CHAPTER 2 – PROPOSED ACTIONS AND ALTERNATIVES

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF PHOTOS

This page intentionally left blank.

2.0. PROPOSED ACTIONS AND ALTERNATIVES

Chapter 2 describes the alternatives for the project, including those that were considered but not fully analyzed. The alternatives are organized as a set of MMPO alternatives (Alternatives M1 through M3) and a set of land disposal alternatives (Alternative L1 through L5). The agency-preferred alternative for each set is identified. The MMPO alternatives are independent (do not depend on the outcome) of the land disposal alternatives as the mine would not operate differently if TCMC acquired the selected land, which contains the southern portion of the mine. The range of alternatives considered in an EIS are based on the proposed actions (Alternative M2 for the MMPO alternatives and Alternative L2 for the land disposal alternatives) and the purpose and needs of the lead agency (or agencies) as well as by considering issues identified by other agencies and through public scoping. The range of alternatives to be evaluated in an EIS should meet certain key principles including the following:

- All action alternatives considered for analysis in an EIS should achieve the objectives of the Federal agency's purpose and need for the project;
- The overall range of alternatives should be governed by the "rule of reason." When there are potentially a large number of alternatives, only a reasonable number, covering a full spectrum need be analyzed in an EIS;
- Reasonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense, rather than simply being desirable from the standpoint of the applicant;
- Alternatives that are speculative and geographically remote need not be considered; and
- Alternatives with environmental effects that have greater environmental effect (common sense basis) than the action(s) proposed by the applicant or other alternatives under consideration can be eliminated from analysis.

The BLM, Forest Service, and USACE are responsible for issuing decisions regarding the MMPO (the USACE will issue a decision on a 404 permit application necessary for TCMC to implement the MMPO), and the BLM is responsible for issuing a decision for the land disposal alternatives/RMP amendment. The NEPA requires the lead agency(s) to identify the preferred alternative in a draft EIS if one is known. The BLM- and Forest Service-preferred MMPO alternative is Alternative M2, and the BLM-preferred land disposal alternative is Alternative L2, with the RMP amended to allow the disposal of the selected land. These agency-preferred alternatives were identified by the agencies after they considered which alternative in each set would best fulfill its statutory mission and responsibilities given economic, environmental, and technical factors.

2.1. MMPO Alternatives

The agency objectives used to guide the MMPO alternatives include the following:

- Ensure compliance with relevant Federal and State laws and regulations;
- Ensure compliance with the BLM and Forest Service land use plans;
- Minimize effects on surface and groundwater quantity and quality;
- Minimize surface disturbance;
- Provide for reclamation that returns disturbed areas to stable, natural vegetation communities as quickly as practicable;
- Minimize waste that would require treatment or disposal;
- Address uncertainties to minimize long-term risks to the environment; and,
- Ensure that monitoring and reporting requirements allow efficient and effective oversight of mining operations.

The mine is currently permitted to complete Phase 7 (Alternative M1 – No Action). The MMPO submitted by TCMC in December 2008 would allow the completion of Phase 8 (Alternative M2 – MMPO as submitted by TCMC). Alternative M3 (No Name WRSF) is generally the same as Alternative M2, except the No Name WRSF would be included within the overall configuration of the WRSFs and the Buckskin and Pat Hughes WRSFs would have correspondingly smaller final footprints. The core mine operations (e.g., molybdenum production rate and reclamation measures) are essentially the same in all of the MMPO alternatives. Therefore, the core operations are outlined separately (Section 2.1.1.) to allow the reader to focus on the portion of each alternative within the Federal "decision space" (i.e., overburden (waste rock) and tailings storage, long-term water management, and a power line relocation). Note that the description of Alternative M1 is necessarily a very brief summary of the currently approved MPO (i.e., the 1979 MPO as modified during the last 30 years), which includes the reclamation plan (or from the perspective of the IDL, the 1999 Consolidated Reclamation Plan which includes the portion of the Operating Plan for the private land at the mine, as amended). In the event of a discrepancy between the summary of the MPO in this DEIS and the MPO, the MPO is the authoritative document. The same is true for the summary of the MMPO (Alternative M2) in the DEIS.

2.1.1. Features Common to All MMPO Alternatives

This section describes the existing facilities, operations, and environmental management at the mine which would be common to all alternatives. The reclamation of the mine would generally be the same under all alternatives, except for the differences described in Section 2.1.3.6. , Section 2.1.4. and Section 2.1.1.8.

2.1.1.1. General Facilities

The mine operations are supported by a variety of ancillary facilities and personnel. The support facilities include maintenance shops, warehouses, change houses, and administrative offices (Figure 2.1-3). The mine infrastructure includes systems to supply and store process and potable water, to dispose of solid waste, to treat sewage and process water, and to distribute electrical power. Personnel not directly involved in mining and ore processing perform management, safety, security, engineering, equipment and facility maintenance, environmental compliance monitoring, accounting, purchasing, human resources, and various other tasks. TCMC employs 379[1] full-time workers at the mine and operates 24 hours per day, 365 days per year.

