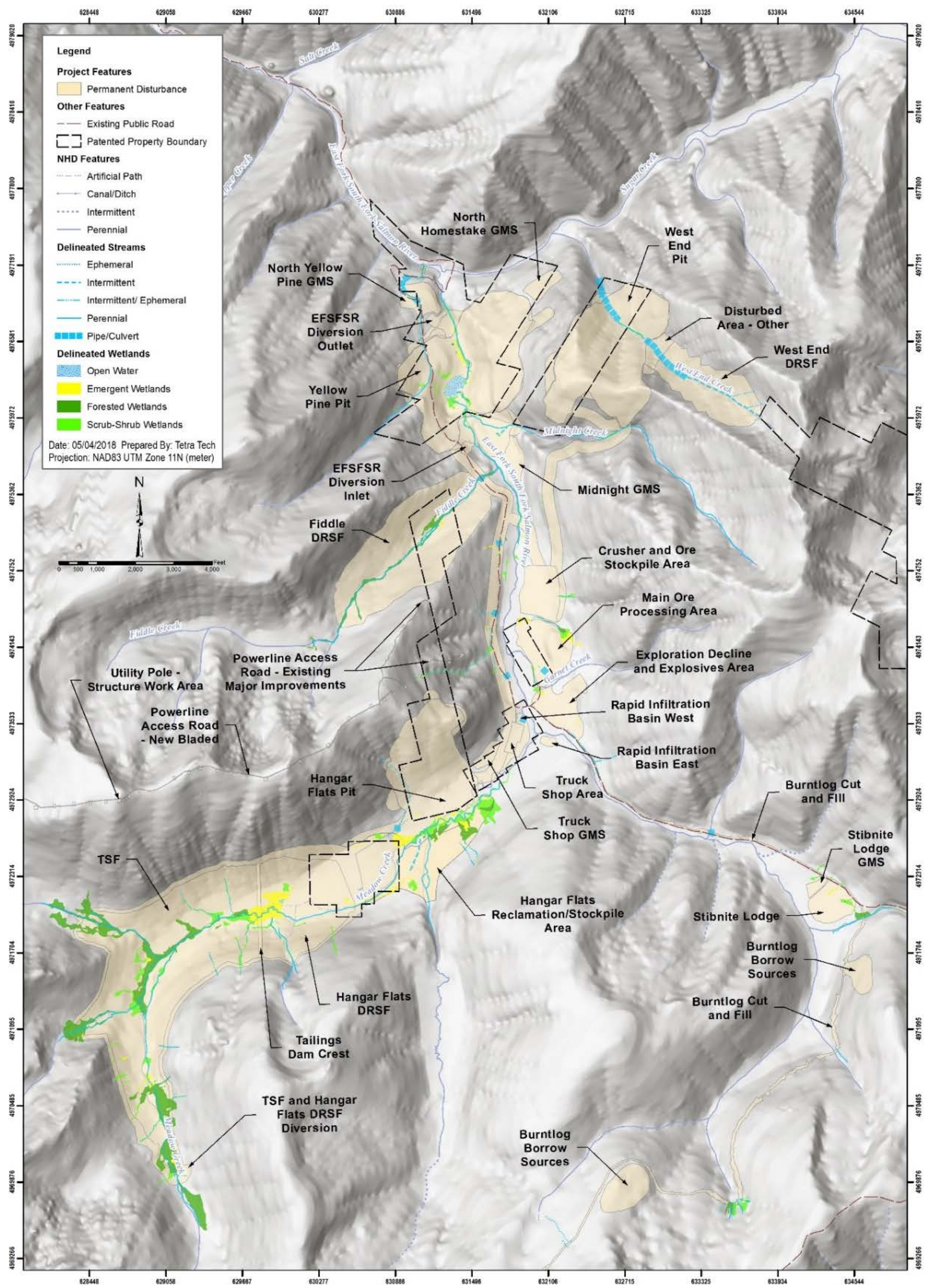

Figure 2-2. Proposed Mining Footprint Overview (Source: Tetra Tech)

2.1 Overview of Avoidance and Minimization

As part of the SGP planning and design, Midas Gold sought to avoid and minimize impacts to streams and wetlands to the extent practicable, while still meeting the Project purpose and need. These measures are described in the Draft Wetlands Avoidance and Minimization Measures Technical Memorandum submitted to the USFS and U.S. Army Corps of Engineers (USACE; Tetra Tech 2018), Appendix G of the PRO (Midas Gold 2016), and in several responses to Requests for Additional Information. Despite efforts to avoid and minimize, some unavoidable impacts would still take place, and compensatory mitigation will be required to comply with Section 404 of the CWA. Compensatory mitigation would involve a series of stream and wetland enhancement and restoration projects, described in detail in the CMP (Tetra Tech 2019a) and Stream Design Report (Rio ASE 2019b). Section 7 of this report provides a general summary of the restoration techniques that will be used to enhance and restore stream habitat.

In addition to avoidance and minimization implemented at the planning level, and required compensatory mitigation under the CWA, Midas Gold also proposes to implement BMPs to minimize impacts to fish and aquatic resources throughout the life of mine (Section 6). Midas Gold has also considered the timing of proposed impacts, and when possible, has deferred impacts to occur later in the Project and scheduled proposed enhancement and restoration projects earlier in the life of the mine to minimize the extent of potential impacts to fish species (Section 7.3). Furthermore, Midas Gold proposes to improve fish passage within and through the Project site by including a fishway in the proposed EFSFSR diversion tunnel. This would help to restore volitional migratory fish access to the EFSFSR and Meadow Creek—an area where historical mining activities have prevented upstream fish passage since 1938. The proposed design of the EFSFSR tunnel fishway is provided in McMillen Jacobs (2018) and additional detail is included in the Fishway Operations and Maintenance Plan (BC and BioAnalysts in progress); a summary is provided in Section 5.1.

2.2 Regulatory Context

2.2.1 Endangered Species Act

The SGP will undergo review and require consultation under the ESA as it may affect ESA-listed threatened and endangered species. The USFS is the lead federal agency for the ESA consultation, and the action agencies are USFWS and NOAA Fisheries (together, the "Services"). The USFS has ESA responsibility for bull trout and NOAA Fisheries has ESA responsibility for Chinook salmon and steelhead. Critical habitat has been designated for Chinook salmon, steelhead, and bull trout and occurs within the project area. For Chinook salmon, critical habitat includes all streams in the EFSFSR drainage that are currently occupied by Chinook salmon, or within habitat historically accessible by Chinook salmon. Steelhead critical habitat includes the EFSFSR upstream to Sugar Creek and including Sugar Creek. Critical habitat for bull trout includes the EFSFSR and Meadow Creek. The specific areas considered to be important as critical habitat within the project area are under consideration by the USFS and the Services in coordination with Midas Gold.

Understanding that the SGP may affect ESA-listed fish species and/or modify their designated critical habitat, Midas Gold has built into the SGMP measures for the enhancement and management of the known habitats for these ESA-listed species. The Stream Design Report (Rio ASE 2019b) specifically focuses on the habitat requirements and preferences of Chinook salmon, steelhead, and bull trout, and the FMP includes measures to avoid and minimize potential impacts on these species and westslope cutthroat trout during mining and reclamation.

Midas Gold was designated by the lead federal agency (USFS) as the non-Federal representative for informal consultation under the ESA and as having “Applicant” status under Section 7 ESA formal consultation for the SGP. As the designated non-federal representative, Midas Gold has and will continue to engage with the USFS, AECOM, and participating agencies in coordination with the Services to continue informal consultation under ESA. Midas Gold will also continue to coordinate on impact analyses and prepare a biological assessment (BA) for the SGP (BC 2018a) considering the potential impacts of the Project on ESA-listed species and their designated critical habitat and developing measures to avoid and minimize potential impacts during mining. Midas Gold anticipates identifying optional or additional fisheries management measures through the ESA Section 7 informal consultation process. Such measures may be added to the FMP, CMP, and the fishway design and operating plans.

2.2.2 Magnuson-Stevens Fishery Conservation and Management Act

In addition to compliance with ESA, the USFS is required to comply with the Magnuson-Stevens Fishery Conservation and Management Act on actions that might adversely affect essential fish habitat (EFH), including habitats that fish rely on throughout their life cycles, and the Act requires consultation with NOAA Fisheries. EFH consultations are typically combined with existing environmental review procedures, such as those required under the National Environmental Policy Act and the ESA.

EFH encompasses habitats necessary to allow sufficient production of aquatic species with commercial value to support a long-term sustainable fishery and contribute to a healthy ecosystem, including spawning and rearing habitats. Chinook salmon is the only fish species with EFH designated within the project area. As described in Pacific Fisheries Management Council (PFMC) (2014), Chinook salmon EFH includes all habitat currently or historically occupied within Washington, Oregon, Idaho, and California. Freshwater EFH for Chinook salmon consists of four major components, (1) spawning and incubation; (2) juvenile rearing; (3) juvenile migration corridors; and (4) adult migration corridors and holding habitat.

2.2.3 Clean Water Action, Section 404

Development of the SGP would result in a discharge of dredge and fill material into waters of the United States and is therefore required to obtain a permit from USACE. Section 404 of the CWA establishes the program to regulate the discharge of dredge and fill material into waters of the United States including wetlands. The regulatory program is administered by USACE, specifically the USACE Walla Walla District, Regulatory Division, for the SGP. As part of its permitting decision regarding the Project, USACE must evaluate the compliance of the Project with the CWA Section 404(b)(1) Guidelines and decide as to the issuance of a DA permit.

Section 3

Goals and Objectives

The FMP provides the framework for the fish and aquatic resources management program throughout all phases of the SGP, including construction, mine operations, and closure/reclamation. The overall goal of the FMP is to protect and promote the conservation of ESA-listed fish species and other aquatic resources within the Project area throughout all phases of the Project.

Specific objectives of the FMP include the following:

- **Manage operations to protect water quality during mining operations**: Diversions and other water infrastructure will be constructed and managed to keep non-contact (clean) water separate from contact water and process water, collect and manage/reuse contact water separately, and limit erosion (see item #4 below) to protect water quality in downstream reaches. Furthermore, existing sources of pollutant loading would be removed or isolated from contact with surface water and groundwater, and newly generated tailings and development rock would be stored in modern, fully engineered facilities that protect water quality.
- **Manage water infrastructure to protect fish during construction and mining operations:** Water diversions and other infrastructure (EFSFSR tunnel fishway) would be constructed and maintained to minimize harm to fish by implementing best practices for diversion, dewatering, isolation, and fish salvage prior to instream construction and maintenance activities.
- **Maintain instream flows for fish species and other aquatic resources:** Flows within fish-bearing constructed stream diversions and natural channels affected by Project operations would be maintained to meet seasonally appropriate and stream-specific low-flow needs.
- **Implement site-wide BMPs:** A comprehensive program to manage and minimize soil erosion, dust generation, and sedimentation will be implemented as required by National Pollutant Discharge Elimination System (NPDES) general permits (e.g., Construction Stormwater General Permit, Multi-Sector General Permit for Stormwater Discharges from Industrial Activities) and USFS-mandated BMPs.
- **Conduct stream restoration and enhancement, concurrently with mining where practicable:** Rather than delaying stream enhancement and restoration until site closure, once mining operations are completed within a given area, streams in that area would be restored. Stream enhancement would be conducted in otherwise unimpacted areas throughout mine life and may include removing local barriers to fish migration, restoring riparian vegetation, installing habitat improvement (woody debris, etc.), and re-establishing floodplains. The restoration of East Fork of Meadow Creek (aka Blowout Creek) would occur early in mine construction and operations.

Streams supporting migratory or resident populations of ESA-listed fish species that would be affected by Project development and operations would either be diverted during mining and subsequently restored or enhanced in place as operations shift within the Project site (Rio ASE 2019b).

The following sections summarize fish protection and management activities during all phases of the project, with the goals of protecting water quality and fish habitat, maintaining streamflows, implementing BMPs to minimize erosion and sedimentation impacts, and restoring and enhancing stream habitat both as mitigation for unavoidable impacts and as voluntary, additional habitat rehabilitation.

Section 4

Water Quality Protection During Mine Operations

Midas Gold would prevent water quality degradation by diverting upgradient runoff sources around potential sources of contamination (“keeping clean water clean”), collecting and managing contact water appropriately (e.g., detention, reuse, and/or treatment), and storing tailings and development rock in modern, engineered facilities. Furthermore, Midas Gold would isolate or remove existing sources of pollutant loading from historical mining activities and fixing ongoing water quality problems originating from those materials. Each of these water management elements are discussed below.

In general, surface water diversions would be constructed surrounding all major facilities such as the tailings storage facility (TSF), development rock storage facilities (DRSFs), process plant, open pits, and the Stibnite Lodge. Diversions would be designed to convey water without eroding during high flow/flood events (100-year, etc.) appropriate to the risk level of the facility and would be lined with geosynthetics where needed to prevent loss of water into underlying materials. Surface water management measures are discussed in detail in the PRO (Midas Gold 2016) and recent clarifications relating to water management practices have been provided in responses to requests for additional information (RFAI; BC 2018b–g).

