2. DESCRIPTION OF ALTERNATIVES

The purpose of this EIS is to analyze the potential environmental impacts of the Proposed Action and the No Action Alternative, as well as the potential environmental impacts of reasonable alternatives to the Proposed Action, so that DEQ can make an informed permitting decision. This chapter describes the No Action Alternative and the Proposed Action. In addition, this chapter describes the process of identifying and screening ideas that could potentially be incorporated into an alternative. This screening process resulted in development of the Agency Modified Alternative (AMA). Finally, this chapter describes other alternatives that were identified in the screening process that were considered, but not carried forward for detailed analysis.

2.1. NO ACTION ALTERNATIVE

The No Action Alternative is the baseline upon which potential impacts can be measured due to the Project. Under the No Action Alternative, DEQ would not approve the Proponent's application for an operating permit under MMRA, an MPDES Permit, or Air Quality Permit. The Proponent would not be able to construct and operate the proposed mine. Land within the Project area would remain largely as it is today (see Affected Environment sections of Chapter 3) with the potential exception of current and additional exploration activity.

2.2. PROPOSED ACTION

The following documents collectively provide the basis for the Proposed Action:

- MOP Application, Revision 3 (Tintina 2017), dated July 14, 2017, and appendices (management plans);
- MOP Application Updates:
  - DEQ letter dated January 30, 2018 (DEQ 2018d), "Update to Proposed Treated Water Disposition for the Black Butte Project," which includes UIGs to Sheep Creek alluvium (Proponent request letter dated January 11, 2018 [Tintina 2018c]);
  - DEQ letter dated January 30, 2018 (DEQ 2018b), "Update to Proposed Rail Load Out Facilities for Shipment of Containerized Copper Concentrates" (Proponent request letter dated January 11, 2018 [Tintina 2018d]); and
  - DEQ letter dated November 21, 2018 (DEQ 2018e), "Updates to Mine Operating Permit Application for the Black Butte Copper Project, Proposed Holding Pond Facility for Treated Water, Revision to Annual Water Balance, and Addition of a Wet Well" (Proponent request letter dated October 26, 2018 [Tintina 2018b]).
- DEQ responses to MOP Application comments:
  - MOP Application, Revision 3 (Tintina 2017), Section 9, Responses to Comments; and
  - MOP Application Comments and Responses (DEQ 2018c).

- Integrated Discharge Permit Application Narrative (Hydrometrics, Inc. 2018b), revised February 15, 2018;
- Addendum to Integrated Discharge Permit Application for the Black Butte Copper Project, dated October 29, 2018 (Zieg 2018); and
- Black Butte Copper Mine Traffic Impact Study (Abelin Traffic Services 2018), dated April 2018.

2.2.1. Proposed Action Overview

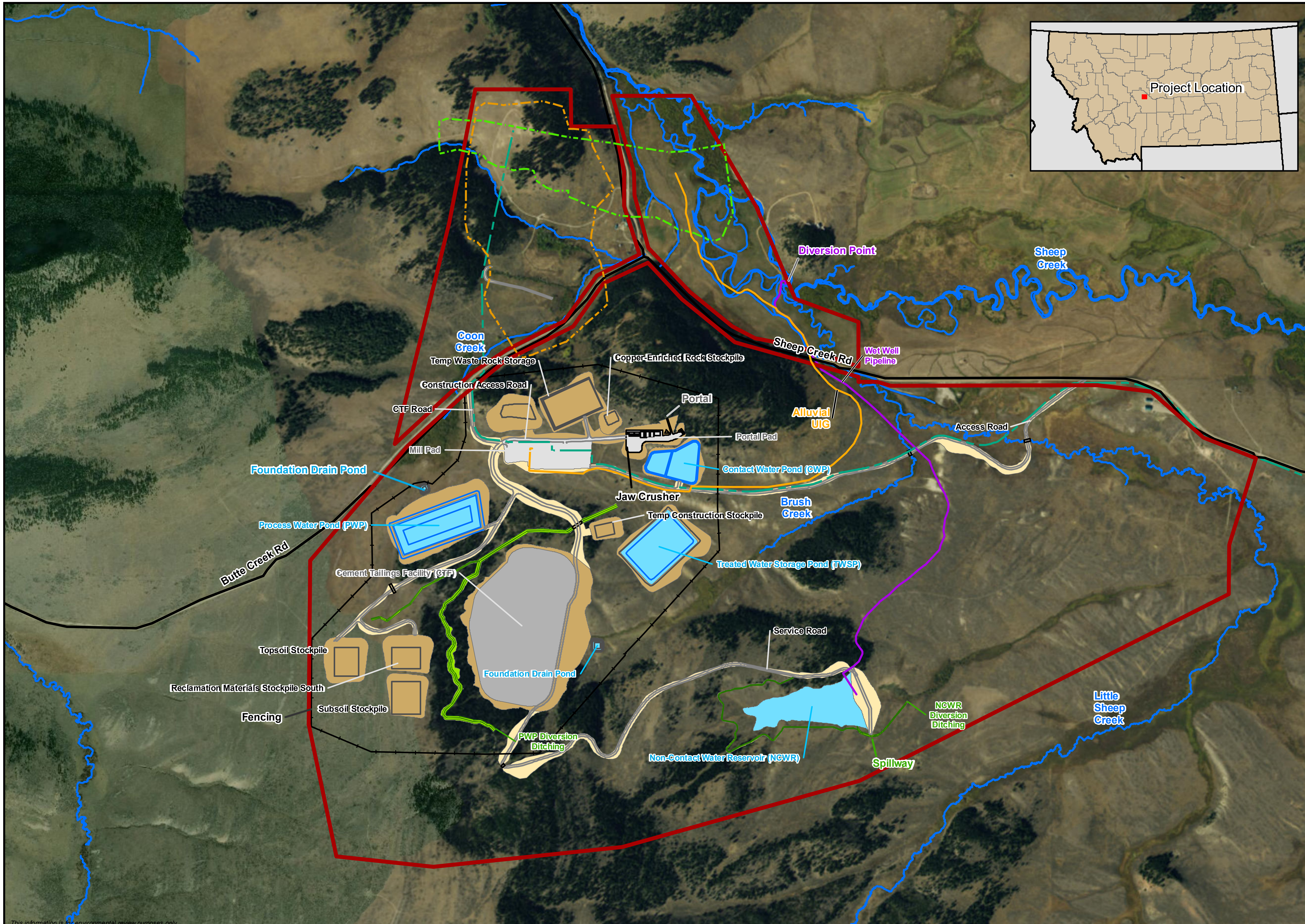
The Proponent's purpose for the Project is to mine the Johnny Lee Deposit by underground mining methods, to process the copper-enriched rock on site into a salable copper concentrate, and to ship the concentrate to a load out facility from where it would be shipped to a purchaser.

The Proponent intends to construct, operate, and reclaim a new underground copper mine over 19 years, followed by monitoring and closure of the site. There is no history of industrial development on the site. The site is located about 15 miles north of White Sulphur Springs in Meagher County, Montana. The Project area is in Sections 24, 25, and 36 in Township 12N, Range 6E, and in Sections 19, 29, 30, 31, and 32 in Township 12N, Range 7E. All operations would occur within a permit boundary encompassing approximately 1,888 acres of privately owned ranch land under lease to the Proponent (see **Figure 2.2-1**). Surface disturbances would occur on private land and total approximately 310.9 acres (see **Table 2.2-1**).

The Project would mine approximately 15.3 million tons of copper-enriched rock and waste rock from the Johnny Lee Deposit. This includes 14.5 million tons of copper-enriched rock with an average grade of 3.04 percent copper and 0.8 million tons of waste rock. Mineralization in this ore body consists of an upper copper zone and lower copper zone. The upper copper zone lies at a depth of approximately 90 to 625 feet below ground surface (bgs), and the lower copper zone is at a depth of approximately 985 to 1,640 feet bgs. The Proponent would employ approximately 235 workers, with an additional 24 contract miners and 127 associated support workers working at the site during the first 4 years of mining. Construction of mine facility and surface support structures during the initial 30 to 36 months would require a maximum of approximately 173 sub-contracted employees.

The Proponent plans to access the deposit through a single 17-foot wide by 17-foot tall mine portal at the surface. A decline ramp would provide access for all personnel, mine equipment, and materials to the underground working areas. Approximately 18,800 feet of access ramp and level access drifts would be developed beyond the surface portal for mining. Four ventilation raises constructed to surface would also be collared above the regional groundwater table. One of these ventilation raises would be constructed as a secondary emergency escape way.