2.1.1.2. Transportation, Access, and Power

The primary access road to the mine is via the S.[2] Creek Road at milepost (MP) 219.6 on State Highway (SH) 75. The S. Creek Road leads 4.1 miles north along S. Creek to the confluence of S. and Bruno creeks where there is a staging area and a remotely controlled security gate. The mine is reached by traveling 5.0 miles past the gate (exclusive TCMC access) on the Bruno Creek access road. TCMC provides road maintenance and dust control for the section of S. Creek Road that leads to the mine and for the Bruno Creek access road, as well as all other mine access roads.

TCMC accesses three outlying facilities in the Thompson Creek drainage via the Thompson Creek Road, which begins from SH 75 at MP 215.6: the Cherry Creek pump station, Pat Hughes WRSF, and Buckskin WRSF (Figure 2.1-3). TCMC has exclusive easements for the access roads from Thompson Creek Road to these facilities, and access to these facilities is controlled by gates, respectively, at MP 2.9, MP 4.1, and MP 6.8 on Thompson Creek Road. TCMC also owns the bridge across the Salmon River on the Thompson Creek Road, and owns (and controls with a gate) the lower portion of the road which is on property owned by TCMC.

The Salmon River Electric Cooperative supplies the mine electric power from the Bonneville Power Administration. The power is transmitted by a 230-kV power line from the Spar Canyon substation to the South Butte substation, where the power is then transmitted by a 69-kV power line to the mill. The mine uses approximately 160 million kilowatt-hours (kW-hr) per year, with a monthly peak use of approximately 15.6 to 15.7 million kW-hr (22 megawatts). TCMC pays approximately $6 million to $7 million annually for the electricity.

The existing power line, pipeline, road, and fiber optic networks require maintenance and possible replacement of equipment during the mine life and, in some cases, until the end of mine reclamation. Trees are removed from the power line corridors for fire protection and to avoid damage. All of the transportation and utility corridors required by the mine are authorized by the MPO under the General Mining Laws of the US. However, TCMC has chosen to also obtain rights-of-ways (and pay annual fees) under the FLPMA for some of these corridors.

2.1.1.3. Mining Operations

The mine is a conventional open pit hard rock mine (Photo 2.1-1.), utilizing drilling and blasting to fragment the rock; electric shovels to excavate waste rock and ore (Photo 2.1-2.); off-road diesel haul trucks (Photo 2.1-3.) to transport ore and waste rock from the open pit to the crusher or WRSFs, respectively. At the end of Phase 7, the pit, at its largest diameter, would be

[1] TCMC temporarily reduced its workforce from 379 employees to 274 in October 2012 (TCMC 2012a); a similar number of employees would be hired back when Phase 8 overburden removal resumes.

[2] *Squaw Creek* is an official place name in Custer County, and appears in numerous published documents including US Geological Survey topographic maps. The name was established by the US Board of Geographic Names to maintain uniform geographic name usage throughout the Federal Government. However, the word *Squaw* is offensive to some people including the Shoshone-Bannock Tribes. Therefore, *Squaw Creek* is hereafter referred to in the main text as *S. Creek*.

5,700 feet long and 5,150 feet wide, and the base of the pit would be at an elevation of 6,350 feet. Measured from its highest (8,600 feet) to lowest point the pit would be 2,250 feet deep.

The waste rock is analyzed to determine its sulfur concentration, acid generation potential (AP), and neutralization potential (NP). Overburden and waste rock with an NP:AP ratio greater than or equal to 1.5:1 and sulfur concentration less than or equal to 0.10 percent is classified as non-acid generating (Type 1) and can be disposed of anywhere in either WRSF. Waste rock with an NP:AP ratio less than 1.5:1 and sulfur concentration greater than 0.10 percent is classified as potentially acid-generating (Type 2), and is placed in either the Pat Hughes WRSF or a designated part of the Buckskin WRSF (Figure 2.1-3).

Ore is crushed in the primary gyratory crusher and moved to the mill coarse-ore stockpile via an overland conveyor 7,200 feet in length (Photo 2.1-4., Photo 2.1-5., Photo 2.1-6). The crusher and conveyor operate at 4,450 tons per hour, and the coarse ore stockpile has a basic capacity of 75,000 tons (~ 3 day supply, but can be expanded to 220,000 tons with a bulldozer). The stockpile, exposed on a windy ridge, is surrounded by a mesh wind fence to reduce fugitive dust.