Contact water from mine facilities (DRSFs, ore stockpiles, open pits, etc.) would be collected with ditches, sumps, and ponds, and generally reused for process makeup or dust control. Excess contact water would be evaporated or treated to meet discharge standards and discharged via permitted NPDES outfalls. Estimates of contact water volumes and timing are included with the site-wide water balance (BC 2018h) and contact water quality was addressed through site-wide water chemistry modeling (SRK Consulting, Inc. 2018a,b). A water management plan describing surface water management and contact water collection, storage, transfer (pumping), reuse, and disposal will be developed in between preparation of the draft and final EISs. The hydrologic and water quality effects of water management are discussed in the Proposed Action hydrologic modeling (BC 2018i) and site-wide water chemistry reports (SRK 2018a,b). The following design and performance standards are intended as the minimum criteria for protection of public health and the waters of the state.

Newly-generated tailings would be placed in modern, fully-engineered storage facilities, permitted under applicable Idaho water quality, dam safety, and mine reclamation regulations, as well as requirements for water quality protection under Idaho Rules for Ore Processing by Cyanidation IDAPA 58.01.13. The TSF would be lined with a composite geomembrane liner system and would incorporate a leak detection system. DRSFs and the TSF would be reclaimed as soon as practicable after they no longer receive material. Key details of these facility designs are found in the PRO (Midas Gold 2016) and subsequent RFAI responses, and further design is in progress as part of the Project permitting and Feasibility Study. Design details, plans, technical specifications, and quality assurance procedures will be submitted to the appropriate agencies as part of the permitting and National Environmental Policy Act efforts.

Finally, Midas Gold proposes to remove, reprocess, reuse, or isolate various existing sources of pollutant loading from historical mining operations. Chief among these are the approximately 10.5 million tons of tailings and spent heap leach ore that presently contribute to metals loading in Meadow Creek. The heap leach ore in the Spent Ore Disposal Area (SODA) and Hecla heap would be reused as construction material for the TSF, where it would be placed above seasonal high groundwater levels and underneath geomembrane liner, permanently isolating it from contact with surface water and groundwater.

The Bradley tailings underlying the SODA would be reprocessed to recover additional metals, then placed in the lined TSF with the other tailings generated by the Project. Construction of the EFSFSR tunnel around YPP and associated diversions of Hennessy Creek and Midnight Creek would separate flow in those waterways from interaction with existing materials (Bradley dumps, underground workings), potential contaminants from project operations (dust, nitrates from blasting agents, and fuel/oil spills or leakage from mining equipment) and natural mineralization (the Yellow Pine ore deposit itself).

Site-wide water chemistry modeling (SRK 2018b) demonstrates water quality improvements that would result from the removal of historical facilities in Meadow Creek valley and managing tailings and development rock during Project implementation. Midas Gold would appropriately manage other existing contaminated materials (tailings, spilled fuel, aerosol cans, etc.) that may be encountered during mining and construction. The approach for characterizing and appropriately treating or disposing of existing contaminated materials that may be encountered is addressed in the PRO (Midas Gold 2016; Sections 2.4, 5.1.1, and 8.7.4). Procedures for characterizing and appropriately disposing of contaminated media will be provided in a forthcoming Environmental Monitoring and Management Program (EMMP).

Section 5

Fish Protection During Mine Operations

Protection for fish and aquatic habitat would be implemented for several categories of mining activities to avoid and minimize potential direct and indirect impacts. These include the following:

- Diversion of existing natural stream channels and streamflow around mine features and other proposed disturbances such as pits and DRSFs, or diversion of water from or within existing stream channels to route flow around construction areas or during stream restoration activities in progress
- Activities that result in indirect loss of streamflow by groundwater pumping for pit dewatering, and associated infiltration basins to return unused water to the aquifer to maintain streamflow
- Blasting activities associated with mining in the Yellow Pine, Hangar Flats, and West End pits and excavation of the EFSFSR tunnel
- Draining of the YPP lake and diverting the EFSFSR through the tunnel
- Construction and maintenance of access and mining haul roads
- Transport and storage of fuel, chemicals, and reagents

During these activities, fish protection and management actions would include the following:

- Design and maintain diversion channels and restored channels to reduce the risk of stranding fish including juvenile and adult salmonids.
- Utilize fish protection, salvage, and relocation to avoid and minimize impacts to fish during operation of stream diversions.
- Maintain appropriate streamflows and water quality conditions in natural or restored channels where fish are present.
- Protect stream segments not directly impacted by mining to protect fish species from indirect physical or chemical impacts.
- Provide fish passage enabling volitional or managed movement of migratory species around blockages that may currently exist in high-gradient stream sections or at existing road crossings or other drainage culverts to areas not currently accessible.
- Capture and relocate fish from streams being diverted or other dewatering activities to undisturbed locations or upstream habitats as necessary.

The following sections provide details for each of these mining activities and fish management actions.

5.1 Water Diversions

Midas Gold would divert surface streams to separate them from planned open pits, DRSFs, and the TSF. Dewatering and fish handling procedures related to diversion and other instream construction are discussed later; this section addresses conditions in operating diversions.

With the exceptions of the EFSFSR tunnel and the diversion of Meadow Creek around Hangar Flats pit, stream diversions would not be designed specifically to provide fish habitat, as this could compromise their function as diversions and, in the case of the TSF, present a risk to dam safety. However, as many of the streams to be diverted presently support fish, it is presumed that fish would at least occasionally be present in those diversions accessible to fish from adjacent fish-bearing reaches of stream. Furthermore, operation of diversions could potentially affect downstream reaches and associated fish habitat by altering water quality. Diversions will be designed to minimize potential negative downstream impacts on fish habitat.

Temporary surface diversions of perennial, fish-bearing streams would generally include either rock cut channels along steep slopes with shallow bedrock, or excavated channels in alluvium or colluvium along hillsides and crossing valley bottoms. For channels excavated in erodible or permeable materials, or materials that could degrade water quality, Midas Gold would line them as needed with rock riprap, bioengineered bank stabilization measures, and/or geosynthetic liners to prevent erosion and to minimize seepage out of the channel (BC 2018i). For natural channel design segments (Meadow Creek diversion around Hangar Flats pit, and restored channels across the TSF, DRSFs, and YPP backfill), the geosynthetic liner would extend under the restored floodplain as well as the channel, to prevent water loss or interaction with underlying materials.

Trash racks, debris basins, or similar structures may be needed at select diversion locations (particularly the upstream portal of the EFSFSR tunnel discussed below) to prevent debris accumulation within the diversion that could compromise its hydraulic function. Trash racks would be designed to prevent impingement of fish or allow fish passage as applicable.

Most diversions would not include instream habitat features, apart from those around Hangar Flats pit and around YPP (tunnel and fishway, discussed below). The Hangar Flats diversion would feature a natural channel design with habitat for spawning/rearing salmonids, and a connected floodplain with wetlands—built early in mine operations to increase ecological function and offset Project impacts. Details of the diversion design are included in the CMP (Tetra Tech 2019a) and Stream Design Report (Rio ASE 2019b).

5.2 Fish Handling, Salvage, and Protection Measures During Dewatering

Dewatering, isolation, and fish salvage would be required for the construction and maintenance of both diversions and instream habitat enhancement measures on fish-bearing streams. To protect ESA-listed fish species, Midas Gold will develop a standard procedure for channel segment isolation, dewatering, fish salvage, and fish relocation 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 2012). Additional sources of information on fish protection protocols may be considered in developing the program. For example, the Bonneville Power Administration Habitat Improvement Program (HIP) III provides a series of conservation measures intended to protect and restore fish and wildlife habitat affected by construction activities (Bonneville Power Administration 2016). A summary of proposed dewatering, fish handling, salvage, and protection measures is outlined in Midas Gold's responses to RFAI#57 and RFAI#57a (BC 2018b,c).

When stream segments need to be dewatered, they would be isolated using a variety of methods appropriate for each individual location, including block nets, sandbags, straw bales, concrete blocks, heavy tarps, sheet piling, diversion pumps, and devices such as water-filled bladders, flashboards, pickets, cofferdams, or other structures. The type of method selected would depend on the stream segment location, dewatering and diversion sequencing, operational requirements, length, slope, flow conditions, depth, fish presence/absence in the segment(s) being dewatered, and site-specific safety measures for isolation and salvage. All isolation barriers would be routinely monitored during installation, operation, and maintenance activities (BC 2018i).

Dewatering would generally be conducted during low-flow periods to facilitate stream segment isolation and fish salvage. When practicable, dewatering would also be timed to avoid or minimize impacts during known spawning periods for Chinook salmon, steelhead, and bull trout. Whenever possible, dewatering would not begin until fish have been captured and removed for relocation. However, depending on the site and water depth, it may be necessary to partially draw the water down first so fish removal can be performed. In that case, pumps would be screened to meet NOAA Fisheries and IDFG standards (BC 2018h).

Exclusion and fish handling, using a trap, seine, electrofishing, or other method designed to minimize injury risk, would be supervised by a qualified fish biologist. Specific fish collection methods would be based on species, size class, and number of fish expected. Electrofishing would not be used to recover Chinook salmon, steelhead, and bull trout unless dip nets and seines are not successful, though dip nets and seines may be not be successful and electrofishing may still be needed to capture any remaining fish. Electrofishing would be conducted using protocols approved by the Services. Fish would be safely captured, handled, and relocated to a suitable location as part of the plan developed during the ESA Section 7 consultation process (BC 2018i).

5.3 Mitigation Measures for Draining of the YPP Lake

During the early stages of construction of the SGP, the entire flow of the EFSFSR will be diverted through a tunnel around the YPP so that the pit lake can be dewatered and the YPP mined to a greater depth over several years. The YPP lake is currently used by three ESA-listed fish species (Snake River spring/summer Chinook salmon, Snake River basin steelhead, and bull trout), one designated sensitive species (westslope cutthroat trout), and two other native fish species (mountain whitefish, rainbow trout). Understanding the importance of these species, Midas Gold initiated discussions with USFS and the Services and developed a study plan, the results of which would result in a better understanding of the populations of ESA-listed fish species present in the lake, their seasonal use of the lake, and movements in and out of the lake. The results of these studies were intended to be useful during ESA Section 7 consultation to help determine the best timing and manner of excluding and removing fish prior to and during draining[1] of the pit lake.

This section of the FMP provides a description of the following:

- Historical and current conditions in and near the YPP lake
- Populations and movement of fish in the pit lake
- YPP lake draining process and schedule of draining activities
- Measures proposed by Midas Gold for fish protection, salvage, and movement to avoid and minimize impacts to fish.

It is expected that the YPP lake draining and mitigation measures will be included in the BA prepared for the SGP, and that additional details may be included at that time.

5.3.1 Historical and Existing Conditions

The YPP (aka the Glory Hole) was first mined in the 1930s. During mining of the YPP, flow in the EFSFSR was routed around the YPP in surface ditches from 1938 through early 1943. From 1942 to

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[1] Draining here refers to the process of diverting the EFSFSR through the tunnel around the pit lake and the draining of the pit lake prior to mining.

1943, the 3,500-foot Baily Tunnel was developed, which was activated in 1943, routing all the flow to the northeast through the mountain to discharge to Sugar Creek. This allowed for continued pit expansion.

The site was abandoned in the late 1950s, and the YPP was never reactivated. The flow of the EFSFSR was allowed to cascade down an unreclaimed highwall into the abandoned pit, forming a lake (Figure 5-1). The high-gradient cascade still exists and is a barrier to upstream fish passage. Over time, the YPP lake has partially filled with sediment making the pit less deep in areas and developing an alluvial fan at the south end of the YPP lake (Figure 5-1). Midnight Creek also flows onto a second alluvial fan and into the YPP.

Figure 5-1 and Figure 5-2 depict the current conditions of the YPP. A recent bathymetric map of the current condition is provided in Figure 5-3. The lake is generally steep-sided and has a near flat bottom at the lake center at about the maximum depth of approximately 35 feet. Much of the lake perimeter is surrounded by steep highwalls and is very difficult to access. Flatter terrain and an access area are located to the southeast, on the alluvial fan, and to the northeast where a service road provides access to the lake. This is the only boat access to the YPP lake and no boat launch is available. Launching of small boats is possible only with considerable effort. The outflow of the YPP lake is a shallow bench-like formation that is composed of rock and sediments (Figure 5-2). Depth over the outflow is about 1 to 2 feet and varies with rate of inflow from the EFSFSR.

Figure 5-1. View of the Yellow Pine Pit and Lake

The EFSFSR enters from the right (south) flowing down a steep (>20% gradient) boulder-strewn cascade, and over and through the alluvial fan into the pit lake. The lake discharges at the far center of the lake. .