Figure 2.2-1
Black Butte Copper Project
Project Facilities Site Plan
Meagher County, Montana



- LCZ_Footprint
- UCZ_Footprint
- MOP Application Boundary
- Fencing
- County Road
- Alluvial UIG
- Power Line
- Access Road
- Culvert Crossing
- Pipeline
- Mill Area
- Cement Tailings Facility
- Water
- Access Road
- Topsoil Stockpile
- Diversion Ditching
- Stream

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FILE: M:\Clients\M-O\MTDEQ\BlackBute_Copper_ArcGIS\2019\01\Facilities_Site_Plan\MTDEQ_Black_Butte_Facilities_Site_Plan.mxd | REVISED: 01/25/2019 | SCALE: 1:15,562 when printed at 11x17

DRAWN BY: JPB

Table 2.2-1
Surface Disturbances in the Project Area

Facility or Activity	Linear Feature (lineal feet)	Construction Disturbance Width (feet)	Surface Disturbance (acres)
New Access Roads Sub-total			**57.7**
Main Access Road to Mill Site	7,973	84	15.4
Contractor Access Road Butte Creek Road to CTF Road	1,178	98	3.5
CTF Road – Portal to CTF	4,223	164	11.8
Powerline Corridor Parallel to Main Access Road (overlap with main access road removed)	7,256	20	4.5
Truck Road to WRS Pad	305	98	0.7
Service Road – Truck Road to Soil Stockpiles (Includes Road to PWP)	4,490	98	7.7
Service Road – Main Access to CWP	Already disturbed		
Service Road – CTF to NCWR	6,594	98	13.4
Ventilation Raises New Access Roads	1.081	49	0.7
Direct Underground Mine Support Sub-total			**7.9**
Portal Pad, Including Support Facilities	984	410	6.9
Ventilation Raise Collar Areas (4) (100 x 100’, 0.3 acres each) 6-foot Chain Link Fence	100	100 (x4)	0.9
Pumping Lines to Portal to PWP	992 undisturbed	5	0.1
Pumping Lines to Portal to WTP	2300	5	Already disturbed
Temporary Waste Rock Storage (WRS) Sub-total			**12.1**
Temporary WRS	820	591	10.2
Copper-enriched Rock Storage Pad	295	295	1.9
Drainage Piping WRS to CWP	550	20	Already disturbed
Contact Water Pond (CWP) Sub-total			**9.0**
CWP	656	656	8.9
CWP Pump-back Piping to WTP	2,328	5	Already disturbed
CWP Pump-back Piping to PWP	989 undisturbed	5	0.1
CWP 8-foot Wildlife Fence	2600	5	included
Mill/Plant Site Sub-total			**9.8**
Plant Site (includes Mill, Laydown Area, Substation, Truck/Shop/Admin, Paste Backfill Plant, and Water Treatment Facilities, etc.)	1,312	492	9.8
Primary Crusher and Conveyor	NA	NA	included

Facility or Activity	Linear Feature (lineal feet)	Construction Disturbance Width (feet)	Surface Disturbance (acres)
Process Water Pond (PWP) Sub-total			**28.7**
PWP	NA	NA	23.9
PWP Foundation Drain Pond	NA	NA	0.4
Pump Back Piping to PWP[1]	50	20	0.0
PWP Diversion Channel	NA	NA	3.7
Piping PWP to Mill	1,548	20	0.7
PWP 8-foot Wildlife Fence	NA	NA	included
Cemented Tailings Facility (CTF) Sub-total			**82.5**
CTF	NA	NA	71.9
CTF Foundation Drain Pond	NA	NA	0.7
CTF Foundation Drain Pond to WTP [a]	420 2,350	20 20	0.2 already disturbed
CTF Pump-back Piping to PWP [a]	2,628	20	1.2
Tailings Pumping Supply Mill to CTF	4,423	20	2.0
CTF Diversion Channel	1,002	20	6.5
CTF 8-foot Wildlife Fence	NA	NA	included
Non-Contact Water Reservoir (NCWR) Sub-total			**7.6**
NCWR	NA	NA	4.7
NCWR Diversion Channel	1,252	NA	2.1
NCWR Spillway Channel	286	NA	0.5
NCWP Piping to Spillway Channel	738	20	0.3
Wet Well and Pipeline Sub-total			**2.4**
Wet Well	NA	NA	<0.1
Discharge Pipeline within UIG Pipeline Excavation	1,970	20	Already disturbed
Discharge Pipeline	5,181	20	2.4
8-foot Wildlife Fence	NA	NA	included
Treated Water Storage Pond (TWSP) Sub-total			**20.2**
TWSP	NA	NA	19.6
TWSP Foundation Drain Infiltration Pond	NA	NA	0.1
TWSP Pump Back to Piping to WTP (undisturbed)	1,232	5	0.5
TWSP 8-foot Wildlife Fence	3,879	5	included
Water Supply Sub-total			**6.3**
Public Water Supply Well and Pipeline (100 x 100' Pad, 0.3 Acres Includes Water Tank)	NA	NA	0.3
Pipeline Well to WTP	5,913	20	2.7

Facility or Activity	Linear Feature (lineal feet)	Construction Disturbance Width (feet)	Surface Disturbance (acres)
Powerline Well PW-6 to substation	Same as above	NA	2.7
Water Tanks (Mill) Distribution Lines	1,320	20	0.6
Underground Infiltration Gallery (UIG) Sub-total			**5.4**
UIG to Sheep Creek Alluvium	NA	NA	5.4
Stockpiles Sub-total			**32.4**
Top Soil	492	525	8.0
Subsoil	1,083	558	7.0
Excess Reclamation Stockpile (North)	623	492	7.10
Excess Reclamation Stockpile (South)	NA	NA	7.5
Temporary Construction Stockpile	NA	NA	2.8
Other/ Miscellaneous Sub-total			**0.6**
Septic System	NA	NA	0.2
Temp. Powder Magazine	NA	NA	0.4
8-foot Chain Link Fence	NA	NA	included
Barbed Wire Fencing of Active Mine	NA	NA	included
New Monitor well and Piezometer Sites	NA	NA	included
Subtotal			**282.6**
Construction Buffer Zone/Miscellaneous [b] (10% of subtotal, and includes a 25-foot perimeter around all facilities)			28.3
Disturbance Acres Total			**310.9**

Source: Modified from Tintina 2017; Tintina 2018b

CTF = Cemented Tailings Facility; CWP = Contact Water Pond; NA = not applicable; NCWR = Non-Contact Water Reservoir; PWP = Process Water Pond; TWSP = Treated Water Storage Pond; UIG = Underground Infiltration Gallery; WRS = Waste Rock Storage; WTP = Water Treatment Plant

Notes:

[a] Much of this pipeline is constructed on ground disturbed by a facility; the amount shown is additional disturbance.

[b] Examples include chain link and barbed wire fences, monitor wells and piezometer locations, storm water ponds, storm water ditches outside of disturbed areas, rock roll and erosion control berms.

2.2.2. Construction (Mine Years 0–2)

Early Project activities would include the clearing of vegetation to allow for the construction of Project surface facilities and infrastructure. Pre-construction treatments may include mechanical means (e.g., mowing, brush clearing, tree harvesting). Noxious weeds would be controlled prior to soil stripping and soil redistribution to the extent feasible and herbicide application may be used, depending on the vegetation species present and size of the population. The total area of surface disturbance required for construction would be approximately 310.9 acres. Once the ground surface has been properly prepared, construction would commence. The Project's major components would include a portal and portal pad, temporary initial mine support facilities on the portal pad, permanent underground mine workings and utilities, and an electrical substation. In addition, construction would include a processing plant (including a crusher, grinding mills, a flotation circuit, and tailings thickener), a paste tailings plant, a Water Treatment Plant (WTP), a concentrate storage facility, a truck shop, an office complex parking, and two construction materials laydown areas. Other surface facilities include a Process Water Pond (PWP), a Cemented Tailings Facility (CTF), a Contact Water Pond (CWP), a Treated Water Storage Pond (TWSP), Non-Contact Water Reservoir (NCWR), a wet well, buried pipelines, roads, a Waste Rock Storage (WRS) pad facility, an ore stockpile, three overburden stockpiles, powerline, ditches, and fencing. A temporary access road would also be built to aid in construction and be replaced by a more substantial road operationally. With the exception of the CTF and the mill that need to be completed prior to production in Mine Year 3 through 4, other facilities are expected to be largely completed during the initial 2-year construction period.

Approximately 315,238 cubic yards of topsoil and 248,454 cubic yards of subsoil would be stockpiled (Tintina 2018b). This organic loamy material would be removed from proposed disturbance areas prior to construction and would be stored in separate topsoil and subsoil stockpiles of 8 and 7 acres, respectively. The amount of subsoil removed would be limited to that required by excavations for the facilities. A separate northern 7.1-acre excess excavation (reclamation) material stockpile would also be constructed and be used in Mine Year 2 or 3 to reclaim the WRS pad facility after all waste rock has been relocated to the CTF. A southern (7.5 acre) excess excavation (reclamation) material stockpile would also be constructed to store excess material from major facility construction for use in final mine reclamation. In addition, a temporary construction material stockpile would be constructed to store processed (crushed and screened) material for specific uses in the construction of major facilities.

During the construction period, development mining would take place. Development mining consists of excavating the portal, declines, and access drifts in preparation for production mining of copper-enriched rock. During the initial years of mining, two 6,000-gallon water tanks would be constructed at the east end of the portal pad for supplying water required by underground mining. In the first 2 years of construction, underground development mining would produce approximately 453,642 tons of waste rock. This waste rock would be placed on a lined WRS pad temporarily while the CTF embankments and liner system were constructed. During Year 3, this waste rock would be used to construct the interior (above the liners) basin drain system of the CTF. The maximum design capacity of the 12.1-acre temporary WRS pad is 551,155 tons.

The PWP would store water that is recycled for use in the operation of the mill to minimize consumptive use of water by the Project. The CTF would store a portion (about 55 percent) of the fine-grained rock material from the mill (tailings) once copper-enriched minerals have been extracted. The remainder of the tailings (45 percent) would be used operationally and in closure to backfill mine production workings. Both the PWP and CTF impoundments would be double-lined. Each of the two liner layers would be constructed of 0.1-inch High Density Polyethylene (HDPE) geomembrane with a 0.3-inch high flow geonet layer sandwiched between the geomembrane layers. Any seepage through the upper geomembrane layer into the geonet would be directed via gravity to a sump and pump reclaim system at a low point in the PWP or CTF basin. Before water is pumped to the PWP, it would be pumped to the crest of the CTF and returned to the CTF first where it would ultimately flow into the CTF basin drain and into the

CTF reclaim system. The MOP Application states that service life of the CTF liner is estimated as 400 years or more (Tintina 2017).