Figure 5-2. View of the Yellow Pine Pit Lake Showing the Outlet of the Lake

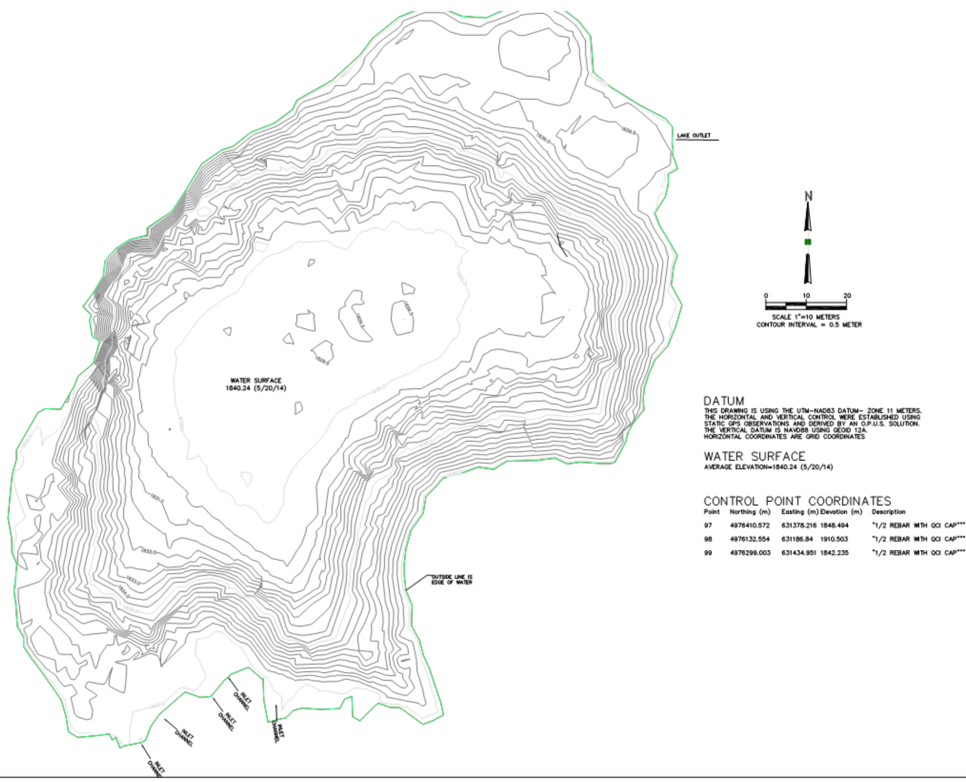

Figure 5-3. Bathymetric Map of the Yellow Pine Pit Lake

May 2014 survey, metric scale

The sides and lake bottom are dominated by either bedrock or fluvial sediments (cobble, gravel, sand, and silt) transported by the EFSFSR and Midnight Creek. Fluvial sediments are generally patchy and graded—finer in slow depositional areas and coarser in others like the alluvial fan. The entire lake bottom has a mantle of fine sediments, and in some areas, those have accumulated to form a thick layer of loosely consolidated fine sediments. These high sediment areas occur in deep water areas and near the outflow of the lake in the northeast corner.

The volume of water entering the YPP lake is high relative to the size of the lake. When flows are their greatest during the spring, residence time[2] of the lake is less than 24 hours and inflow often provides enough water to refill the lake two to eight times in a single day (BC 2019b). Even during periods of low flow, residence time of the lake is only about 5 to 7 days. This rate of flow-through relative to the volume of the lake is an important feature of the YPP. Water temperatures in the lake largely reflect the inflow temperatures of the EFSFSR even during summer. Thermal stratification in YPP lake is limited. The Stream and Pit Lake Network Temperature Model Existing Conditions Report (BC 2018j) has considerable additional details about the YPP lake thermal regime.

5.3.2 Fish Populations and Movement

In consultation with USFS and the Services, a sampling and tagging study was conducted to better understand populations of ESA-listed fish species present in the lake, their seasonal use of the lake, and fish movements in and out of the lake. Because the study required the capture and handling of ESA-listed fish species, permits and approvals were needed from the Services and the IDFG. This required a sampling plan and a BA (USFS 2018).

The BA evaluated the potential effects of conducting fish sampling and tagging at the YPP lake on species listed as endangered, threatened, or proposed for listing under the authority of the ESA, as well as designated critical habitats for those species under ESA (USFS 2018). Federally listed species covered in the BA included Snake River spring/summer Chinook salmon (*Oncorhynchus tshawytscha*), Snake River Basin steelhead (*O. mykiss*), Columbia River bull trout (*Salvelinus confluentus*), and the Canada lynx (*Lynx canadensis*).

Following submittal of the BA to the Services by the lead federal agency (USFS), the YPP lake fish sampling was subsequently authorized by the Services in biological opinions for the Snake River Basin steelhead and the Snake River spring/summer Chinook salmon (NOAA Fisheries 2018) and for the bull trout (USFWS 2018). The biological opinions were prepared pursuant to ESA, approved the sampling program, and established limits on take of each species through issuance of incidental take statements. Sampling was authorized for three summer-fall sampling periods for up to 3 years ending in 2020.

5.3.3 Summary of YPP 2018 Sampling and Tagging

The 2018 YPP lake fish sampling summary report (BC 2019b) includes the following:

- A description of sampling and summary of sampling methods
- The number and species of fish collected and site conditions during each of the three sampling events
- Population estimates by species in the YPP lake
- A summary of the observed movement patterns by tagged fish

Sampling of the YPP lake was conducted in three separate events: May, July, and September 2018. Sampling was completed primarily by seining with a 100-foot by 20-foot seine supplemented by

[2] Calculated residence time of the lake ranges between 3 to 7 days at base flow and 3 to 12 hours during spring/summer high flows.

periodic hook-and-line angling. Mountain whitefish dominated the catch of fish in all sampling periods, with hundreds of mountain whitefish fish caught over the three sampling periods; they were not a targeted species for the sampling and so were returned to the lake upon capture. Bull trout were the most abundant target species in the lake with a total of 103 captured over the three sampling periods; population estimates ranged between 47 and 109. Juvenile Chinook salmon and westslope cutthroat trout were equally represented in the catch (52 and 50 fish caught, respectively); population estimates for westslope cutthroat trout ranged between 15 and 81 fish. There were no recaptures of juvenile Chinook salmon to provide population estimates, and too few rainbow trout (4 fish total) were captured to provide a population estimate.

5.3.4 Abundance and Timing of Fish Movements

The information collected in 2018 provided information on the abundance of bull trout, juvenile Chinook salmon, westslope cutthroat trout, and rainbow trout in YPP lake. Ninety-five percent confidence intervals indicated that there were fewer than 325 bull trout and fewer than 217 westslope cutthroat trout. Population estimates for juvenile Chinook salmon and rainbow trout were not possible with the few fish recaptured.

Detection of passive integrated transponder (PIT) tags implanted in captured fish indicated that some bull trout resided for the entire period in the YPP lake. Some PIT-tagged bull trout moved in and out of the YPP lake while others left and did not return. Bull trout that left YPP lake and did not return were not detected downstream at other PIT tag interrogation arrays. However, detection histories of tagged bull trout were only assessed through November 2018 (BC 2019a). The size and movement of bull trout did not indicate a clear size (and presumably age) related pattern of movement (BC 2019a). All tagged juvenile Chinook salmon moved downstream of the YPP lake after being tagged, and 6 of the 37 were detected further downstream. These fish were detected at PIT tag arrays on the EFSFSR at Parks Creek (ESS) and on the South Fork Salmon River at the Guard Station Bridge (SFG), approximately 13 and 32 miles downstream of the YPP lake, respectively. The majority of the 32 tagged westslope cutthroat trout remained in the YPP lake; only four moved downstream and none returned (BC 2019a).

Fish movement results were instructive, but not definitive. Information on the movement of PIT-tagged fish is expected to improve over time as additional data becomes available through 2019. Supportable conclusions for the 2018 sampling and fish movement data to date are as follows.

- Bull trout moved freely in and out of YPP lake as documented by their PIT tag detection histories through November of 2018. These movements did not appear to be size related because both large and small bull trout were documented moving in and out of the lake repeatedly.
- Bull trout appear to move freely within the YPP lake and in/out of the EFSFSR near the YPP lake; movements of bull trout did not seem to be related to fish size as similar numbers of both large and small fish moved in and out of the lake and continuously resided in the lake during the 2018 sampling period and PIT Tag Information System results through November 2018.
- Juvenile Chinook salmon movements appeared to be related to downstream migration, as no recaptures occurred, and all detections were downstream of the YPP lake and detected as far as 51 kilometers downstream of the YPP lake.
- Westslope cutthroat trout appeared to be primarily resident in the lake during the summer, as only four left the lake.

5.3.5 YPP Draining Sequence and Timing

A general description of the sequence of mining activities is provided in the PRO (Midas Gold 2016). Additional information and details of the mine construction, operations, and reclamation/closure sequence are provided in response to Request for Additional Information 57 (BC 2018c,d).

Construction of the EFSFSR Tunnel, the diversion of the EFSFSR through the tunnel, and the draining of the YPP lake will occur in the early years of mine development.[3] Under the PRO, construction of the tunnel diversion around the YPP will be started in mine year -2 and would be completed by the end of mine year -1. The draining of the YPP lake is anticipated to occur by the end of mine year -1, and EFSFSR, Midnight Creek, and Hennessy Creek would be directed into the tunnel at that time to keep water from entering the YPP.

Following diversion of the EFSFSR flow into the tunnel, the lake would passively drain down to the level of the channel invert at the lake outflow (about 2–3 feet lower than average YPP lake levels), possibly lower if water from the lake drains though the fluvial sediment deposits or fractured rock at the mouth of the outlet. Further draining of the lake will require pumping. Pumping of the pit lake to its bottom and removal of the fine sediments during initial dredging of the lake bottom will require the construction of an access road into the pit lake near the outlet, the most accessible location.

After the lake is drained, mining will proceed for approximately 7 years, expanding and deepening the YPP. Later in the mining operations sequence, about mine year 7, mining activities in the YPP will cease and backfilling of the YPP will begin using development rock from the West End pit. Backfilling of the YPP is fundamental to reestablishing the EFSFSR in its approximate original position, with a gradient suitable for the restoration of fish passage on a permanent and sustainable basis.

5.3.6 Measures for Fish and Aquatic Impact Avoidance and Minimization

There is an opportunity during construction and early operations to proactively implement measures to avoid and minimize potential impacts to fish populations in the YPP lake prior to its draining. Capture and handling stress would be avoided if fish were excluded from entering the lake prior to draining. That is, fish would be prevented from moving upstream into the lake thus reducing the need to capture and salvage migratory adult salmonids (i.e., Chinook salmon and bull trout). Draining of the YPP lake to prior to periods of fish movement into the lake and salvage of remaining fish remaining in the lake would be accomplished as described below. These activities would be accomplished leading up to lake draining and before flows are fully diverted into the EFSFSR tunnel.

5.3.6.1 Fish Upstream Barrier (Exclusion) and Trapping

The procedures for excluding, capturing, salvaging, and releasing fish described below will generally follow the guidelines outlined in the USFWS's Recommended Fish Exclusion, Capture, Handling, and Electroshocking Protocols and Standards (Brennan-Dubbs 2012). Midas Gold's proposed method focuses on seining, the preferred method for fish capture (Brennan-Dubbs 2012), and many of the important measures to minimize fish stress and mortality will be used.

In consultation with the Services, Midas Gold will design, install, and operate a fish trap and one or two weirs designed to allow fish to leave the YPP lake but not allow fish to migrate upstream past the trap. A key objective is to ensure that the fewest number of individual ESA-listed fish species are present in the YPP lake when the draining process begins. The upstream fish barrier will be in place in advance of the completion of the EFSFSR tunnel and diversion of the EFSFSR into the tunnel to

[3] Activities are depicted in the earliest possible year of implementation. Actual implementation will be phased to accommodate site construction activities, material availability (earth, rock, and vegetation), lodging for workforce, mine plan, and general leveling of contractor and internal resources. It is possible that mine plan improvements in the ongoing Feasibility Study could slightly alter the construction timing of the tunnel, and thus the timeline to drain the YPP lake.

allow fish abundance in the lake to be as low as possible by prohibiting fish migration downstream. Conceptually, the upstream fish movement barrier could be designed similarly to the adult picket weir, upstream and downstream trap box currently used in Johnson Creek (Rabe and Nelson 2009; Figure 5-4) or other fish counting weir designs (https://fishbio.com/projects/fish-counting-weirs).

Figure 5-4. Upstream and Downstream Trap Box Currently Used in Johnson Creek

Source: Rabe and Nelson 2009

The timing of deployment of the upstream passage barrier and fish salvage will also be developed in consultation with the Services. This will be done in consideration of several factors, including the following:

- Stream discharge—lower discharge better
- Fish abundance—lowest fish abundance best
- Adult Chinook and bull trout spawning and migration period—avoid periods of highest abundance
- Juvenile Chinook salmon and bull trout emigration—avoid periods of highest abundance
- Algae growth or ice—avoid these periods to maximize fish capture efficiency
- Stream temperature—avoid lowest and highest stream temperatures
- Handling stress—avoid high stream temperatures that may increase handling stress
- Fish activity and catchability—low water temperatures decrease fish activity and fish are in cover, reducing catchability
- Day length—longer days best for salvage operations

These factors are arranged by season in Table YPPC-1 to facilitate consideration and decisions as to the best time of year for installing the barrier and completing fish relocation and salvage. Based on the considerations above, the early Fall period, after Chinook salmon and bull trout spawning/migration period has ended may be the best time for draining the lake and completing fish salvage.

Table 5-1. Considerations in Determining the Timing of Installing an Upstream Fish Barrier Downstream of the YPP Lake, Fish Salvage, and EFSFSR Diversion Prior to YPP Dewatering

Season	Pros	Cons
Winter (Dec 15–Mar 15)	Lowest stream discharge Low fish abundance No adult Chinook salmon Fluvial bull trout in winter habitat downstream of YPP Low juvenile emigration No algae growth Low risk of handling stress	Low fish activity and catchability Fish are cover oriented Ice conditions Coldest stream temperatures Shortest day length Safety concerns working in winter
Spring (Mar 16–Jun 15)	Increasing stream temperatures Low algae and decreasing ice Increased fish activity and catchability Low risk of handling stress Long day length	Highest stream discharge Increased fish abundance Adult Chinook and bull trout migration begins Increased juvenile emigration
Summer (Jun 16–Sep 15)	Lower stream discharge Warmest stream temperatures Fish least cover oriented and most active Increased fish catchability Long day length	Increased fish abundance Increased risk of handling stress Adult Chinook salmon and bull trout migration and spawning period Algae growth Increased juvenile emigration
Fall (Sep 16–Dec 14)	Lowest stream discharge Decreasing fish abundance Adult Chinook salmon and bull trout migration and spawning period complete Decreasing juvenile abundance Declining stream temperatures Low risk of handling stress Little or no algae to complicate sampling	Decreasing fish activity and catchability Shorter day length

5.3.6.2 Capture and Salvage of Remaining Fish

Prior to or concurrent with diversion of the EFSFSR into the tunnel, capture and salvage operations will begin for the fish remaining in the lake. Experience collecting fish with seining during the 2018 YPP lake fish sampling provides valuable insight into the best way to collect fish from the lake for salvage. Weir operation, fish collection, and salvage operations are best done with a manageable flow coming into and through the lake to maintain temperatures and dissolved oxygen levels and to help flush out turbidity resulting from disturbance of the fine sediments on the bottom of the lake.

Implementation of the work area isolation and fish capture and removal protocols will be planned and directed by a qualified biologist (referred to in this document as the directing biologist) possessing all necessary knowledge, training, and experience. The directing biologist will plan the delineation of the work area, fish capture and removal, and dewatering with consideration for the following:

- Habitat connectivity and fish habitat requirements
- Duration and extent of planned in-water work
- Anticipated flow and temperature conditions over the duration of planned in-water work
- Risk of exposure to turbidity or other unfavorable conditions during construction

All individuals participating in fish capture and removal operations will have the training, knowledge, skills, and ability to ensure safe handling of fish, and to ensure the safety of staff conducting the operations. The directing biologist will work with the appropriate personnel (such as the construction and equipment operators for the project) to plan the staging and sequence for work area isolation, fish capture and removal, and dewatering.

Seine collection methods from the 2018 YPP fish sampling will be modified by designing and custom-ordering a longer and deeper seine for the collection and salvage. The seine would be deployed using one or two boats and would be used to collect or herd fish in greater numbers per seine haul than collected to date during the 2018 sampling. Seine operations may also be used to herd or direct fish towards the lake outlet without capturing and handling the fish and guiding nets may be used to facilitate directing fish to the lake outlet. If large numbers of fish are herded (and/or captured and released), overcrowding or concentrating fish in areas where their habitat needs cannot be met will be avoided. It may be necessary to allow some fish to stay in the enclosed net area or pursed seine until they move volitionally downstream of the weir or are relocated downstream of the lake. In some circumstances it may be appropriate to relocate fish at a greater distance downstream, to ensure fish are not concentrated in areas where their habitat needs cannot be met, or where they may be exposed to unfavorable conditions including increased predation.

Fish captured in the YPP lake would be immediately released downstream of the upstream fish movement barrier or in another location determined by the Services. Seining efforts would continue until the level of catch per unit effort dropped considerably or to a level defined in consultation with the Services. The directing biologist will ensure that fish capture and removal operations adhere to the following minimum performance measures or expectations:

- Only dip nets and seines composed of soft (non-abrasive) nylon or similar material will be used.
- Salvage operations will not resort to the use of electrofishing equipment unless and until other, less injurious methods have removed most or all the adult and sub-adult fish (i.e., fish in excess of 300 millimeters).
- Fish capture and removal operations will be confirmed as completed before completely dewatering.
- Fish will not be held in containers for more than 10 minutes, unless those containers are dark-colored, lidded, and fitted with a portable aerator.
- Water temperature and dissolved oxygen will be monitored in all containers and fresh water replaced as needed.
- A plan for achieving efficient return to appropriate habitat will be developed before the capture and removal process.
- Every attempt will be made to release ESA-listed specimens first.
- Seines, once pursed, will remain partially in the water while fish are removed with dip nets.

5.3.6.3 Documentation and Reporting

The directing biologist will document and maintain accurate records of the operations, including the following: project location, date, methods, personnel, water temperature, conductivity, visibility, gear used, fish species, number, age/size class estimate, condition at release, release location, and other comments. Midas Gold anticipates that the YPP lake draining sequence and fish salvage operations will be included in the BA to be prepared by the USFS for the SGP and that additional reporting requirements may be included in the associated biological opinions for the SGP.

5.4 Improvements to Fish Passage

Streams in the Project site and along the Burntlog Route have several known and/or indicated barriers to fish passage. Among these are the high-gradient cascade immediately upstream of the YPP lake at the relic southern highwall remaining from historical mining at the YPP, which has blocked upstream fish passage since 1938 (Midas Gold 2016). Others include the box culvert at the Stibnite Road crossing of the EFSFSR, portions of the lower EFSFSR just downstream of Meadow Creek, and potential barriers to passage at stream crossings along existing portions of the Burntlog Route.

Reviews of the effectiveness of stream and fish habitat improvement methods have consistently reported that the removal of barriers or installation of fish passage is one of the most effective at increasing fish numbers and is one of the highest-priority habitat improvement measures for salmon, steelhead, and other stream fishes (Roni et al. 2002, 2008, 2014). Providing fish passage should produce tangible biological benefits by reestablishing the opportunity for natural production in previously inaccessible habitats and restoring watershed connectivity. The EFSFSR tunnel fishway has the potential to produce a 15-year head start on reestablishing natural production prior to restoring the EFSFSR stream channel across the YPP.

For these reasons, Midas Gold has prioritized measures to restore and improve fish passage during mine operations and as mining ends. These measures include the following:

- A proposed fishway in the EFSFSR tunnel during operations
- Design of the restored EFSFSR stream channel over the backfilled YPP to allow for volitional upstream passage by salmonid species present
- Enhancement of fish passage conditions in certain areas of stream channels during operations in areas thought to currently impede fish passage
- Improvement of fish passage conditions at stream crossings along the Burntlog Route

The following sections briefly describe these plans and the documents that can be referenced for further details; the details are not provided here to avoid duplication.

5.4.1 EFSFSR Tunnel Fishway

A key feature of the Midas Gold mitigation program is a roughly 0.9-mile-long temporary stream diversion tunnel (the EFSFSR tunnel) around the YPP that will include a fishway to support reestablishment of anadromous fish passage to the EFSFSR headwaters and tributaries. To support fish passage into the EFSFSR headwaters during mine operations, a fishway has been designed and would be operated within the EFSFSR tunnel to provide upstream and downstream volitional fish passage throughout mine operations.

Applying NOAA Fisheries (2011) and other relevant (Federal Highway Administration 2007 and Washington Department of Fish and Wildlife 2013) fish passage design guidance, McMillen Jacobs (2018) conducted an alternatives analysis of tunnel design concepts, evaluating each in terms of potential fish passage and advancing the most favorable to detailed hydraulic analysis and constructability review. The selected alternative is presented in McMillen Jacobs (2018) and is at 30 percent design stage. It consists of a 15-foot-wide tunnel featuring a 9-foot-wide maintenance and inspection access way, a 5-foot-tall reinforced concrete divider wall, and a 5-foot-wide by 5-foot-deep fish passage channel. The fish passage channel would not be excavated but rather would be at common grade with the access way (Figure 5-5).

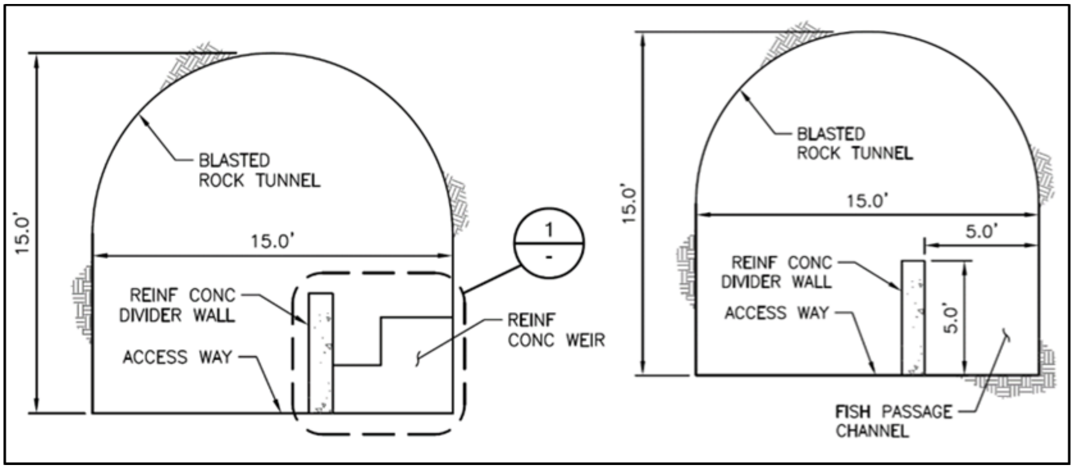

Figure 5-5. Tunnel and Fishway Typical Sections (Source: McMillen Jacobs 2018)

The EFSFSR tunnel fishway represents an important part of the overall SGP mitigation plan by enabling reestablishment of a migratory pathway for anadromous fish to potential spawning grounds and improved connectivity to important coldwater stream habitats upstream of the YPP. Target fish species that will benefit from tunnel construction include Chinook salmon, bull trout, steelhead, and westslope cutthroat trout. The tunnel and fishway designs include tunnel routing, hydraulic analysis, and civil design to support inclusion of an in-tunnel fishway (McMillen Jacobs 2018). Several supporting studies have been completed including fish passage design criteria evaluation, tunnel size alternatives evaluation, geotechnical analysis, rock mass characterization, portal alternatives evaluation, sediment management, and fish passage alternatives analysis.

To supplement the EFSFSR tunnel fishway design, Midas Gold is also developing a Fishway Operations and Maintenance Plan (BC and BioAnalysts in progress), which will outline the proposed startup and operations of the tunnel fishway and describe a systematic, adaptive approach to monitoring and evaluation of the tunnel/fishway (i.e., structural and hydraulic conditions) and biological responses (i.e., fish passage). Adaptive management would integrate biological, structural, and hydraulic systems as part of the overall monitoring and evaluation of the facility.

5.4.2 Restoring and Improving Passage in Stream Channels

The Stream Design Report (Rio ASE 2019b) includes improvements to fish passage at two locations thought to currently be complete or partial impediments to upstream fish passage. These are as follows.

- The existing box culvert on the EFSFSR just downstream of the confluence with Meadow Creek at the Stibnite Road (NF-412) crossing. This box culvert is believed to be a full or partial barrier to upstream movement by salmonids. Providing effective passage at this location would improve watershed and habitat connectivity between the mainstem EFSFSR and important fish habitats upstream.
- The steep and woody debris-clogged portion of the EFSFSR stream channel just upstream from the confluence with Meadow Creek (Rio ASE 2019b). It is believed that this segment of stream may inhibit upstream movement of adult Chinook salmon, and improvement of passage conditions may improve access by adults to potentially important spawning areas identified upstream, especially in the lower-gradient meadow section just upstream.
- Post mining, the EFSFSR stream channel across the backfilled YPP would be reestablished with a channel design that would provide for upstream and downstream volitional passage in perpetuity.

5.4.3 Improving Fish Passage Along Burntlog Route

In addition to restoring fish passage to stream reaches described above, improvements to fish passage will be made along the Burntlog Route within the Project area. 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. Midas Gold will complete this work using the USFS Stream Simulation approach ((Stream Simulation Working Group 2008).

Stream simulation was adopted by the USDA, Forest Service as a pragmatic approach and sustainable long-term solution to maintain passage for all aquatic organisms at all life stages at road-stream crossings while meeting vehicle transportation needs and objectives. Larger crossings would feature channel-spanning bridges or arches rather than culverts. These improvements are expected to benefit salmonid species access to productive habitats and increase watershed connectivity.

5.5 Blasting Mitigation Measures

Blasting is required to remove and break up bedrock overburden and ore during mining operations. The detonation of explosives in or adjacent to fish habitat has been demonstrated to cause disturbance, injury, or death to fish and disturbance to aquatic habitats if blasting occurs in or too close to aquatic habitats. However, most or all these potential effects can be avoided or minimized using appropriate setback distances from aquatic habitats to limit overpressure and 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.

The purpose of this part of the FMP is to establish the practices that Midas Gold proposes to avoid and minimize blasting impacts to fish and aquatic habitats. This section briefly describes the following:

- The types of concussive impacts that can occur from blasting activities
- The potential impacts of blasting on fish and aquatic habitats
- Accepted standards that limit injury or mortality to salmonids and salmonid embryos
- Calculation of protective setback distances requirements for areas of the Project where blasting may be near streams and lakes
- The procedures and BMPs Midas Gold will employ and refine to minimize blasting impacts on fish and aquatic habitat.