In addition to the liner system, the CTF also has an internal (above the liners) basin drain system to remove any liquids present in the cemented tailings facility to the basin drain for treatment and/or disposal. Finally, the foundation drain system would collect groundwater flows below the PWP and CTF liner systems and convey them to a foundation drain collection pond downstream of the facilities. Water collected in these ponds would be pumped back to the PWP or directly to the WTP for treatment and disposal in the alluvial UIG. The PWP is operationally designed to never be more than half full. The CTF is designed to have no surface water storage on the facility except following rainfall events. Both facilities are designed to contain the probable maximum flood event.

Early in the 2-year construction period, the lined CWP would be completed to capture surface water run-off from potentially contaminated constructed facility footprint materials (i.e., mill pad facility and haul roads) and facility seepage (i.e., waste rock and copper-enriched stockpile pads) prior to being pumped to the WTP for treatment and disposal. The CWP would also be used to store excess water from the underground mine prior to treatment and disposal, and initially (prior to completion of the PWP) for brines generated from the reverse osmosis (RO) WTP in a segmented brine cell within the CWP. The CWP is designed operationally to have a minimal amount of water stored on the facility.

Additionally, a TWSP would be constructed southeast of the WTP. It would store treated water from the WTP if effluent from the WTP does not meet seasonal effluent limits for total nitrogen (between July 1 to September 30) in the MPDES permit (Tintina 2018b). Treated water from the WTP would be pumped through a 6-inch diameter HDPE pipeline to the TWSP for storage during this time. The TWSP is designed to store up to 53.7 million gallons of treated water to provide enough temporary storage of treated water at an average flow rate of 405 gallons per minute (gpm). The pond would be lined with a 60-mil[1] HDPE geomembrane liner installed over a 12 ounces per square yard non-woven geotextile cushion.

The NCWR would also be constructed during the construction period. The primary purpose of the NCWR is water storage for stream flow augmentation that the Montana Department of Natural Resources and Conservation (DNRC) may require for water rights mitigations. Surface water would be diverted from Sheep Creek during spring runoff, when flows are greater than 84 cubic feet per second, protecting the total existing appropriated water rights on Sheep Creek downstream of the diversion (Hydrometrics, Inc. 2018a; Tintina 2018b). Water stored in the NCWR could be used to augment flows at several locations, as required, including Sheep Creek (via discharge back through the wet well), Coon Creek, Black Butte Creek, Little Sheep Creek (via seepage through the bottom of the reservoir), and Brush Creek (if indirect impacts to wetlands are observed due to interception of groundwater beneath the CTF). Discharges to Coon Creek, Black Butte Creek, and the Brush Creek wetland would likely occur via small UIGs constructed adjacent to the streams so that the transferred water may equilibrate with ground

[1] 1-mil = 1/1,000 of an inch

temperatures before entering the streams. NCWR water could also offset consumptive use of groundwater by the milling and mining operation (about 220 gallons per minute), as per DNRC requirements (DNRC 2012). As the NCWR would be used for transfer of water between Sheep Creek and other streams, discharges from the NCWR would not require coverage under an MPDES permit (see ARM 17.30.1310(1)(g) and 40 CFR 122.3(i)).

The point of diversion would be a wet well that consists of an 8-foot concrete manhole, which is connected to Sheep Creek through a 22-inch HDPE intake pipe. The intake pipe would be extended approximately 6.5 feet into Sheep Creek and would be a solid pipe buried beneath the ground surface at an elevation equal to or slightly below the streambed elevation. When the flow in Sheep Creek exceeds 84 cfs, water would be pumped from the wet well, using a vertical turbine pump, through approximately 7,150 feet of 20-inch HDPE transfer pipeline to the NCWR. The transfer pipeline would be placed on the ground surface along the access road within a hay meadow and would remain on the surface except where it crosses the Sheep Creek County Road 119. The pipeline would cross Brush Creek in an area with narrow wetland fringe areas and be suspended above the wetlands and stream channel.

Noise associated with construction activities could be reduced by implementing the noise mitigation measures described below to minimize disruption of humans and wildlife (Tintina 2017).

- On all diesel-powered construction equipment, replace standard back-up alarms with approved broadband alarms that limit the alarm noise to 5 to 10 A-weighted decibels (dBA) above the background noise.
- Install high-grade mufflers on all diesel-powered equipment.
- Reduce the noise of the underground haul trucks by enclosing the engine.
- Restrict the surface and outdoor construction and operation activities to daytime hours (7:00 a.m. to 7:00 p.m.).
- Combine noisy operations to occur for short durations concurrently.
- Turn idling equipment off.

2.2.3. Operations (Mine Years 3–15)

During the first 4 years of operations, ramps would be constructed down to the deposit and cross-cuts would be developed to access the mining stopes. This mine access construction would continue during the first year or 2 of operations. After approximately 2.5 years, the Proponent would progressively mine larger amounts of copper-enriched rock from the production drifts until reaching the average design production rate (3,640 tons per day). Within the mine, ground control stabilizing support would be installed in the tunnel backs and ribs, and electrical, water, compressed air, and ventilation utilities would be established. Grouting to stem the flow of water into the mining access drifts could be completed in major water bearing fractures or faults as they are encountered. The mining cycle would consist of advancing mine headings or tunnels by drilling face blast rounds, loading the rounds with explosives comprised of either emulsion or ammonium nitrate/fuel oil, using detonators to blast the rounds, mucking (removing broken material from the round), and then installing ground support so that the next cycle could continue. Production mining proposes to use the drift-and-fill mining method in actual mining stopes to extract copper-enriched rock. This method allows the entire deposit to be mined while incrementally backfilling the mined-out voids between stopes with fine-grained cemented tailings paste. This backfilling creates a safe underground working environment for the miners. This pattern of drifting and backfilling continues both laterally and vertically until the entire resource is mined out.

Pumps would remove groundwater via underground sumps to the surface and a portion would be used for makeup water in the mill process circuit and cemented tailings paste plant. The remaining portion of the underground sourced water would be treated with RO at the WTP prior to discharge to the alluvial UIG. During its life, the Project would mine a total of approximately 14.5 million tons of copper-enriched rock. The overall mine production rate would be approximately 1.3 million tons per year during the peak years of active mining. The design average production rate of 3,640 tons per day requires mining in approximately 18 active mining stopes. All copper-enriched rock mined would be hauled by articulated underground haul trucks either to the surface crusher supplying the mill or to the ore stockpile.

In the mill, crushed copper-enriched rock would travel to a surge bin through a series of three grinding mills (a semi-autogenous grinding mill, ball mill, and tower mill) in the processing plant that would progressively reduce the size of the rock. A dust control system would control fugitive dust emissions from the crushing operation. The finely crushed copper-enriched rock would then enter a flotation circuit where copper would be separated from non-copper bearing rock through chemical and physical processes. The flotation circuit also would include a concentrate re-grind mill. The resulting copper concentrate would then be thickened and pressed to remove water and shipped in sealed containers via truck off site to a railhead. About 440 tons of copper-rich concentrate would be produced daily and transported in closed shipping containers by, on average, 18 trucks per day. The closed shipping containers would minimize or avoid potential leakage or spillage during transport and eliminate dust potential and spills.

The road system that would be used to transport mine concentrates between the Project site and the Livingston and Townsend railheads includes portions of Sheep Creek Road, U.S. Route 89, U.S. Route 12, Interstate 90 (I-90), and local roads in Livingston and Townsend. Rail facilities used to haul mine concentrates include Montana Rail Link rail yards at Livingston and Townsend, Montana, Rail Link mainline tracks serving these railheads, and Burlington Northern Santa Fe Railroad mainline tracks in Montana. All onsite mine haul roads would require berms of one-half axle height or greater for the largest truck using the road as per Mine Safety and Health Administration safety requirements. Similar berms would be constructed along the main mine access road, if determined to be necessary by the Mine Safety and Health Administration.

Tailings, a fine-grained waste product from the mill, would total 12.9 million tons over the life of the Project. The tailings would be thickened and sent to a paste plant where cement, slag, and/or fly ash may be added to the tailings as a binder. The product, called cemented paste tailings, would be pumped in pipes either to the underground mine where it is used to backfill workings, or to a double-lined tailings basin called the CTF. The CTF was designed to hold 4.7 million cubic yards of cemented tailings, 703,606 cubic yards of waste rock, and 400,000 cubic yards of storm water from a probable maximum flood event. Approximately 55 percent of the cemented tailings paste produced by the Project would be stored in the CTF, with the remaining 45 percent used to backfill production workings during the sequential mining of drifts. As operations proceed, opportunities to increase the tailings used for underground mine backfill would be sought. For example, additional backfill could be placed in primary and secondary access drifts in the lower copper zone and the lower zone mine access ramps.

During operations, the PWP would also receive water from direct precipitation and runoff, the CTF, the WTP, and the mill. Water from the PWP would be sent either to the mill for reuse or to the WTP. The WTP would receive water from underground mine dewatering, the PWP, the TWSP, and the CTF foundation drain. The WTP then delivers water to the mill, to an alluvial UIG, or to the freshwater tank. Any seepage from the temporary waste rock and mill feed storage pads, and contact water from the portal pad, mill facility, and onsite haul roads would travel by pipeline and lined ditch to the CWP for treatment and discharge (or alternatively used as make-up water in the mill). From October 1 to June 30, treated water stored in the TWSP would be pumped back to the WTP via a 6-inch diameter HDPE pipeline, where it would be mixed with other WTP effluent. The blended water would be sampled prior to being discharged per the MPDES permit. The TWSP would be operational prior to dewatering the mine workings.

The Proposed Action groundwater model predicts approximately a 70 percent reduction in stream base flow in lower Coon Creek. To augment this flow reduction, water from the NCWR could be routed to either a direct discharge to Coon Creek, or to the new alluvial UIG adjacent to Coon Creek. This augmentation would only be implemented when drawdown impacts are detected at the monitoring sites in the vicinity of Coon Creek. Water stored in the NCWR would also be used to offset potential hydrologic impacts to wetlands at the head of Brush Creek (Tintina 2017).

Waste rock, estimated to total 0.8 million tons, would be generated for the duration of construction and operations. Waste rock stored on the temporary WRS pad during construction would be transferred to the CTF upon completion of the CTF. All future waste rock would be placed directly into the CTF along with the mill tailings. The temporary WRS facility would be completely reclaimed in Mine Year 3. No mined waste rock would be left on the surface after closure. The CTF construction would use crushed and screened granodiorite and/or alternatively excavated Ynl Ex (near-surface Lower Newland shale) and a 12-ounce/square yard non-woven geotextile fabric as a protective layer under its double HDPE liners. Alternatively, development mining waste rock may be used as bedding material on top of the liner package internally in the CTF for the basal layer in the basin drain system.

Operational monitoring would be conducted. Groundwater monitoring wells would be installed downgradient from water-bearing facilities to allow quarterly sampling of water quality. The results of the sampling would be used to confirm that impacts to groundwater are not occurring.

Water encountered in the underground workings would be pumped to underground settling ponds, and then to the CWP or WTP. If monitoring identifies the need, hydrocarbon booms or oil skimming methodologies would be used to remove any hydrocarbon contamination from the underground settling ponds (Tintina 2017).

Wetlands would also be monitored in the Project area and at reference wetlands outside of the Project area to compare changes to water levels or vegetation. Air emissions would be monitored for fugitive dust to comply with the Montana Air Quality Permit (MAQP). Noise levels would be monitored during construction and operations, and could be reduced by implementing the noise mitigation measures described in Section 3.11 to minimize disruption of humans and wildlife. Additionally, reclamation monitoring would occur to compare the stability and utility of reclaimed areas to pre-mining conditions. For example, management of noxious weeds would occur if one or more of the following three criteria are met: (1) a new noxious weed population is confined to the Project area; (2) a noxious weed population is expanding because of Project activities; and/or (3) a noxious weed population is impeding revegetation establishment. Refer to the MOP Application (Tintina 2017) for additional information about these operational monitoring procedures.

2.2.4. Water Treatment Plant

A WTP would be used during construction, operations, and closure. Each phase would have different design flows and raw water quality. The treatment processes would include an oil and grease skimmer, clarifier, filtration, and RO system to remove contaminants. The concentrated RO reject (i.e., water that does not pass through RO membranes for treatment; also called brine) would be stored in the CWP brine cell during construction. During operations, brine would be stored in the PWP and used in the tailings thickener and/or hauled off site. Liquid and solid treatment residuals (i.e., materials or constituents that are filtered out by the RO membranes) would be disposed onsite using the PWP and CTF, respectively.

The RO permeate (i.e., water that passes through RO membranes or filters for treatment) that meets discharge requirements would be discharged to an alluvial UIG system or reused. The UIG would be functional at the onset of mine development and before the dewatering of mine workings begins. The shallow groundwater alluvial UIG (5.4-acre surface disturbance) would be located adjacent to Sheep Creek and receive an average of approximately 398 gallons per minute of treated water from the WTP if the treated water meets the total nitrogen effluent limit as described in the Integrated Discharge Permit Application Narrative (Hydrometrics, Inc. 2018b). However, if the total nitrogen concentration is greater than the effluent limit, the treated water would be discharged to the TWSP from July 1 to September 30. Starting October 1, the stored water would be routed back to the WTP and blended with the WTP effluent prior to discharge to the alluvial UIG, with an average discharge of 530 gallons per minute (Tintina 2018b). The depth to the groundwater table in the UIG area once the mine has been developed would be approximately 8 to 13 feet. The UIG would be located outside of all wetland areas, and its length would be oriented perpendicular to the groundwater flow direction.

2.2.5. Roads

An approximately 8,000-foot-long, two-lane gravel road (15.4-acre surface disturbance) would provide vehicle access from the county road to and from the mine site. This access road would have storm water drainage controls, culverts, sediment control basins, and potentially berms. A CTF road (11.8-acre surface disturbance) would run from the portal pad north of the mill pad and then southeast to the CTF. There would be short branch roads from the CTF to the temporary WRS and ore stockpile. The CTF road and these later two roads would be considered haul roads for ore from the copper-enriched rock storage stockpile and mine wastes back to the CTF and would have storm water collected from the road and piped to the CWP for treatment and discharge. Service roads would allow access to the PWP, NCWR, CWP, and topsoil and subsoil storage areas. Roads would have water drainage conveyances and controls. All roads were engineered to reduce the horizontal distances between individual facilities. This reduces the disturbance footprint, the length of haul roads, and the length of pipelines between facility sites. New road construction would disturb approximately 57.7 acres within the Project area (see **Table 2.2-1**).

2.2.6. Pipelines and Ditches

The Project would include several pipelines. An 18-inch HDPE pipeline would convey the flows from the PWP to the mill reclaim tank. Contact water would be delivered to the CWP during operations via a rock-lined drainage channel underlain with a 0.03-inch HDPE liner or in HDPE pipelines. The Project also includes a brine pipeline to the PWP and to the CWP brine section, a pipeline to the WTP, pipelines to convey seepage from the foundation drain beneath the CTF to the foundation drain collection pond, and drainage piping from the WRS to the CWP. The CWP would have pipes to convey water to the WTP and PWP. The WTP would have a 6-inch HDPE pipeline to convey water to and from the TWSP (Tintina 2018b). Additionally, a 22-inch HDPE intake pipeline would extend into Sheep Creek to convey water to an adjacent wet well, which would ultimately convey water to the NCWR via a 20-inch HDPE transfer pipeline (Hydrometrics, Inc. 2018a; Tintina 2018b).

The MOP Application (Tintina 2017) describes that all pipelines carrying potentially contaminated water (e.g., WRS and copper-enriched stockpile to CWP, CTF to PWP, PWP to WTP, CWP/brine pond to WTP, and CTF foundation pond to WTP or PWP) would have secondary containment measures. Further, the MOP Application states:

> "The [CTF] pipeline will be constructed with secondary containment to capture and contain tailings in the event of a main pipeline leak, (one alternative includes a double-walled pipeline between the mill site and the CTF and between the mill and the portal, another such as a lined trench with a cover may be more appropriate for the project). Secondary containment will not be required on the CTF crest as tailings will flow onto the liner and into the CTF in the event of a leak. The pipeline will have an internal HDPE liner to prevent corrosion." (Tintina 2017)

The MOP Application also states:

> "The Project will be operating in freezing temperatures for a significant portion of each year. The pipeline will be insulated or heat traced to protect against freezing. Additionally, the pipeline will be flushed with about 5,000 gallons of water per pumping cycle (every 6-7 days) and drained when not in use so that no standing water or tailings are left in the pipeline to freeze or set up." (Tintina 2017)

During construction, it is anticipated that a contractor would be responsible for foundation preparation, basin shaping, liner bedding placement, geomembrane installation, and the installation of instrumentation, sumps, pumps, and pipelines. Prepared materials used for drainage gravel in the construction of the CTF and PWP drainage sumps, foundation drains, and sub-grade bedding material used above and below HDPE liners for all facilities would be sourced from suitable non-acid generating rock material present in a minable configuration in the CTF and PWP excavation footprints.

Ditches and best management practices (BMPs) would be used to manage non-contact storm water on site and convey it to a discharge location. BMPs may include revegetation, mulching, rolled organic matter, silt fencing, and sediment basins, among other options. These measures would be used during both construction and operations, and as necessary during reclamation and closure.

2.2.7. Power and Miscellaneous Facilities

It is estimated that 9 to 12 megawatts of electricity would be necessary to power the mine. This would be delivered by overhead powerlines and connected through an onsite substation during operations. However, two diesel EPA Tier 3 certified and compliant generator sets (545 kilowatts and 320 kilowatts) would provide power to the portal pad in support of underground development mining prior to the substation coming online. The 9 to 12 megawatts power requirement would necessitate upgrading the existing powerlines and the construction of a new powerline to the mine site. The primary source of electricity to the site during operations would be by outside feed provided by either Fergus Electric Cooperative or NorthWestern Energy using above ground, overhead powerlines. The most critical power loads are required for fire/equipment and pumps, thickener rakes, reagent agitators/pumps, emergency lighting, ventilation exhaust fans, and electrical heaters. Other (320 to 1,800 kilowatts) trailer-mounted mobile generators would be used around the mine site to support specific construction projects. Operationally, backup emergency power would be provided by two, 1-megawatt diesel generators.

Other Project-related facilities include a truck shop and administration building; fuel storage and fueling area; lube and oil storage and dispensing; construction laydown areas and container storage; supply tanks for process, fresh, and potable water; and parking.

2.2.8. Reclamation and Closure (Mine Years 16–19)

The purpose of the closure and reclamation plan for the Project is to:

- Reclaim disturbances to the approved post-mine land use;
- Assure the physical and chemical stability of all facilities; and
- Maintain water quality and quantity.

No mined waste rock would be left on the surface in closure. Closure and reclamation would focus on removal of surface infrastructure and exposed liner systems, and covering exposed tailings. The reclamation plan requires removal of all buildings and their foundations and surface facilities including the portal pad, copper-enriched rock stockpile pad, PWP, CWP, plant site, and NCWR. The reclamation plan also requires re-contouring the landscape, subsoil and soil replacement, and revegetating all the sites with an approved seed mix. The revegetation would also work toward the stabilization of disturbed areas using erosion and sediment control BMPs as well as achieving measures to prevent air and water pollution. Downstream silt fences would be installed if necessary to prevent the release of sediment outside of permitted soil storage areas. In tandem with revegetation, noxious weed control would also be a component of the closure process. Any reestablished vegetative cover, if appropriate, would meet county standards for noxious weed control in accordance with § 82-4-336(8), MCA.