The analyses provided below focus on impacts to streams, but they are relevant to lakes as well, though impacts to the latter are less likely due to the limited number of lakes in the SGP area.

Open-pit mining methods for the SGP will occur at each of the open pits and will include drilling, blasting,[4] loading, and hauling. Additionally, blasting will be required for construction of the EFSFSR tunnel, Scout exploration decline, and in certain areas along the Burntlog Route. Further details on the anticipated blasting procedures are described in the PRO (Midas Gold 2016; pp. 9-2 through

[4] Drilling and blasting (using explosives) will be required to break the rock into loose fragments suitable for mining shovels and/or front-end loaders to dig and load into trucks. The purpose of blasting is to break the rock in place, with minimum blasted rock displacement; minimal displacement is important for ore control. Blasting will be required for competent bedrock but may not be required before loading of glacial till or alluvium.

9-3). Midas Gold will later develop an Explosives and Blasting Plan[5] as part of the EMMP, which will describe Midas Gold's plan for complying with the very stringent guidelines and safety measures dictated by federal, state, and local laws and regulations.

The analysis and protective measures outlined herein will also be summarized in the BA in preparation for ESA Section 7 consultation for the SGP. In addition, the setback distances and BMPs outlined here will be integrated into or referenced within the Explosives and Blasting Plan, and the blasting foreman and team will use them during blasting operations.

5.5.1 Blasting Effects

The blasting effects on fish and aquatic habitat have been studied by U.S. and Canadian governmental agencies and numerous researchers. The potential impact mechanisms are generally well known and described. During detonation of explosives, a rapid chemical reaction occurs that produces pressure, heat, and gas products. The detonation velocity and pressure form a shockwave front resulting in rock fragmentation, displacement, air overpressure, ground vibration, and water overpressure (ISEE 2011). Blast energy travels in waves outwards from the blast source and travels through the air and ground.

Blast energy resulting in potential impacts on fish and aquatic organisms is most often expressed in two forms—peak particle velocity and blast overpressure (Wright and Hopky 1998; Timothy 2013). Peak particle velocity is the measure relevant to streambed vibrations, and blast overpressure is the measure most relevant to concussive forces in the water.

- **Peak Particle Velocity (Streambed Vibrations).** Blast energy travels through the ground as particle motion and is characterized in terms of amplitude or intensity, duration, and frequency. Peak particle velocity is a measure of ground vibration magnitude and is the maximum instantaneous particle velocity at a point during a given time interval in millimeters per second. Ground vibration intensity is typically measured and expressed as peak particle velocity to evaluate its potential damage. Peak particle velocity, which corresponds to an indicator of a structural damage, largely depends on the maximum charge, the distance between the blast and measuring point, and the characteristics of the medium, including media saturation.
- **Airblast Overpressure (Stream Overpressure).** Overpressure, also called a blast wave, refers to the sudden onset of a pressure wave after an explosion. This pressure wave is caused by the energy released in the initial explosion—the bigger the initial explosion, the more damaging the pressure wave. Pressure waves are nearly instantaneous, traveling at the speed of sound. Blast overpressure intensity may be influenced by numerous factors such as blast design, weather, and field characteristics. Overpressure may be expressed in pascals or in decibels, a measure of force per unit area or pressure.

5.5.1.1 Effects on Fish and Aquatic Habitat

The range of potential effects of blasting on fish and fish embryos have been extensively studied. A complete summary of these reports and associated literature is beyond the scope of this section, but good literature synopses are available (Wright and Hopky 1998; Dunlap 2009), including two focusing specifically on salmonids (Kolden and Aimone-Martin 2013, Timothy 2013). These detailed studies of the potential impacts on fish have led to well-accepted standards for pressure and vibrations that are protective of fish and incubating eggs (see below). Studies of blasting impacts on aquatic organisms have focused largely on fish and fish embryos. Kolden and Aimone-Martin (2013) summarize the results of several empirical studies of blasting effects on fish.

[5] Midas Gold will comply with the blasting requirements of the Mine Safety and Health Administration, 30 CFR Part 56, Subpart E – Explosives and Part 57, Subpart E – Explosives and other applicable regulations.

The detonation of explosives in or adjacent to fish habitat may cause disturbance, injury and/or death to fish, and/or the harmful alteration, disruption or destruction of their habitats, sometimes at a considerable distance from the point of detonation (Wright and Hopky 1998). The use of explosives in or near water produces a post-detonation compression shock wave with a rapid rise to a peak pressure followed by a rapid decay to below ambient hydrostatic pressure (Wright and Hopky 1998). This final pressure deficit causes most of the known adverse effects to fish from blasting by damaging the swim bladder, kidney, liver, spleen, and circulatory system (sinus venous). Any of these organs may rupture or hemorrhage because of blasting, with the swim bladder being the most sensitive.

For aquatic species, risk of injury or mortality resulting from a blast is generally related to the effects of rapid pressure changes, especially on gas-filled spaces in the animal's body (such as swim bladder, lungs, sinus cavities, etc.). Common blast-induced injuries are swim bladder ruptures and hemorrhaging in the coelomic and pericardial cavities. Laterally compressed species are more susceptible to blast pressure gradients than are the fusiform fishes (e.g., trout, suckers). In some cases, blasting can cause mortality, physical injury, auditory tissue damage, behavioral changes, and decreased egg and larvae viability (Hastings and Popper 2005). The duration of temporary hearing loss varies depending on the nature of the stimulus, but by definition there is generally recovery of full hearing over time (Popper and Hastings 2009).

Although the physical aspects of underwater explosions are relatively well understood and predictable, considerable uncertainty still surrounds the responses and meaningful thresholds of exposure for a large majority of fish species and their life history stages. Pressures and vibrations generated from blasting have the potential to cause mortality to salmonids (Timothy 2013), and the sensitivity to shock varies with the developmental stage of fish (Alaska Department of Fish & Game [ADF&G] 1991). Shock can also cause mortality of eggs and larvae. Most salmonid eggs are relatively resistant to shock immediately after fertilization, until epiboly begins at about 50 temperature units (i.e., 5 days at 10 degrees Celsius). During early epiboly, the germ ring, which will later become the body wall, begins to cover the yolk mass. By late epiboly, the exposed portion of the yolk (blastoderm) is nearly covered. During epiboly, embryos are highly sensitive to physical shock; after epiboly the yolks plug is closed, and the embryos are much more tolerant to physical shock (Kolden and Aimone-Martin 2013).

The effects on fish are variable and relate to the type of explosive; size, pattern, and timing of charges; method of detonation; distance from the point of detonation; water depth; and species, size and life stage of fish. Small fish, including juvenile salmon, are more likely to be injured by an explosion than large fish (ADFG 1991). Wright (1982) demonstrates that effects on fish from blasting occur when the overpressure exceeds 100 kilopascals, or 14.5 pounds per square inch. Larger fish may be startled by the shock waves, and smaller fish can be injured or killed when their internal swim bladder is ruptured. Small fish can also be stunned temporarily by shock waves making them more susceptible to predation (ADF&G 1991).

Shock waves generated by in-water explosions generally have more adverse effects on fish than underground explosions, in part because some energy is reflected and lost at the ground-water interface (Keevin 1998).

5.5.1.2 Effects on Other Aquatic Biota

Research for impacts to other aquatic biota yielded little information about the effects of underwater explosions on amphibians (i.e., frogs, salamanders, etc.) or macroinvertebrates. Although untested, amphibians with air-containing organs, such as lungs, probably have mortality comparable to fish with swim bladders (Keevin and Hempen 1997). For impact assessment purposes, the relationship between distance/pressure and fish mortality/injury are probably close (Keevin and Hempen 1997).

Although untested, amphibians without air-containing organs are probably immune to underwater explosives, as are benthic fish species without swim bladders (Goertner et al. 1994).

Very little is known about hearing, use of sound, or effects of blasting on freshwater aquatic invertebrates. Due to the apparent high resistance of benthic invertebrates to blast impacts, any damage sustained by these organisms should be negligible outside of the immediate blast vicinity (Kevin and Hempen 1997).

5.5.2 Blasting Impact Avoidance

Researchers have developed blasting standards for the protection of fish and eggs (ADF&G 1991; Wright and Hopky 1998; Timothy 2013). The ADF&G Division of Habitat reviews and permits, when appropriate, blasting activities in or near anadromous water bodies per AS 16.05.871(b), and in or near resident fish water bodies per AS 16.05.841. In 1991, ADF&G produced a draft Blasting Standard for the Protection of Fish (ADF&G 1991) that limited blast-induced pressures in the water column and vibrations in the spawning gravels to levels below those known to be harmful to fish. That blasting standard was updated in 2013 (Timothy 2013).

5.5.2.1 Alaska Blasting Standard for the Proper Protection of Fish (TR 13-03)

The 2013 Alaska blasting standard is based on 20 years of research and technological advances that provide accurate data on pressures and vibrations generated by an explosion. The standard is below levels that have been shown to cause injury or mortality to salmonids and salmonid embryos and provides a baseline for pressure and vibration monitoring that will aid ADF&G in assessing the effectiveness of the standard to properly protect fish and embryos.

The 2013 Alaska blasting standard is designed to be applied to projects where the impacts of blasting on fish and embryos in fish-bearing water bodies cannot be entirely avoided and must be minimized and mitigated. Monitoring, if needed, is completed by using hydrophones to monitor pressures and geophones to monitor vibrations. These devices are placed in the appropriate habitats as close to the point of detonation as possible without damaging the equipment. The Alaska Blasting Standards for the Proper Protection of Fish are as follows.

> "The instantaneous pressure rise in the water column in rearing habitat and migration corridors is limited to no more than 7.3 pounds per square inch (psi) (50 kPa) where fish are present.
>
> "Peak particle velocities in spawning gravels are limited to no more than 2.0 inches per second (in/s) [51 mm/s] during the early stages of embryo incubation before epiboly is complete."

5.5.3 Canadian Blasting Standards

The Canadian Standard developed by the Department of Fisheries and Oceans are outlined in the document Management Consideration for Blasting Near Fish or Fish Habitat (Timothy 2013). The Canadian Blasting Standards for the Proper Protection of Fish are as follows.

> "No explosive is to be detonated in or near fish habitat that produces, or is likely to produce, an instantaneous pressure change (i.e., overpressure) greater than 100 kilopascals (kPa) (14.5 pounds per square inch (psi)) in the swim bladder of a fish.

> "No explosive is to be detonated that produces, or is likely to produce, a peak particle velocity greater than 13 mm/s (0.5 in/s) in a spawning bed during the period of egg incubation."[6]

Other methods or practices that may also be used or recommended are outlined in the Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters (Wright and Hopky 1998).

5.5.4 Calculation of Protective Setback Distances

Midas Gold developed a spreadsheet tool to compute the required setback distances from fish-bearing streams and lakes. The spreadsheet tool was developed using the following steps:

1. The equations used in the spreadsheet were taken from Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters (Wright and Hopky 1998), including equating the peak particle velocity to charge weight and distance.
2. The standards used came from the Alaska Blasting Standard for the Proper Protection of Fish (TR 13-03) described above—the blast overpressure threshold limit was set at 7.3 pounds per square inch and peak particle velocity threshold was set at 2.0 inches/second).[7]
3. The spreadsheet tool was then populated with the anticipated drill and blast assumptions (bench height,[8] drill hole diameter, stemming length, powder column height, powder volume and charge per hole [weight]).

[6] Gravel substrates where incubating eggs can be found were the focus of regulations limiting blasting vibrations to 13 mm/s. (0.5 in/sec).

[7] NOAA Fisheries has indicated that the most up-to-date and scientifically based blasting standards should be used in any analysis for the SGP for federally listed fish under their authority, and specifically referenced the Alaska Blasting Standard (Sandow 2018).

[8] A mine bench is a narrow strip of land cut into the side of an open pit mine. These step-like zones are created along the walls of an open-pit mine for access and mining. Their height is determined by many factors including operation plans, equipment size, capacity of drilling machines, rock properties, geological characteristics of ore reserve, and production parameters such as hole diameter and road grade (Kose et al. 2005).

The spreadsheet tool calculates the resulting minimum setback distance to achieve enough setback to meet the threshold limits. The results are summarized below for bench heights of 20 and 40 feet.[9]

Table 5-2. Required Setback Distances Needed to Meet Alaska Blasting Standard for the Proper Protection of Fish

Bench Height	20 Feet	40 Feet
Required Setback to Meet Peak Particle Velocity Standard	202 feet	353 feet
Required Setback to Meet Overpressure Standard	239 feet	419 feet

Source: Timothy 2013.

The results indicate that required setbacks are greater to meet maximum overpressure than to meet maximum peak particle velocity and that a 425-foot blasting setback from the closest point the blast field to stream and lake habitats should be protective in most cases, assuming a 40-foot bench height.