Mine closure and reclamation would remove, treat, and dispose of all water from the CTF (if any is present), the PWP, and the CWP until the facilities are empty and could be reclaimed. The CTF would be capped with a 0.1-inch HDPE geomembrane, which would then be covered with a minimum of 5.2 feet of non-reactive fill material. The fill material would consist of 2 feet of crushed and screened granodiorite at the base overlying the HDPE membrane, and the upper layer would include rock fill (from excess reclamation materials stockpiles), 20.5 inches of subsoil, and 7 inches of topsoil). Grading of the cap system would create a self-draining topographic surface for closure. Water produced from the CTF internal basin drain system in closure (if any) would go directly to the WTP. This would continue into closure while water quality and water levels are monitored, with gradually decreased monitoring until sufficient data are available to support a conclusion that final closure objectives have been met. Water may continue to flow from the CTF foundation drain system in closure, but require no treatment if all discharge criteria are met. The PWP and PWP foundation drain pond would be dewatered and the liners would be buried by an estimated 9,888,107 cubic feet of embankment fill (an approximate depth of 30 feet above the liners). After water monitoring concludes that final closure objectives have been met, the CWP would be closed by treating all remaining water stored and then discharging it to the alluvial UIG. The remaining brine (in the brine cell) would be hauled offsite for disposal. The liners would then be removed and hauled offsite for disposal or recycling, and the embankment material would be regraded and reclaimed.

The TWSP would remain operational during closure until the discharge to the UIG is discontinued (Tintina 2018b). Once storage of treated water is not necessary, the TWSP liner would be removed and hauled offsite for disposal or recycling. Embankment material would be used to re-shape and reclaim the TWSP disturbance footprint. The footprint would be ripped to relieve compaction, the site would be regraded, soil would be placed, and the site would then be seeded.

Mine closure would include the backfilling of some primary and secondary access drifts with fine-grained, low permeability, cemented paste tailings. Vent raises are proposed to be closed with continuous backfill with non-acid generating excess construction materials from bottom to top, and closure includes a hydraulic plug above the upper sulfide ore zone (separating it from the shallow groundwater aquifer, Ynl A) and one near the surface at the top of the regional water table. The decline access ramp and some primary and secondary mining stope access drifts would not be backfilled.

Mine workings would be sequentially flooded by segments based on sulfide content at closure. Prior to the final flooding in a particular segment of the mine, the walls of the workings within that zone would initially be flooded and rinsed with RO treated water to remove sulfide oxidation by-products from the mine walls. Rinse water would be collected, pumped, and treated as necessary, and the rinsing process would be performed repeatedly for a particular segment of the mine. The zone would then be flooded with groundwater and a hydraulic barrier would be installed at the top of the segment. In all, 14 hydraulic barriers—both plugs and walls, which are masses of concrete installed in the adit with adjacent grouting of the bedrock formation—would be installed. Five of the hydraulic barriers would be installed in the main access ramps, eight in the four ventilation raises (an upper and lower barrier in each raise), and one plug at the mine portal. The primary purposes of installing the hydraulic barriers would be to segment the mine workings based upon sulfide content to facilitate rinsing, minimize flow past the plug and between stratigraphic units, and improve water management and quality in closure. If post-closure groundwater quality monitoring indicates potential contamination or water quality degradation above groundwater non-degradation criteria, additional monitoring wells could be installed to determine the full extent of the impact and contingency pumping wells would capture the impacted water. The Proponent would continue to treat water until groundwater non-degradation criteria are attained.

The NCWR would be used for mitigation of depletion in surface waters during operations and for approximately 20 years after the end of mine dewatering (Hydrometrics, Inc. 2018a). Once the flow mitigation system is unnecessary, the wet well, intake pipeline into Sheep Creek, and transfer pipeline to the NCWR would be removed and reclaimed.

Closure objectives would be expected to be attained by water treatment within approximately 1 year after mining and milling is completed and facility closure activities have been sufficiently implemented. Monitoring would continue after closure to ensure no unforeseen impacts were occurring. Monitoring would continue until DEQ determines that the frequency and number of sampling sites for each resource could be reduced or that the closure objectives have been met and monitoring could be eliminated.

2.2.9. Design and Safety Considerations

Reasonably foreseeable and/or potential environmental consequences and effects due to the Project have been analyzed in Chapter 3 of this EIS. The failure analysis of Project facilities and processes is described in more detail in the “Failure Modes Effects Analysis” (Geomin Resources, Inc. 2015), which is included as Appendix R of the MOP Application (Tintina 2017).

2.2.9.1. Cemented Tailings Facility

Section 82-4-376, MCA, requires a permit applicant proposing to construct a new tailings storage facility to submit a design document to DEQ that contains certification by an engineer of record. The design document must demonstrate compliance with design requirements in § 82-4-376, MCA, for tailings impoundment safety and stability, including a dam breach analysis, a failure modes and effects analysis or other appropriate detailed risk assessment, and an observational method plan addressing residual risk. The impoundment design must also demonstrate that the seismic response of the tailings storage facility would not result in the uncontrolled release of impounded materials when subject to the ground motion associated with the 1-in-10,000-year event or the maximum credible earthquake, whichever is greater.

Under § 82-4-377, MCA, an independent review panel consisting of three independent review engineers is required to review the design document. The panel is required to submit its review and recommended modifications to the permit applicant. The panel's determination is conclusive, and the engineer of record is required to modify the design document to address the recommendations of the independent review panel.

The Project’s CTF would not meet the definition of "Tailings Storage Facility" as described in § 82-4-303 (34), MCA, because it would store less than 50 acre-feet of water within it. Despite this, the Proponent opted to conduct a safety and stability review of the proposed CTF under §§ 82-4-376 and 377, MCA. Knight Piésold Consulting prepared a “Tailings Storage Facility Design” review in September 2017 (Knight Piésold Consulting 2017), which served as the tailings storage facility design document pursuant to § 82-4-376, MCA. An independent review panel of three scientists or engineers reviewed the design document, pursuant to § 82-4-376, MCA. The design document was modified to incorporate recommendations of the independent review panel. The “Tailings Storage Facility Design” document (Knight Piésold Consulting 2017) concludes that the likelihood of embankment failure due to foundation and slope instability is ‘Very Low’. It states:

> “An earthquake could potentially induce deformations and settlement of the embankment crest, which could theoretically lead to a potential loss of freeboard and overtopping. However, this has a very low probability of occurrence as the CTF is designed to withstand the 1 in 10,000 year earthquake event, and would have to be simultaneously flooded by a storm event at the time of failure. The risk of earthquake-induced deformation leading to overtopping is very low.” (Knight Piésold Consulting 2017)

Because the CTF is designed to retain the Probable Maximum Precipitation event of 22 inches, which is estimated to be a 1-in-10,000-year event as well, the odds of a major earthquake and a Probable Maximum Precipitation storm event occurring within 1 month of each other is extremely low.

Additionally, Knight Piésold Consulting prepared a "Tailings Operations, Maintenance and Surveillance (TOMS) Manual" in July 2017, which is included as Appendix I of the Tailings Storage Facility Design document (Knight Piésold Consulting 2017), pursuant to § 82-4-379, MCA. Appendix G ("CTF Dam Breach Risk Assessment") of the "Tailings Storage Facility Design" document analyzes the risk of seismic activity on the CTF. Appendix G states that tailings deposited in the CTF would be mixed with binding agents (e.g., cement, fly-ash) before deposition. Once it sets, it would be a non-flowable mass. Although it is very unlikely the CTF embankment would breach and the liner system would tear, the tailings would likely slump in place in such a situation, but would not flow out to the downstream receiving environment. Although the probability of failure is very low, the consequence of failure under normal operating conditions or an earthquake event is considered to be Moderate, which means there could be serious deformation but no uncontrolled release of containment (Appendix G of Knight Piésold Consulting 2017). The "Tailings Storage Facility Design" document concludes:

> "The probability of failure for the various hazards (foundation and slope instability, overtopping, internal erosion and piping) is either not credible or 'Very Low'. The CTF is designed for the storage of non-flowable cemented tailings, and is not a water retaining impoundment. Therefore, the resulting consequences of failure for the credible but 'Very Low' probability items are 'Moderate'. This indicates an overall 'Very Low' risk related to a breach of the CTF." (Knight Piésold Consulting 2017)

2.2.9.2. Liner Performance

The CTF impoundment would be double-lined, and each of the two liner layers would be constructed of 0.1-inch HDPE geomembrane with a 0.3-inch high flow geonet layer sandwiched between the geomembrane layers. Any seepage through the upper geomembrane layer into the geonet would be directed via gravity to a sump and pump reclaim system at a low point in the PWP or CTF basin, and would be pumped back into the PWP. The MOP Application (Tintina 2017) describes that the estimated potential seepage from a fully saturated CTF to the geonet layer would be approximately 4.2 gallons per day; however, the CTF would be operated with a small volume of stored water, and so seepage rates are expected to be less. Seepage through the lower liner of the CTF would be limited by the upper liner at the rate of 4.2 gallons per day (assuming inundated conditions). Seepage through the lower liner would be collected in the CTF foundation drain system.

The life expectancy of HDPE geomembrane liners was evaluated and reported in the MOP Application (Tintina 2017). HDPE geomembranes used in landfills should last for about 400 years (Peggs 2003). Tintina (2017) estimates the service life of the CTF lining system to be about 400 years as well, given the specific design details, ambient temperature range, and recommended construction methods.

2.3. ALTERNATIVES TO THE NO ACTION AND PROPOSED ACTION ALTERNATIVES

MEPA states, "A reasonable alternative is one that is practical, technically possible, and economically feasible. A reasonable alternative should fulfill the purpose and need of the proposed action and will address significant and relevant issues" (Montana EQC 2017).