5.5.5 Blasting Management

Midas Gold used these findings and examined likely areas where blasting would be near streams or lakes. This examination indicated that the 239-foot blasting setback would be met everywhere within the mine plan for 20-foot bench blasts. Considering a 40-foot bench, blasts may encroach on the 419-foot blasting setback in very limited areas adjacent to the YPP lake near the 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 and ensuring that the calculated instantaneous pressure and peak particle velocity limits would be met. Of course, field measurements during operations may require adjusting the calculations and adjusting blasting practices.

In addition to protective setbacks and bench height, there are other ways to avoid and minimize impacts on fish. These include using controlled blasting techniques following industry BMPs, modifying blasting variables including charge size, and vibration and overpressure monitoring. Midas Gold will employ these methods when warranted.

5.5.6 Summary and Conclusions

Blasting is a necessary activity at the SGP for development of the pits, construction of the EFSFSR tunnel, Scout decline, certain surface water diversions (TSF and the Hangar Flats and Fiddle DRSFs), and portions of the Burntlog Route. Of these, pit production blasts have the greatest potential impact due to both total charge weight (blasting of 20-foot and 40-foot pit benches vs. ~15-foot tunnels or small road/ditch cuts) and proximity to waters (nearer to Meadow Creek and EFSFSR vs. on/under sidehills away from perennial streams). Though detonation of explosives in or adjacent to fish habitat has been demonstrated to cause potential impacts to fish, most or all these potential effects can be avoided or minimized using appropriate setback distances to aquatic habitats to limit overpressure and vibrations to harmless levels, explosive charges and techniques can 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. Midas Gold has evaluated the potential impacts of blasting activities planned for the SGP and, by using the Alaska Blasting Standard for the Proper Protection of Fish, has determined the required site-specific setback distances to avoid impacts.

[9] Midas Gold plans to use 40-foot benches for overburden (development) rock and 20-foot benches in ore bearing formations.

As part of its EMMP, Midas Gold will develop an Explosives and Blasting Plan that will ensure compliance with the blasting requirements of the Mine Safety and Health Administration, 30 Code of Federal Regulations (CFR) Part 56, Subpart E – Explosives and Part 57, Subpart E – Explosives. The blasting plan will include the setback distances and options for other mitigative measures and BMPs.

Based on the foregoing considerations, careful blasting operations using standards-based setbacks designed to be protective of fish and fish embryos would likely result in little or no adverse effects to fish life stages from blasting for those stream reaches near the mine area. As such, there would be little need for additional mitigative measures for protecting fish and their habitat during mining. Monitoring of underwater overpressure and ground vibration effects during the initial stages of regular production would not be needed but may be carried out to better define the concussive attenuation characteristics developed for this site.

5.6 Monitor and Maintain Streamflows

The results of groundwater and streamflow hydrologic modeling have demonstrated that operations of the Project would not affect the timing, duration, or magnitude of high flows in affected stream reaches (BC 2018b,k). This is because the effects of the Project on streamflows result only from indirect effects on streamflow by altering, in certain areas, the contribution of groundwater to streamflow; the Project includes no direct depletion of streamflows via withdrawal (BC 2018k). The Project would affect streamflows during baseflows months (January through March and August through November) in some stream segments where groundwater drawdown would be enough to reduce groundwater contributions to baseflows. These stream reaches are generally those nearest to the Hangar Flats pit during groundwater drawdown, and downstream of the YPP for a period after the EFSFSR is restored over the backfilled YPP. The impact of the Project on streamflows was provided in detail in the Response to RFAI-88a (BC 2018k) and included historical hydrologic analysis, streamflows simulation results, and the timing of streamflow reductions (> = 10%) for base flow months for each SFA reach for the PRO and the No Action. The 10% threshold was used because it is widely recognized in the literature that flow alterations less than about 10–20% have negligible to minor effects on instream habitat and biota and that limiting flow reductions to less than 10–20% is protective (Chessman et al. 2001, Flannery et al. 2002; Maret et al. 2006, Apse et al. 2008, Richter et al. 2011, EcoMetrics and Colorado State University, 2013, Linnansaari et al. 2013).

The PRO includes certain measures to limit baseflow reductions during active operations, including a combination of lining key reaches of streams potentially impacted by pit dewatering, and infiltrating groundwater that is extracted for pit dewatering into infiltration basins. Lining of streams and certain diversions would reduce or eliminate streamflow loss to groundwater and is discussed in the Stream Design Report (Rio ASE 2019b), the PRO (Midas Gold 2016), particularly for in the reaches of Meadow Creek adjacent to the groundwater drawdown zone of the Hangar Flats pit. Downstream of the Hangar Flats pit, infiltration basins would return groundwater pumped from Hangar Flats pit to the shallow groundwater system, contributing directly to baseflow in lower Meadow Creek and the EFSFSR immediately downstream of the confluence of Meadow Creek and ameliorating baseflow impacts in the EFSFSR downstream.

Since the results of mine operations on streamflows were modeled in detail (BC 2018k), Midas Gold has been evaluating options and measures to further avoid and minimize the magnitude and duration of effects of the Project through other measures. These measures include extending the length of lining in key segments of streams, extending the duration of operating the infiltration basins, and more rapid filling of the Hangar Flats pit by diverting seasonal high flows into the pit. This would result in more rapid recovery of groundwater levels and returning groundwater contributions to streamflows to near baseline conditions. These modifications of the PRO are currently under development and will be described in submittals to the USFS. While it may not be possible to avoid all effects of the Project on stream baseflows, Midas Gold continues to explore options for further avoidance and minimization.

During operations, Midas Gold would implement measures to monitor streamflows at key locations. The exact locations of streamflow gauge locations have not yet been determined and will depend on the ultimate objectives in consideration with other streamflow and water management monitoring needs during and after mine operations. Candidate locations include the five current USGS locations and other locations where additional streamflow monitoring would be needed such as at locations where streamflow reductions are anticipated based on modeling or at key locations for monitoring for water management for the Project site overall. Midas Gold will continue to explore and evaluate measures to avoid and minimize effects on stream baseflows and will engage key agencies through the ongoing ESA Section 7 informal consultation process (BC 2018a).

Section 6

Site-Wide Best Management and Maintenance Practices

General site-wide BMPs will be implemented to minimize disturbance of fish-bearing streams and to ensure protection of fish and other aquatic resources, including spawning and rearing habitat for ESA-listed fish species. These BMPs will encompass a wide range of proactive construction and maintenance activities, including techniques for erosion control, road maintenance/dust control, and stormwater management.

A variety of specific BMP planning tools are available, including the BMPs Siting Tool (Environmental Protection Agency [EPA] 2014), which guides designers to adequately identify potential suitable locations/areas for implementing different BMP techniques. Various BMPs are also referenced in the Catalog of Stormwater BMPs (Idaho Department of Environmental Quality [IDEQ] 2005), HIP III Handbook 4.1 (Bonneville Power Administration 2016), BMPs for Mining in Idaho (Idaho Department of Lands [IDL] 1992) and the National Best Management Practices for Water Quality Management in National Forest System Lands (USFS 2012). As conceptual mitigation plans and mining plans are finalized, Midas Gold will use these planning tools to fully develop site-specific BMPs.

Midas Gold demonstrated its commitment to implementing BMPs during resource exploration and geotechnical investigations, as outlined in the Golden Meadows Exploration Project Environmental Assessment (USFS 2014) and Stibnite Gold Project Geophysical Investigation Plan of Operations (HDR 2017) and implemented during those site activities. Midas Gold plans to implement a modified and augmented suite of those BMPs over the life of the Project. The following sections summarize several BMPs Midas Gold would implement during the Project to minimize ongoing impacts to fish and aquatic resources.

6.1 Erosion Control

Mobilization of upland soils, or chronic erosion of stream banks can lead to substantial degradation of fish habitat, especially in critical spawning and rearing areas. Juvenile salmonids rely on the interstitial spaces between cobbles and boulders within the stream bed matrix as protection during extreme flows and to avoid predation. Excess fine sediment increases water column turbidity, fills in pools, and may alter the quality and quantity of invertebrate prey resources (McHenry et al. 1994). Salmonid spawning and nesting habitat are impaired by excessive input and accumulation of fine sediment via a reduction of dissolved oxygen and decreased survival of incubating eggs (Lisle 1989). Juvenile salmonids may avoid turbid stream reaches and may exhibit reduced growth rates under chronic or sustained turbid conditions (Sigler et al. 1984).

Erosion control techniques available to combat upland or excessive streambank erosion at the Project 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. Selection of an appropriate technique (or combination of techniques) would depend on the specific location, extent of the impact area, and the soil/substrate type requiring stabilization. In addition, to minimize human disturbance, which can exacerbate erosion, permanent signage would be posted around the perimeter of individual project sites to prohibit unauthorized foot traffic and the use of all-terrain vehicles and motorbikes, dumping, draining, and cutting and/or removal of plant materials.

Stormwater drains, ditches, and stream channels would be protected against erosion through a combination of adequate dimension, appropriate gradient, and riprap, fabric-encapsulated soil lifts, or other stabilization materials. Diversions will be sized for a peak flow recurrence interval appropriate to the risk level of the facility, in recognition of other water management measures and fail-safes in place (excess flood storage and freeboard in the TSF, etc.), and in accordance with regulatory standards.

6.2 Road Stabilization, Sediment, and Dust Control

Road surfaces throughout the Project would be stabilized and managed to minimize transport of sediment, dust, and other materials, especially near watercourses. Sediment control measures along roads include reducing sediment production and containing sediment if/where produced. The reduction of sediment production would be achieved through appropriate road engineering, surface drainage, watering and application of dust control binding agents (magnesium chloride, lignin sulfonate, etc.), roadside ditching, road-cut stabilization, road surface maintenance, appropriate speed limits, and by limiting traffic. Erodible (i.e., non-rock cut) slopes along roads could be mulched, hydro-seeded, or covered with rock or coarse gravel to minimize the potential for sediment mobilization. Crushed rock would be placed on Project access roads as needed to provide a durable surface and limit sediment transport into nearby streams.

Sediment generated during construction and resulting from ongoing usage would be contained using silt fencing, placement of straw wattles/bales, check dams, and/or captured within sediment catch basins strategically located in and around the Project area. Control of erosion, sedimentation, and dust on roads would be required under the Project’s NPDES/Idaho Pollutant Discharge Elimination System (IPDES) permit and fugitive dust control plan.

Accumulated snow would be removed from the Burntlog Route, temporary construction access routes, and haul roads at the Project site. Care would be taken to dispose of collected snow, which may contain sand or gravel, in a manner that avoids impacts to nearby streams and riparian areas. Coarse sand (less than 20 percent fines) would be used for winter sanding of the main access road and haul roads in combination with a fine-medium gravel to enhance traction.

New roads constructed for the Project on National Forest System lands will be closed and reclaimed, as required by USFS, once they are no longer needed to support Project construction, operations, closure, or reclamation activities.

6.3 Stormwater Management

Throughout construction and active mining phase of the Project, as well as during closure and construction of stream restoration projects, Midas Gold would maintain required stormwater pollution prevention plans for the Project area. Stormwater BMPs associated with construction of stream restoration or enhancement work would be focused on reducing pollutants entering streams and water bodies, thereby sustaining or improving water quality. Stormwater features and facilities would include surface water channels, culverts, and sediment catch basins. Runoff from roads, building sites, and parking lots would be intercepted and processed using sediment traps/ponds, berms, and filtration materials. Design and implementation of these features will be based on local hydrologic conditions and EPA, USFS, IDEQ, and IDL requirements/recommendations. Where appropriate, settling basins would be installed in constructed channels intended to convey runoff around mine facilities. These basins would remove sediment before releasing water downstream.

Sediment collected in settling basins would be removed periodically and placed in DRSFs or used for reclamation purposes (Midas Gold 2016).

Runoff generated from precipitation on general infrastructure areas, including haul roads, laydown yards, and reclamation areas would be routed in channels or through culverts towards stormwater basins where sediment can collect, and water can evaporate, percolate into the ground, or be discharged as appropriate. Runoff generated from direct precipitation on the DRSFs, mine pits, ore stockpiles, ore processing facility area, and truck shop area would be collected in stormwater basins where water can collect and be evaluated for treatment and discharge or used as process makeup water for mine operations. Runoff generated from direct precipitation on the TSF will be retained in the TSF pool for use in ore processing (Midas Gold 2016).

Additional measures may ultimately be developed and included in this FMP to reduce the occurrence of or potential for stranding of fish. It is expected that these will be discussed and considered as part of the plan developed during the ESA Section 7 consultation process (BC 2018h).

Section 7

Stream Restoration and Enhancement Efforts

The prior sections focused on water management approaches during the construction and mining operations phase. Stream channel enhancement within areas otherwise unaffected by mine operations would occur at any time either during or after mining, and stream channel restoration would occur within a given stream segment following mine operations within that area. Midas Gold and its team of consultants have developed stream restoration and enhancement designs 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. Under 33 CFR 332.2, the terms restoration and enhancement are defined below.

Restoration—"the manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historical functions to a former or degraded aquatic resource. To track net gains in aquatic resource area, restoration is divided into two categories: re-establishment and rehabilitation."

- "**Re-establishment** means the manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historical functions to a former aquatic resource. Re-establishment results in rebuilding a former aquatic resource and results in a gain in aquatic resource area and functions."
- "**Rehabilitation** means the manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural/historical functions to a degraded aquatic resource. Rehabilitation results in a gain in aquatic resource function but does not result in a gain in aquatic resource area."
- **Enhancement**—"the manipulation of the physical, chemical, or biological characteristics of an aquatic resource to heighten, intensify, or improve a specific aquatic resource function(s). Enhancement results in the gain of selected aquatic resource function(s) but may also lead to a decline in other aquatic resource function(s). Enhancement does not result in a gain in aquatic resource area."

The designs and rationale supporting the proposed stream restoration and enhancement efforts are presented in the stream design report (Rio ASE 2019b). A summary of the stream design framework is provided below.

7.1 Stream Design Approach

The stream design approach has followed a sequence of coarse- to fine-scale development. Midas Gold assembled a stream design team including specialists in engineering, geomorphology, fisheries biology, riparian ecology, and wetland ecology to refine the coarse-scale analysis initiated with the PRO (Midas Gold 2016). Each stream within the Project area was divided into design reaches based on proposed valley gradient, fish use, and hydrology (Figure 7-1). Reference sites were identified and evaluated. Design criteria, including proposed channel geometries, were developed for each reach based on evidence derived from the following:

- Geographic information system (GIS) and field measurements from reference sites

- Empirical formulae developed from local and regional data
- Published design guidelines available in the scientific literature

Refinements to post-mining topography (primarily changes to valley slope and width) were made to improve the intrinsic potential and associated habitat conditions within select reaches where possible. The channel geometry and reach-specific design criteria were revised then evaluated using standard at-a-station hydraulic calculations to ensure appropriate sediment transport and physical habitat conditions would be achieved.

The reach-specific design criteria were then applied to a design template illustrating the reach plan view, a representative meander plan and profile, and representative cross sections. From these plans, design quantities were calculated to quantify construction costs as well as proposed habitat conditions using Watershed Condition Indicators for comparison with baseline conditions. Typical bank treatments and in-channel features were developed to support the design criteria, provide habitat diversity, and facilitate bank stabilization until riparian vegetation becomes established. Finally, a generalized revegetation and planting plan was developed for specific riparian, wetland, and upland zones to improve long-term bank stability, woody debris recruitment, overhead cover, shade, and terrestrial/wetland habitat. Full details regarding the proposed stream design as summarized above can be found in the Stream Design Report (Rio ASE 2019b).

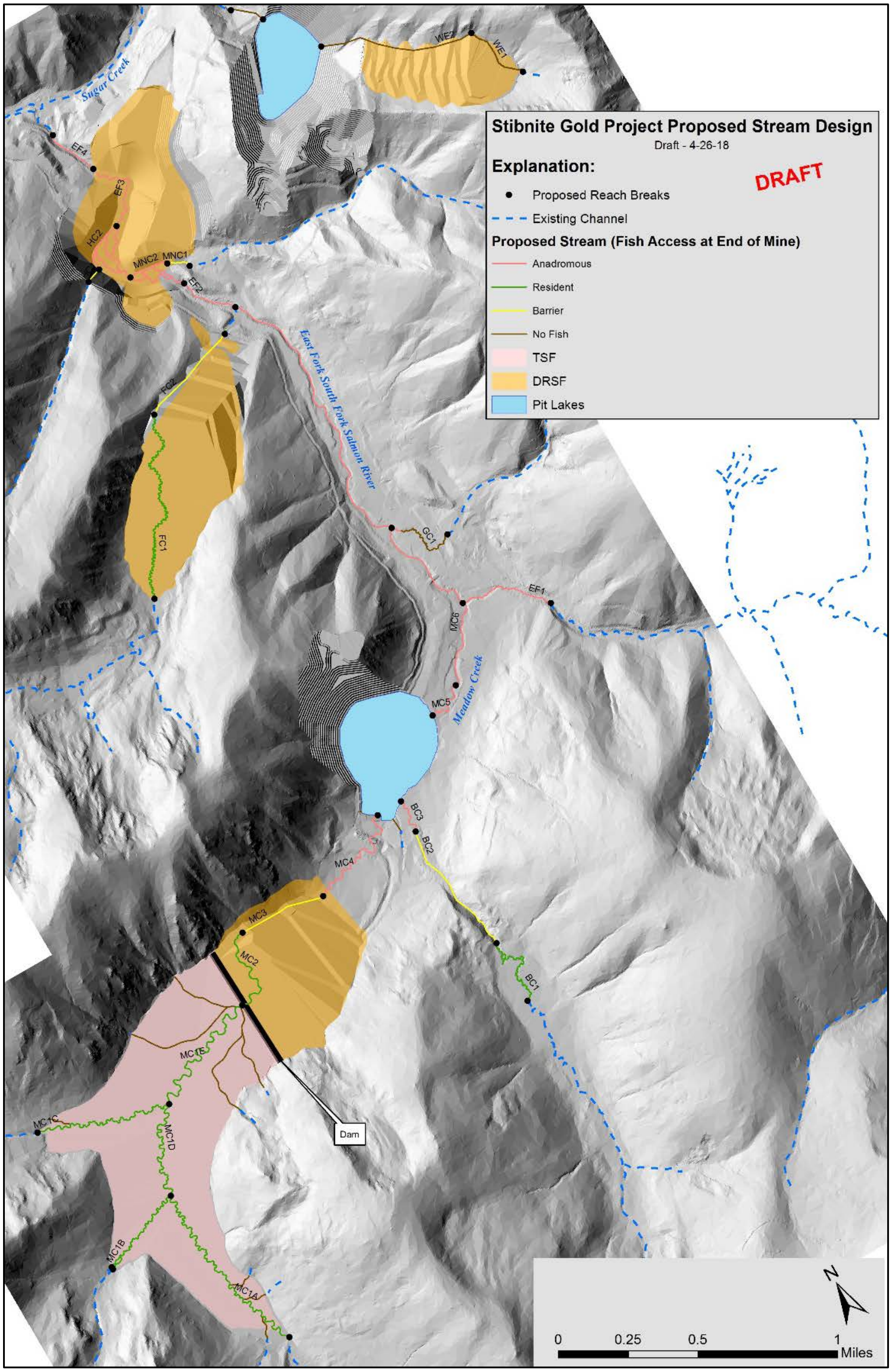

Figure 7-1. Proposed Stream Design Reaches (Source: Rio ASE)

7.2 Stream Channel Design Features

Stream designs are intended to promote fish passage and spawning/rearing habitat for migratory and resident salmonids. Physical design criteria (channel slope, sinuosity, bankfull channel width to depth ratio, etc.) were specified based on geomorphic suitability, habitat potential, and biological objectives (primarily based on intrinsic potential for Chinook salmon and steelhead spawning and rearing) (Rio ASE 2019b). While each design reach has specific associated design criteria, several design features apply generally to many or all the design reaches including the following:

- Where geomorphically appropriate, designs would target sinuous, low-gradient, meadow-like conditions with the potential for significant beaver influence. It is assumed that low-gradient spawning and rearing habitat is less common and more valuable than similar high-gradient habitat. Geomorphic targets have been developed, taking advantage of lower-gradient valley segments and/or increasing the sinuosity in many reaches, thereby reducing channel slope to gain more low-gradient, high intrinsic potential habitat.
- Restored channels would support dynamic channel response within a broad floodplain designed to be wider than the minimum meander belt width required for channel migration.
- Riffle-pool or step-pool sequences would be incorporated into stream profiles as appropriate to support appropriate hydraulic conditions and to enhance fish habitat.
- Instream hydraulic and habitat diversity would be promoted by adding instream structure including rock and/or woody debris. Enhanced hydraulic diversity from instream structure would create areas of flow convergence (to produce pool scouring) and divergence (to sort and deposit sediment) conducive to the development of salmonid spawning and rearing habitat.
- Existing, isolated instream passage barriers (culverts or otherwise) would be removed and/or replaced to provide passage where possible.
- Establishment of representative, native riparian vegetation communities along the stream and elsewhere within the floodplain providing long-term bank stability, cover, and temperature control.

The proposed stream restoration for the Project site would increase overall stream function, providing passage to migratory salmonids above the existing YPP for the first time in over 80 years, decreasing sediment input to the EFSFSR, improving water quality, improving physical channel conditions, and increasing overall aquatic habitat (Rio ASE 2019a). Restoration and enhancement of stream and riparian communities would be complemented by concurrent wetland mitigation (Tetra Tech 2019a) and upland wildlife habitat mitigation (Tetra Tech 2019b). For additional details regarding proposed site-specific stream restoration measures, see the Stream Design Report (Rio ASE 2019b).

7.3 Restoration Sequence

Midas Gold has also considered the timing of proposed impacts, and when possible, has pushed proposed restoration projects earlier in the life of the mine to minimize the extent of potential impacts to fish species within the Project site. Refer to Figure 7-2 for a generalized mining and restoration sequence. Refer to the CMP (Tetra Tech 2019a) and Stream Design Report (Rio ASE 2019b) for more details.

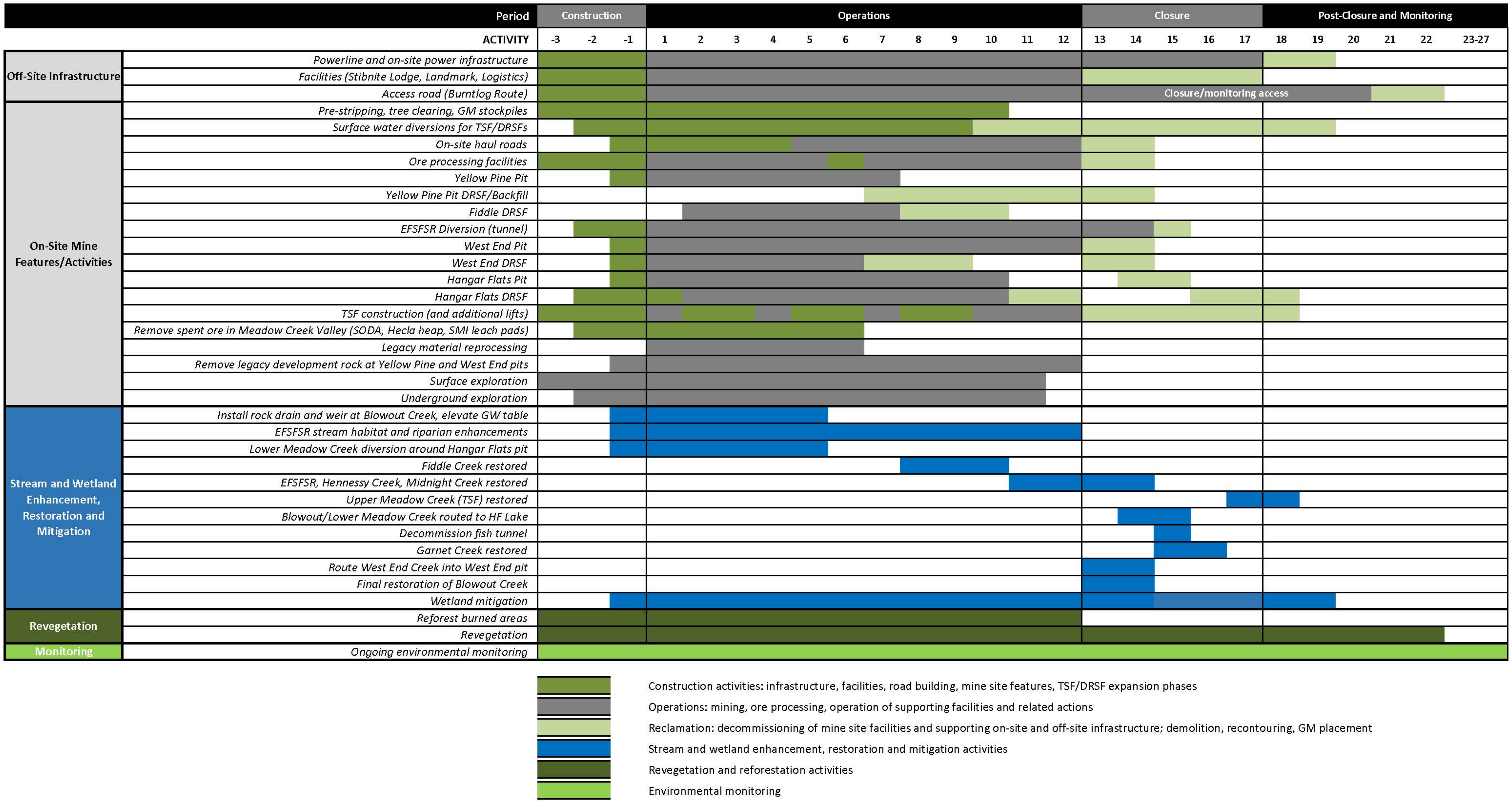

Figure 7-2. General Sequence of Mining, Restoration, Closure, and Reclamation

7.4 Restoration Examples

Provided below are examples of key proposed stream restoration actions, focused on the principal waterways. Restoration and enhancement are also planned for numerous lower-order streams at the Project site. For additional details about the proposed restoration design, see the Stream Design Report (Rio ASE 2019b).