For the purpose of this screening process, individual alternative ideas were identified and evaluated for potential integration into one or more alternatives to be analyzed as part of the EIS. Therefore, this EIS refers to the term "alternative idea" as the concept that was screened, rather than "alternative." The term "alternative idea" includes any aspect of Project construction, operation, closure, or reclamation, as related to timing, geography, design, or process. For example, alternative ideas could include different locations for treatment ponds or facilities, alternate methods of tailings management, or alternate timing of reclamation.

The alternative idea screening process involved a multi-step approach of developing a list of alternative ideas to be screened based on a review of all available information and input compiled to date; developing screening criteria and the screening table to be used for identifying "reasonable" alternative ideas; and evaluating each alternative idea against the screening criteria using the screening table.

The following sources were reviewed:

- Scoping Report (Appendix J of this EIS); original comments were reviewed where additional detail was required beyond that provided in the Scoping Report;
- MOP Application (Tintina 2017) and DEQ-approved updates (Section 2.2, Proposed Updates, of this EIS);
- Technical Memoranda (Appendices A through H of this EIS);
- DEQ's third-party contractor Subject Matter Expert input; and
- DEQ input.

Three screening criteria were used to assess the alternative ideas. The first three criteria were whether the alternative idea is practical:

- Does it meet the Project purpose and need (see definition in Chapter 1 of this EIS)?
- Is it technically feasible (achievable by current technology)?
- Is it economically feasible? Economic feasibility is determined solely by the economic viability for similar projects having similar conditions and physical locations and determined without regard to the economic strength of the specific project sponsor.

An additional consideration was whether the alternative idea provides an environmental benefit to any aspect of the human environment compared to the Proposed Action. For purposes of determining whether to carry forward an alternative for detailed analysis, DEQ may consider the environmental benefit relative to the Proposed Action. The "environment" includes all aspects of the human environment (e.g., physical, biological, chemical, social, and cultural).

The review process identified 13 alternative ideas that merited the initial screening. Of these, 12 were found to not meet at least one of the screening criteria and were therefore eliminated from further analysis. These 12 alternative ideas are described below in Section 2.3.2, Alternatives Considered but Dismissed from Detailed Analysis.

One alternative idea was found to warrant further analysis in the EIS. This alternative idea was carried forward and developed as the AMA, and proposes to backfill certain voids with cemented paste tailings generated from mill processing of the stockpiled ore and/or waste rock at the end of operations. The alternative idea is described in detail in Section 2.3.1.

2.3.1. Agency Modified Alternative: Additional Backfill of Mine Workings

This section describes the Project modifications to be incorporated into the AMA. This alternative idea appears to be a reasonable alternative that is both practicable and likely to result in environmental benefits over the Proposed Action. Environmental benefits of the AMA could include (1) reducing the potential for groundwater mixing between upper and lower aquifers, and (2) reducing the risk of groundwater contamination from exposed underground mine surfaces at closure compared to the Proposed Action. The potential environmental impacts of the AMA are evaluated further for each resource in Chapter 3.

The AMA proposes to backfill additional mine voids as part of mine closure, as compared to the Proposed Action. The AMA proposes to backfill certain voids (i.e., access openings) with a low hydraulic conductivity material consisting of cemented paste tailings generated from mill processing of the stockpiled ore and/or waste rock at the end of operations.

Cemented paste tailings would only be used to backfill certain mineralized mine voids to avoid the potential of degrading groundwater quality in non-mineralized geologic units (DEQ 2018a). The upper section of the access decline (within the Ynl A geologic unit) and a lower section of the access tunnel (within the Ynl B geologic unit) would not be backfilled because these units are non-mineralized, and they have better baseline groundwater quality than the Upper Sulfide Zone (USZ) and the Lower Sulfide Zone (LSZ). All mine voids located within the USZ and the LSZ would be backfilled with cemented paste tailings. Hydraulic plugs would be used to separate the backfilled and open areas of the access decline. This proposed configuration of backfilling is aimed at more effectively separating rock zones that are: (1) mineralized vs. non-mineralized, and (2) more permeable vs. less permeable.

Approximately 106,971 cubic yards of cemented tailings would be needed to backfill the access tunnels and ventilation raises (Tintina 2018a). The backfill material would be mixed with cement in a manner that achieves a similar low hydraulic conductivity as is proposed for backfilling of the mined stope areas. Since this volume of stockpiled ore source would exceed the proposed volume of the Copper-Enriched Rock Stockpile, this Project modification would also need to utilize the temporary WRS pad until the end of operations and backfilling of interior mine surfaces. The backfilling schedule would be coordinated with activities elsewhere in the mine, so as not to interfere with necessary access, ventilation, and safety for other operations.

To implement this Project modification, a revised mine schedule may be necessary to more efficiently backfill the lowest mine workings during concurrent mining operations, followed by upper mine workings, and lastly certain access tunnels and ventilation shafts at closure.

2.3.2. Alternatives Considered but Dismissed from Detailed Analysis

An additional 12 scoping alternatives were considered for detailed analysis. The 12 scoping alternatives and the rationale for dismissing the alternatives from detailed analysis are presented in the following sections.

2.3.2.1. Alternative Tailings Impoundment Locations

Scoping Alternative: Review alternative tailings impoundment locations (CTF sites) that could reduce potential acid rock drainage (ARD) and water quality impacts.

This alternative was proposed during public scoping and by DEQ. The scoping alternative meets the Project purpose and need, and is potentially technically and economically feasible.

The 2017 MOP Application (Appendix Q, Tailings Management Alternatives Evaluation) presented and analyzed four potential locations for the CTF. The West Impoundment location would be a short valley to the west of the other Project facilities, and it would be in a different drainage basin than other facilities. Within that drainage, the location of Black Butte Creek would limit the extent of the West Impoundment footprint, so the facility would only provide a fraction of the tailings storage capacity necessary for the Project. This site would have limited expansion capacity, requiring additional extensive excavation. As such, it would not achieve the purpose and need of the Project and was dismissed by DEQ. The Central Impoundment location would provide adequate storage capacity for the Project, and it would require a disturbance footprint of 97.7 acres, the relocation of a county road, a tailings discharge pipeline length of 0.93 mile, and approximately 6.56 acres of disturbance to wetlands. The East Impoundment location would provide similar storage capacity as the Central Impoundment site, but it would require a larger disturbance footprint of 128.9 acres, a tailings discharge pipeline length of 1.43 miles, and approximately 11.05 acres of disturbance to wetlands. The fourth potential CTF location would provide adequate storage capacity for the Project, but it would require a smaller disturbance footprint of 87.7 acres, a tailings discharge pipeline length of 0.87 mile, and approximately 0.71 acre of disturbance to wetlands.

Based on the analysis of these alternative designs, the Central and East Impoundments were considered to have greater environmental impacts. DEQ concluded that the fourth CTF location, which was selected for the Proposed Action, would result in the least environmental impacts, particularly to wetlands. Therefore, the alternative impoundment locations were dismissed and not carried forward for further detailed analysis.

2.3.2.2. Source Copper from Another Ore Body

Scoping Alternative: Source copper from another ore body or mine to avoid all impacts at the proposed mine location.

The alternative was proposed during the public scoping process. It does not meet the purpose and need for this environmental review, which is for DEQ to take action on the Proponents' application for an operating permit to authorize underground mining of the Johnny Lee Deposit, found in the location described in Section 2.2.1. Furthermore, as defined by MEPA in Section 75-1-220(1), MCA, "alternatives analysis" means "an evaluation of different parameters, mitigation measures, or control measures that would accomplish the same objectives as those included in the proposed action by the applicant . . . it does not include an alternative to the proposed project itself." Thus, the environmental consequences of sourcing copper from another ore body or mine was not reviewed, as this scoping alternative does not meet the purpose and need of the environmental review and is not properly part of the alternatives analysis to be conducted under MEPA.

2.3.2.3. Retain Process Water in Tanks

Scoping Alternative: Retention of process water in tanks rather than lined ponds to reduce the potential for impacted water to seep into groundwater. This alternative was proposed during public scoping.

It is estimated that the Project would require the capacity to store approximately 135 million gallons of impacted water. This includes approximately 111 million gallons of impacted water that would be stored in the PWP under the Proposed Action and 24 million gallons of impacted water that would be stored in the CWP under the Proposed Action. Water that would be stored in the TWSP under the Proposed Action was not included in this analysis as it is a contingency system designed to contain treated water that does not meet discharge standards for nitrogen in the summer months (Zieg 2018).

If the Project used 1-million-gallon tanks (i.e., approximately 51 feet long, wide, and high), which would have to be constructed on site, 135 tanks would be required to contain the impacted water. Surface disturbance for the PWP and CWP are estimated at approximately 29 and 9 acres, respectively, for a total of 38 acres of disturbance. Surface disturbance for 135 1-million-gallon tanks may be less than 38 acres. However, the surface disturbance would depend on the final design of the tank farm to accommodate piping, secondary containment, and space for travel and maintenance around the tanks. Construction and disposal of 135 1-million-gallon tanks would also likely produce additional traffic impacts outside of the Project area.

Managing potential seepage of impacted water from storage ponds by the use of an engineered seepage collection system is a common best practice throughout the mining industry. The PWP and the CWP would have multiple liners and leak detection systems between the liners. The proposed liners and leak detection systems are expected to adequately prevent the seepage of impacted water into groundwater. The PWP and the brine cell of the CWP would both be constructed using two 100-mil HDPE geomembranes separated by a geonet layer that would be instrumented to detect seepage through the upper liner and a sump pump system designed to extract this seepage. In the event of leakage through the lower liner, PWP design and construction would also include a foundation drain system that would intercept groundwater and/or seepage beneath the double liner system and route it to a collection sump from which it could be pumped back to containment.