EFSFSR through YPP—Following permanent cessation of mining activities at the YPP, Midas Gold plans to backfill the pit and restore the EFSFSR with a longer, lower-gradient channel with higher intrinsic potential for Chinook salmon and steelhead spawning and rearing than the channel that exists presently. The floodplain area along the reconstructed channel would include side-channels and other off-channel features and would be revegetated to restore wetland and riparian habitat providing long-term shade/cover favorable to fish. Once the EFSFSR is re-established atop the backfilled YPP, the EFSFSR tunnel used during mine operations would be permanently decommissioned (Midas Gold 2016).

Meadow Creek—The upper portion of the Meadow Creek restoration would occur atop the final TSF and Hangar Flats DRSF surfaces that together would fill the existing valley with material up to several hundred feet thick, resulting in a long, relatively flat surface and a short, steep face. On top of the TSF/DRSF surface, Meadow Creek will be contained within a broad floodplain corridor bound laterally by erosion-resistant terraces and vertically by a subsurface armor layer over an impermeable stream liner. The channel design would emulate high-sinuosity, low-gradient meadow channels observed from reference sites in and near the Project area. Meadow Creek would be routed off the TSF/DRSF surface along a steep, rock-lined chute with multiple energy dissipation pools down to the valley floor below. This steep reach would be a barrier to upstream fish migration.

Along the valley floor between the toe of the reclaimed Hangar Flats DRSF and the Hangar Flats pit, Meadow Creek would flow as a sinuous, single-thread stream over native alluvium. The sinuosity, meander wavelength, meander amplitude, bend radius of curvature, and width-to-depth ratio would all be optimized to enable geomorphic and habitat diversity. Meadow Creek would flow into and out of the proposed Hangar Flats pit lake. The lowest reach of Meadow Creek would occupy an existing restored channel alignment that would be enhanced with instream structure including woody debris and boulder clusters to increase hydraulic and habitat diversity. Meadow Creek between the Hangar Flats DRSF and Hangar Flats pit lake, and from there to its confluence with the EFSFSR, exhibits the highest intrinsic potential for Chinook salmon spawning and rearing of all restoration reaches.

Blowout Creek—Blowout Creek has been severely impacted by historical mining activities and failure of a reservoir dam in 1965 (Midas Gold 2016). The destabilization resulting from this historical impact has resulted in channel incision, habitat degradation, and one of the largest sources of fine sediment for the EFSFSR (Midas Gold 2016). Despite no proposed Project disturbance in this area, Midas Gold proposes to stabilize and restore Blowout Creek to improve watershed conditions, enhance concurrent restoration efforts and improve habitat near the Project site. The proposed design objectives include restoring the water table and long-term function of the upper reach that was historically a low-gradient meadow with broad riparian wetlands. The steep, confined, erosive middle reach will be stabilized to address the significant fine sediment load currently produced from this reach. The downstream, relatively low-gradient reach will be restored to provide rearing habitat for Chinook salmon and other salmonids.

Section 8

Monitoring and Adaptive Management

The Project has a projected life of 20+ years. This includes 3 years of site preparation and cleanup, construction, and early restoration activities; 12 to 15 years for operations; and approximately 6 years for final closure and reclamation work. At the end of this period, the restored/enhanced stream segments will be naturally functioning, self-sustaining aquatic/riparian habitats that will require relatively little maintenance or human intervention over time. However, ecosystems are inherently unpredictable and may require some degree of initial and/or periodic maintenance to achieve Project objectives.

The duration of post-closure monitoring should extend long enough to provide a reasonable assurance that restored/enhanced streams have met their performance criteria. Typically, permit conditions for habitat mitigation projects specify monitoring programs of up to 5 years, to encompass and document the point of most rapid change and the period of stabilization. Additional monitoring parameters may be specified following consultation with resource agencies and as indicated under special permit conditions. Monitoring parameters, frequency, and locations will be provided in a forthcoming EMMP.

Performance indicators (i.e., design criteria), SFA success criteria (i.e., stream functional value), and aquatic communities will be evaluated based on project/design objectives and expectations, and each will be established in coordination with stakeholders on a reach-by-reach basis. The performance indicators will be used to assess if the design intent has been met. SFA success criteria will be used to evaluate the degree of functional uplift. Aquatic communities will be measured as a proxy for restoration success based on the evaluation of strategic keystone species.

As previously stated, Midas Gold anticipates that the SGMP and its component plans may change and be updated or revised as the USFS proceeds through the EIS process and develops the draft and final EIS for the SGP, as part of DA permit review process, or through ESA Section 7 consultation. For this reason, some of the elements of this FMP are conceptual now and will only be refined or completed at the point at which the specifics of the final mitigation plan are known.

8.1 Performance Indicators

Stream physical characteristics (morphology and substrate) will be monitored on an annual basis to track development of target conditions as specified in final stamped design plans and with comparison to reference streams. Performance indicators will be based on specified design criteria and completion of as-built drawings that confirm the implemented project accurately reflects the design intent. Additionally, riparian vegetation will be monitored to confirm it has successfully established and is similar in vegetation composition, diversity, and structure to baseline conditions and/or reference sites.

8.2 SFA Success Criteria

Mitigation success criteria will be evaluated within a certain threshold of the predicted values from the SFA ledger (Rio ASE 2019a). The SFA is based on metrics that quantify how mining and restoration activities affect ecosystem health and habitat. It measures aquatic resource functions directly tied to the behavior and survival of target fish species. By comparing those measures before, during, and after mining, relative impacts and benefits can be evaluated over time. The SFA method proposed for this Project is discussed in detail in the SFA Report for the SGP and associated SFA ledger (Rio ASE 2019a).

Specific SFA elements outlined below will be monitored at strategic locations at a frequency determined in consultation with the agencies and with the USACE. This is because the stream restoration would be part of a compensatory mitigation plan to be submitted by Midas Gold to the USACE for a DA permit pursuant to Section 404 of the CWA. It is anticipated that a specific monitoring plan will be included in the issued permit. Monitoring frequency will vary for different SFA elements and across sites such as continuous hydrologic monitoring (streamflow, temperature), annual field visits included with other performance indicators above, and a full survey 5 years after restoration of each site.

- Habitat elements
  - Substrate embeddedness
  - Large woody debris
  - Pool frequency
  - Pool quality
  - Off-channel habitat
- Water quality
  - Temperature (continual monitoring via automated data recorder)
  - Sediment/turbidity
  - Chemical contaminants/nutrients
- Habitat access
  - Physical barriers
- Channel conditions and dynamics
  - Width/depth ratio
  - Streambank conditions
  - Floodplain connectivity
- Flow/hydrology
  - Peak and baseflow hydrology (continual monitoring via automated stream gages)
  - Drainage network density
- Watershed conditions
  - Road density
  - Disturbance within Riparian Conservation Areas
  - Disturbance history

8.3 Aquatic Communities (Fish and Stream Macroinvertebrates)

Stream biotic assemblages (fish and macroinvertebrates) will continue to be monitored throughout the 20+ year lifespan of the Project, following protocols established and carried out during baseline monitoring studies (2012 through 2017) (MWH 2017). Initially, Midas Gold will continue to monitor aquatic communities on an annual basis (or as permit conditions dictate); however, Midas Gold will periodically review the monitoring results and determine if the frequency and/or spatial scale of monitoring may be reduced or expanded in the future. Any revisions to the program will be discussed with appropriate stakeholders prior to implementation.

Stream fish assemblages will be monitored throughout construction, closure, and restoration/enhancement phases of the Project. Baseline fish community surveys conducted between 2012 and 2018 encompassed over 30 survey sites distributed among the EFSFSR, Sugar Creek, Tamarack Creek, Meadow Creek, East Fork Meadow Creek, Fiddle Creek, Midnight Creek, Hennessy Creek, Cinnabar Creek, and Cane Creek. Fish surveys conducted during construction, closure, and restoration/enhancement phases of the Project will encompass a representative subset of these same locations, selected to represent the range of site conditions (including waterway modifications and diversions), as well as a representative suite of reference sites. During operations, Midas Gold would monitor fish use of the EFSFSR tunnel using a PIT array or arrays placed at appropriate locations in and near the tunnel. One example of potential post-closure monitoring comes from the Services' concern over the potential for predation by bull trout on juvenile Chinook salmon if the Hangar Flats pit lake is connected to Meadow Creek. Monitoring for bull trout predation of juvenile salmonids in the Hangar Flats pit lake may be warranted and may be an adaptive management program that could be implemented if significant predation occurs.

Stream macroinvertebrate community composition will be monitored annually throughout construction, closure, and restoration/enhancement phases of the Project, as an indicator of water quality and overall stream habitat condition. Baseline stream macroinvertebrate surveys encompassed a total of 11 survey sites located within the EFSFSR, Meadow Creek, Sugar Creek, and Tamarack Creek; the stream macroinvertebrate surveys conducted during construction, closure, and restoration/enhancement phases will encompass a representative subset of these same locations, selected to represent the range of site conditions (including waterway modifications and diversions).

The metrics used in the analysis will be based on those used in the baseline aquatic biological surveys (MWH 2017), to provide an appropriate basis for comparison of stream macroinvertebrate communities over the 20+ year Project timeframe.

8.4 Adaptive Management

Adaptive management is the process of adjusting management actions and/or directions based on new information as it becomes available. Adaptive management is an approach that recognizes and prepares for uncertainty (e.g., in simulated outcomes, restoration effectiveness, etc.) and stochastic natural events or disturbance (climate change, fire, etc.). It couples the decision-making process with monitoring, performance criteria, and ongoing evaluation, and is typically implemented with explicit process steps and needed adjustments when monitoring indicates that performance objectives are not being met. That is, if the results of the monitoring program indicate that mitigation areas are failing to achieve the ecological performance standards as anticipated, reasons for failure would be evaluated and corrective actions would be proposed to correct shortcomings.

Midas Gold recognizes that there is inherent uncertainty in elements of simulated impacts and the anticipated effectiveness of management measures and mitigation plans. Certain monitoring elements described above, such as monitoring of specific SFA habitat elements, water quality monitoring, streamflows, and fish and aquatic community monitoring are examples of monitoring that would be implemented in an adaptive management framework once performance expectations are established. The Fishway Operations and Maintenance Plan currently under development (BC and BioAnalysts, in progress) will include an adaptive management implementation approach because of uncertainties about fish use of the fishway and passage effectiveness and the need for information useful to assessing its performance.

As described in the SGMP, more details of monitoring and maintenance, performance standards, and adaptive management will be more fully addressed at the appropriate time, when the SGMP is closer to its final form and after the agencies and public have been provided an opportunity to comment on the draft EIS and the SGMP. Midas Gold will continue to consult with federal and local regulatory agencies to identify strategies for meeting mitigation obligations including, where appropriate, the development and implementation of an adaptive management plan for certain elements of the Project. It is expected that these will be discussed and considered as part of the plan developed during the ESA Section 7 informal consultation process (BC 2018a).

Section 9

Reporting and Quality Assurance/Quality Control

Midas Gold proposes to lead annual site visits for USACE, EPA, IDFG, and other interested agency personnel to facilitate agency review of mitigation areas if desired. Final reporting and data archival requirements would be subject to permit conditions; however, at a minimum, it is anticipated that monitoring reports would be prepared by Midas Gold annually and submitted to USACE Walla Walla District, EPA, IDFG, IDL, NOAA Fisheries, USFWS, and USFS and other interested agencies, Project partners and stakeholders. Each report would include "as built" drawings of each stream mitigation project completed that year, illustrating site conditions and dimensions, topography, planted areas, and water supply and control features. Any deviations from the original designs would be documented, and the report would include photographs taken from established reference points. Subsequent monitoring reports would summarize field observations of pre-determined monitoring criteria. Photographs taken from the established reference points would be used to illustrate riparian vegetation conditions and stream habitat quality. The monitoring reports would assess annual progress towards achieving Project goals/objectives and include recommendations from Midas Gold regarding any necessary adjustments or changes in monitoring schedules, parameters measured, and success criteria.

Midas Gold would develop and implement a Quality Assurance (QA)/Quality Control (QC) program to ensure the integrity of all monitoring data collected at the Project site. QA assures the integrity and reliability of monitoring and measurement data. QC is the application of procedures to evaluate data acquisition techniques and analyses according to established criteria. A draft post-restoration monitoring QA/QC plan will be developed and submitted for approval by the resource agencies (e.g., IDEQ, IDL, USACE, USFS, USFWS, NOAA Fisheries, and USFS). The plan would include sample documentation procedures, as well as sample control and data validation methods, from collection through reporting of analytical results. Additional elements of the plan would include sample identification protocols, use of standardized field data collection forms, and chain-of-custody sample tracking and documentation.

Section 10

Limitations

This document was prepared solely for Midas Gold in accordance with professional standards at the time the services were performed and in accordance with the contract between Midas Gold and Brown and Caldwell dated January 1, 2019. This document is governed by the specific scope of work authorized by Midas Gold; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by Midas Gold and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

Further, Brown and Caldwell makes no warranties, express or implied, with respect to this document, except for those, if any, contained in the agreement pursuant to which the document was prepared. All data, drawings, documents, or information contained this report have been prepared exclusively for the person or entity to whom it was addressed and may not be relied upon by any other person or entity without the prior written consent of Brown and Caldwell unless otherwise provided by the Agreement pursuant to which these services were provided.

Section 11

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