The CWP is designed to retain runoff from the portal and mill site as well as water pumped from underground mine development. This water would be treated via RO and discharged in accordance with the MPDES permit. Brine produced as a byproduct of RO treatment would be retained in a separate brine cell of the CWP. The CWP would normally store only a minimal volume of water during mine operations. Once the PWP has been constructed (i.e., prior to start-up of mining and milling operations), brine that had been stored in the CWP brine cell would be transferred to the PWP.

Storing process water in tanks is not common practice in mining due to several factors. Tanks do not provide a greater level of protection to groundwater, in part, due to increased potential risks associated with failing valves, piping, and secondary containment. The tank farm would require extensive piping systems, increasing potential leak locations.

There is a concern that birds and other wildlife may come into contact with impacted water stored in ponds. Under the Proposed Action, the PWP and CWP would be within the fenced facility area, eliminating the possibility for wildlife to come in contact with the impacted water. Geochemical modeling indicated that the quality of water stored in the CWP and PWP would not present a hazard to terrestrial wildlife or to waterfowl that may land on these ponds. The brine cell would contain concentrated waste water, and is proposed to be covered with bird netting to prevent waterfowl from landing on the pond.

A tank farm would cause a significant increase in visual impacts relative to the proposed PWP and CWP.

For these reasons, storing impacted water in tanks was not considered to have significant environmental benefit as compared to the Proposed Action (storing process water in ponds). Therefore, an alternative requiring storage of impacted water in tanks was not carried forward for detailed analysis.

2.3.2.4. Alternative Truck Transportation Routes to Rail Load Out Site

Scoping Alternative: Evaluate alternative truck transportation routes to rail load out sites to further reduce potential environmental and safety risks along the proposed route.

Initially, the Proponent proposed five options for offsite copper concentrate load out facilities (i.e., rail load out sites) in Livingston, Townsend, Harlowton, Raynesford, and Belt. Section 1 of the MOP Application states that, “The company’s final decision will be based on economic considerations at the time of shipping.” In January 2018, the Proponent modified the MOP Application (which was accepted by DEQ) to reduce the proposed rail load out locations to two: Townsend and Livingston (DEQ 2018b). The routes to these two proposed rail load out locations are the most direct routes. Any other routes would be significantly longer.

The next shortest route from the mine to Townsend is to travel north on U.S. Route 89, over King’s Hill, then west on U.S. Route 3 through the city of Great Falls, then south on Interstate 15 adjacent to the Missouri River, through Wolf Creek Canyon, through Helena, then south on

U.S. Route 287 to Townsend. The next shortest route from the mine to Livingston (without going through Townsend) is to travel to just northeast of White Sulphur Springs, east on U.S. Route 12 to Harlowton, south on U.S. Route 191, cross the Yellowstone River at Big Timber, then west on I-90 along the Yellowstone River to Livingston.

Further, a traffic study (Abelin Traffic Services 2018) was completed to assess the traffic and safety along the two routes to the proposed load out locations: U.S. Route 89 to east of Livingston and U.S. Route 89/U.S. Route 12 to Townsend, and local roads within Townsend. Local roads in Livingston were not evaluated, as the exact rail load out location had not yet been determined. During operations, there would be 18 truck round trips (36 one-way trips) per day to rail load out sites in Livingston and/or Townsend. For these highway segments evaluated, the traffic study concluded that Project impacts on traffic congestion and safety were comparable on the highways between the two proposed load out locations and that actual Project-related traffic volume increases would be small compared to the capacity of the roadways.

The environmental consequences of the Project on transportation routes are presented in this EIS in Section 3.12, Transportation, as a disclosure of the potential impacts to the human environment as required by MEPA. Alternative truck transportation routes to rail load out sites would not offer an environmental benefit because they would be longer, and could potentially increase environmental and safety risks versus the two proposed routes.

2.3.2.5. Use Wetlands as Part of the Water Treatment System

Scoping Alternative: Use a passive wetland treatment system to reduce the dependency on active water treatment methods if long-term water treatment would be required.

This alternative was proposed during public scoping. A public comment questioned whether the wastewater treatment plant could be maintained in “operating order” and suggested passive wetland treatment as a potential long-term solution.

While there is no basis for the concern that an active treatment plant cannot be maintained for as long as it is needed, this scoping alternative was evaluated to determine whether the addition of a wetland treatment system could provide an environmental benefit over the Proposed Action.

Wetlands are effective at removing certain water quality constituents, but are not considered an alternative to primary treatment. Wetlands are usually effective only as a “polishing” step to active water treatment methods. Therefore, wetlands would not be able to remove all of the contaminants expected in the Project wastewater, and thus would not be able to achieve the effluent standards required under the MPDES discharge permit. In addition, wetland systems require effort in ongoing monitoring and maintenance, particularly in northern climates. Further, the MOP Application states that water quality closure objectives (meeting non-degradation criteria) are expected to be met within 2 to 4 years post-closure and thus no water treatment would be required long-term (see MOP Application Section 1; and Section 3.5.3.2, Surface Water Quality and Temperature, in this EIS).

2.3.2.6. *Increase Cement Content in Tailings*

Scoping Alternative: Increase the cement content in the tailings to further reduce potential ARD and water quality impacts.

Both Appendix Q of the 2017 MOP Application (Geomin Resources, Inc. 2016) and Technical Memorandum 1 (see Appendix A of this EIS) show that the cement and binder contents proposed for both the surface CTF (0.5 to 2 percent) and the cemented tailings backfill (4 percent) of the underground mine are sufficient to achieve necessary strength and comply with water quality protection requirements. Increasing the cement and binder content in the paste tailings in either location would not provide additional environmental benefits, and if too much cement and binder were added, it would not be possible to pump the tailings through a pipeline. Technical Memorandum 1 recommended operational flexibility in cement content to allow optimizing performance in pumping and final behavior.

The quantity of cement and binder proposed to be added to the paste tailings is not intended to delay or prevent ARD formation. Rather, it is meant to provide structural strength and to change the physical properties of the solidified tailings to a stable, non-flowable material with low hydraulic conductivity. Elevated sulfide content in the tailings does not necessarily equate to acid production. In order for the internal sulfides to oxidize and produce sulfate, the right physical and chemical conditions for oxidation are required. This is precluded if the material has low hydraulic conductivity and it sufficiently limits ingress of water and/or oxygen.

The tested quantities of cement and binder (2 percent and 4 percent) were determined to be sufficient to limit blowing dust (i.e., in the CTF) and reduce the formation of acidity on the tailings surface, although the test cylinders were unsupported and eventually disaggregated and further oxidized. In the underground mine, the cemented paste tailings backfill would solidify in approximately 1 month, but the potential for expansion, disaggregation, and exposure of the backfill would be limited due to placement methods. The cemented paste tailings backfill would be confined by a shotcrete bulkhead. The backfill would solidify in the stope within low conductivity bedrock, further reducing the potential for physical degradation and oxidation of the tailings surfaces and the resulting impacts to water quality.

The tailings surface in the CTF would be covered by successive layers of paste tailings within 7 to 30 days, before extensive oxidation and degradation could occur. Near closure, whether permanent or temporary, the upper lift of cemented paste tailings would contain additional cement and binder (4 percent) (Tintina 2017). This would decrease the potential for dust, increase the surface strength, and create a more durable surface for equipment to perform reclamation activities. No tailings would be left exposed near the surface in closure. Sections 2.2.2 and 2.2.8 of this EIS describe that the CTF foundation would be double lined with HDPE liners, and the top would be capped with a HDPE geomembrane liner covered by a minimum of 5 feet of non-reactive fill material and soil, which would then be revegetated. Any seepage or contact water within the liner, during the reclamation steps or following closure, would be captured by the internal sump and pumped to the WTP. As with the underground backfill, when the CTF has been encapsulated, there is very limited potential for breakdown or disaggregation of the cemented tailings. The vegetated reclamation cover and upper liner placement would also restrict water and oxygen from entering the CTF, precluding sulfide oxidation on exposed surfaces and impacts to water quality.

2.3.2.7. Elevate the CTF above the Water Table

Scoping Alternative: Elevate the CTF above the water table to further reduce potential for groundwater quality impact.

Analysis presented in Technical Memorandum 2 (see Appendix B of this EIS) shows there would be no environmental benefit to water quality or flow by elevating the CTF, compared to the CTF elevation in the Proposed Action. Groundwater intercepted by the CTF would be diverted beneath the composite liner system and/or captured by the foundation drains. In either case, these are considered diversions, not removals from or degradation to, the overall baseline water system. As designed, the CTF underdrain would lower the water table such that there would be no groundwater pressure against the CTF liner. Therefore, potential impacts to groundwater would not necessarily be reduced by raising the elevation of the CTF. Additionally, an elevated CTF would have a larger footprint (with greater wetland impacts), additional geotechnical stability requirements, and greater visibility impacts than the Proposed Action design. For example, the visual impact would expand as the CTF increases in elevation, with concomitant embankment extension downslope to the north, east, and south. A lift of 30 feet would be visible from portions of U.S. Route 89.

2.3.2.8. Separate Sulfide Prior to Tailings Disposal

Scoping Alternative: Fully separate sulfide from the tailings prior to tailings disposal to further reduce potential for long term ARD formation in the CTF.

There is no net environmental benefit to full sulfide mineral separation prior to tailings disposal, when compared to the Proposed Action. Analysis presented in Technical Memorandum 3 (see Appendix C of this EIS) concludes that while full sulfide mineral separation from tailings may have some environmental benefits (e.g., reduced risk of ARD formation) over the Proposed Action, other issues such as appropriate onsite or offsite long-term storage and disposal would be challenging. The tailings de-pyritization[2] process would generate a larger volume of non-Potentially Acid Generating tailings and a smaller fraction of Potentially Acid Generating concentrated sulfides, the latter corresponding to a potentially more hazardous pyritic sulfide-rich waste stream in comparison to either the remaining tailings or the Proposed Action. With other minerals or buffering constituents removed from the sulfide-rich waste stream, the fine-grained material would have greater potential for oxidation (i.e., acid production) and/or spontaneous combustion.

Production of the concentrated pyritic sulfide-rich waste stream would also require the use of considerably more chemicals (e.g., acids, bases, and organic flotation chemicals). Handling of these materials would require an additional and larger pyrite flotation circuit in the mill, a separate tailings pumping system, and a separate PWP in addition to the proposed PWP. If surface storage were the preferred method for long-term disposal, a new and separate storage

[2] The process of removing pyrite from the tailings, resulting in a tailings stream and concentrated pyrite stream

facility (tailings impoundment) would be needed for handling and disposal of the sulfide concentrate (i.e., two impoundments would be required). A surface impoundment may also be needed under the scenario where only a portion of the total volume of sulfide-rich tailings would fit in the underground workings, and/or the sulfide-rich tailings would not provide sufficient strength characteristics to allow using it completely for underground backfill.

If underground storage were the preferred method for long-term disposal, only about 45 percent of the total tailings volume could be physically placed underground as backfill. If the volume of high-sulfide waste from full pyrite separation exceeds that amount, it would require additional storage space beyond the proposed mine plan for complete underground disposal. This would require mining un-mineralized rock in order to provide room for sulfide concentrate storage underground, thereby generating additional amounts of waste rock to be disposed on the surface. It may not be feasible to convert the pyrite concentrate into a cemented paste that would cure properly and provide the necessary strength for ground support in the underground backfill. This would limit the ability to fully utilize the sulfide concentrate as backfill adjacent to mining areas, meaning that additional storage space would need to be mined or a surface disposal facility would also be necessary.

The separation of a concentrated (i.e., 95 percent) pyrite tailing stream and the suitability of placing that material underground as either unconsolidated tailings or cemented tailings backfill was not specifically tested because the environmental risks and potential water quality impacts produced by creating and disposing a separate pyrite concentrate stream were deemed too significant. Whether the sulfide-rich waste would be stored in a surface impoundment, as underground backfill, or both, additional management strategies would have to be developed for long-term storage to mitigate oxidation (i.e., acid formation) and/or spontaneous combustion. Development and implementation of such special management methods may not be technically feasible.

DEQ could not find active mineral processing operations in Montana or other western states that accept sulfide concentrates for disposal or use as combustion fuels produced at other mines (i.e., so that the Project would not have to store its sulfide mineral concentrate on site). Additionally, transporting the sulfide mineral concentrate for offsite disposal or use would further increase the truck traffic on roads. Due to all these factors, an alternative requiring full pyrite separation was considered but dismissed from detailed analysis.

2.3.2.9. Tunnel Operations: Add Water Source Controls to Limit Oxidation during Operations

Scoping Alternative: Add additional water source controls to the tunnel operations to further limit oxidation and potential for ARD formation during operations.

Groundwater inflow would supply the water for the mine operation, although only 40 percent of the predicted inflow would actually be needed. Under the Proposed Action, several methods are proposed to limit inflow and the potential to contaminate groundwater. Proposed measures include: grouting of major water bearing fractures or faults; using pilot holes drilled into areas scheduled for mining to identify and pressure grout water-bearing geological structures;

collecting and treating groundwater inflow to non-degradation standards; and backfilling certain features with cemented tailings. Technical Memorandum 6 (see Appendix F of this EIS) reviewed several additional potential methods for controlling groundwater inflow and applying surface treatments to limit oxidation during operations. Technical Memorandum 6 concluded that most of the commonly used methods in the mining industry to control inflow are already proposed for the Project, and other water source control options would be no more effective than the proposed best practice methods. The modeling of post-closure conditions demonstrates compliance with non-degradation groundwater criteria, so additional methods of inflow control are not deemed necessary.

While the application of asphalt, synthetic spray-on covers, or wax barriers could be used to limit oxidation on tunnel surfaces, they would be subject to degradation and would not be practical for underground mining. Polypropylene fiber reinforced shotcrete is proposed to be used to aid in ground support for underground stability, as well as a cementitious surface cover over the bulkheads used for sealing backfilled mine surfaces. The use of potassium permanganate was not reviewed in detail for its potential to prevent oxidation because the stopes that could primarily contribute to acid generation would be backfilled within a short timeframe of exposure (1 to 2 months). As demonstrated by kinetic testing of the mineralized bedrock (Enviromin 2017), the surfaces that would be exposed by mining would have considerable buffering capacity to delay the generation of acidity, even though there are elevated sulfide concentrations in the rock. These surfaces would be backfilled before oxidation results in net acid generation. The application of a reagent like potassium permanganate utilizes the oxidizing ability of the permanganate ion to create a manganese-iron oxide coating on sulfidic rock. All treated surfaces would still have potentially reactive rock below the coating, and oxidation could return if the outer manganese-iron oxide coating is removed, whether by physical or chemical means. The stope backfill approach is considered to be more permanent and effective at limiting the exposure and oxidation of reactive surfaces than the application of a surface treatment.

2.3.2.10. Use Alternative Water Treatment Processes other than Reverse Osmosis

Scoping Alternative: Use alternative water treatment technologies rather than RO to increase water treatment efficiency and effectiveness.

The Proposed Action includes the use of RO for treatment of groundwater collected during dewatering of the underground workings from construction Year 2 through closure. DEQ initially had concerns regarding the ability of an RO system to effectively treat the water in all phases of mine operation to non-degradation standards, particularly for nitrates; and the ability to dispose the large volume of waste brine generated from the RO system. Given this concern, Technical Memorandum 7 (Appendix G) reviewed the proposed RO system (and associated measures), as well as three other water treatment technologies used for mining operations: ion exchange, electrodialysis, and mechanical (vapor compression) evaporators. The memo concluded that (1) RO should be able to effectively treat the water to non-degradation standards, given the proposed pre-treatment methods, and (2) none of the other water treatment technologies would be more effective than RO. Because RO would effectively treat the collected groundwater and none of the other water treatment technologies offered any environmental benefit, alternatives involving the use of the non-RO water treatment technologies were not carried forward for detailed analysis.

2.3.2.11. Construct Two Side-by-Side Declines and Eliminate Ventilation Shafts

Scoping Alternative: Construct two side-by-side declines (one for ventilation and utilities) and eliminate the four proposed ventilation shafts to reduce surface disturbance.

DEQ determined that eliminating the four proposed ventilation shafts by constructing a decline for ventilation and placement of utilities parallel to the access decline did not present an environmental benefit and likely increased health and safety risks. While it is technically feasible to construct two side-by-side declines rather than the four proposed ventilation shafts, doing so would not reduce surface disturbance and would produce more waste rock. More importantly, maintaining proper ventilation for safe working conditions would be more difficult with two declines rather than the proposed single access decline and four ventilation shafts. The ventilation shafts are designed to intercept specific underground mine areas and at differing depths in order to more effectively maintain safe conditions for workers. Additionally, the Mine Safety and Health Administration requires mines to maintain an escape shaft for workers in case the main access is not useable. An obstruction or fire in one decline could potentially obstruct the other, which would eliminate its use as an escape shaft. For these reasons, an alternative requiring construction of two declines rather than the four proposed ventilation shafts was not carried forward for detailed analysis.

2.3.2.12. Maintain Wet Tailings in the CTF

Scoping Alternative: Maintain tailings in the CTF in a wet condition to reduce the potential for ARD formation in the CTF.

DEQ determined that there is no overall benefit to storing the tailings in a wet storage facility, relative to the CTF design in the Proposed Action. Although kinetic testing of tailings indicated that maintaining saturated or sub-aqueous tailings in the proposed CTF would limit tailings oxidation within the facility, it would add further complexity to operations and reclamation plans and may not provide other environmental benefits. This alternative would require higher and wider embankments to maintain geotechnical stability to safely contain both tailings and water, which would result in increased embankment material sourcing impacts, increased embankment disturbance footprint, and increased visual impacts. This alternative would require other methods of operational water balance management, resulting in additional water collection and treatment and potential mitigations to prevent wildlife (e.g., waterfowl, shorebirds, etc.) from interacting with a large pond.

Maintaining permanently saturated or sub-aqueous conditions in the post-closure facility would require a long-term source and water right for the water needed to maintain a pond; water collection; and water treatment facilities may still be needed, which would extend the duration of potential impacts to wildlife and geotechnical stability. Unless the tailings are permanently stored under saturated or sub-aqueous conditions, they would need to be eventually capped and revegetated in order to reduce exposure and geochemical reactivity. This would require the tailings to adequately dry and consolidate before being trafficable.

In order to effectively cover the tailings and limit the potential for oxidation, water from the operational pond would need to be removed and potentially treated. This would extend the timeline for draining the pond and the tailings pore water, as well as the time period for potential tailings oxidation, prior to facility capping and closure. For these reasons, an alternative requiring maintenance of the CTF in a wet condition was not carried forward for detailed analysis.

2.4. PREFERRED ALTERNATIVE

ARM 17.4.617(9) requires an agency to state a preferred alternative in the draft EIS, if one has been identified, and to give its reasons for the preference. DEQ has identified the AMA as the agency’s preferred alternative.

The AMA revises the Proposed Action by requiring the Proponent to completely backfill the Upper and Lower Sulfide Zones with cemented paste tailings. Complete backfill would return hydraulic parameters within these bedrock zones to conditions similar to the pre-mining state, eliminating the potential for development of new groundwater flow paths through these areas. Backfilling would further reduce the potential for groundwater mixing between upper and lower aquifers, and further reduce potential groundwater contamination from exposed underground mine surfaces at closure compared to the Proposed Action.