The mine has cumulatively produced approximately 390 million pounds of molybdenum from 1983 to 2011 (end of Phase 6). The mine typically produces 15 to 20 million pounds of molybdenum each year, but had no production in 1993, and produced only 5 to 10 million pounds of molybdenum during some years. The mine had a record production in 2010 of 25.3 million pounds of molybdenum and TCMC is currently in full production mining and milling approximately 30,000 tons per day of ore. Approximately 110,000 tons per day of overburden are removed during periods of overburden removal. The mine life would vary between Alternative M1 and the other MMPO alternatives, but ore, waste rock, and molybdenum production rates would be the same each year for all MMPO alternatives.

A great deal of overburden (waste rock) overlies the ore body and needs to be removed from top down to expose the underlying ore. Through mine designs and planning, overburden and ore are removed from the open pit in phases such that the pit is continually widened and deepened. Each subsequent overburden (stripping) phase thus comprises a larger volume of waste rock and requires longer to remove. For example, Phase 6 overburden consisted overall of removing a slice of waste rock approximately 250 feet wide and 1,850 feet high (from an upper average elevation of approximately 8,200 feet to a lowermost elevation of 6,350 feet), and had an overall duration of approximately 4 years (August 2007 to December 2011).

Photo 2.1-1. Open pit (June 2011).

Phase 6 ore extraction from the bottom of the pit completed, and Phase 7 stripping along the northeast highwall. View to southeast.

Photo 2.1-2. Electric shovel, 40 cubic yard bucket.

Photo 2.1-3. Haul trucks, 200 tons.

Photo 2.1-4. Primary crusher being fed by haul trucks loaded with ore.
The crusher feeds crushed ore (less than 8 inches in diameter) to the conveyor which is approximately 75 feet underground at this point. View to east.

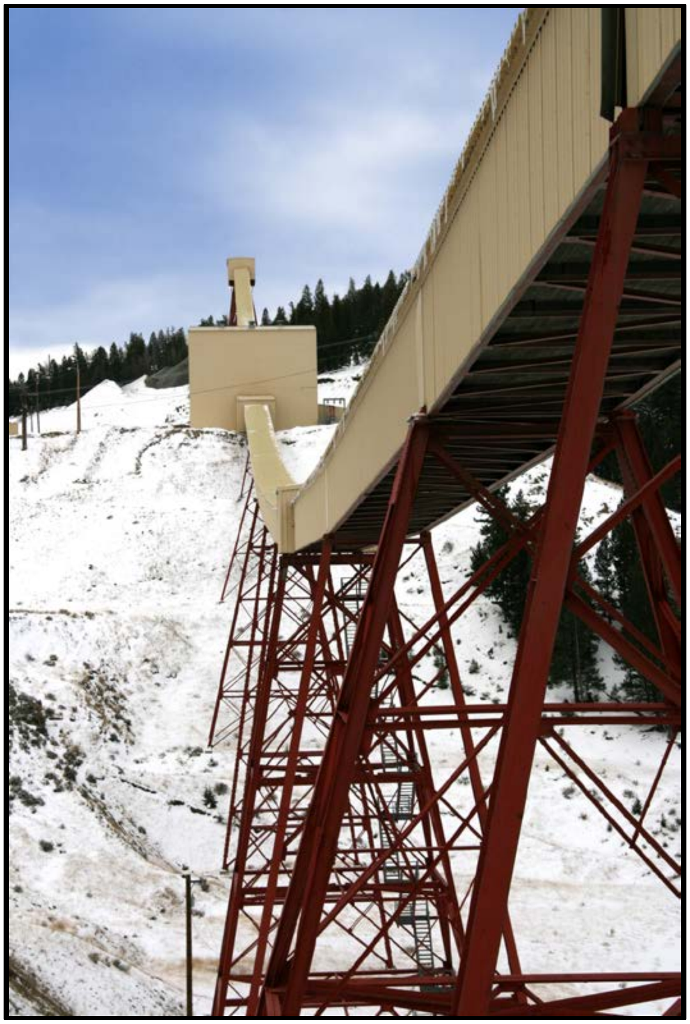


Photo 2.1-5. Overland belt conveyor to mill coarse ore stockpile, view to east.

Photo 2.1-6. Conveyor and, in foreground, coarse ore stockpile and mill.
Conveyor angles northward around hillside in photo center. View to west.

The waste rock and ore of each phase are removed in layers (benches) 50 feet high and up to 75 feet wide. After two benches are removed ("double benching"), the next two benches are removed. The result is a stair-step pattern of catch benches to help maintain the pit walls and prevent long-distance rock fall. The narrower (35 feet) catch bench widths produce an overall steeper wall in more competent rock (e.g., granitic), and the wider (75 feet) widths produce an overall shallower wall in less competent (e.g., volcanic) rock. TCMC completed mining Phase 6 ore in the bottom of the pit in May 2011. TCMC subsequently used stockpiled Phase 6 ore until the end of 2011 when Phase 7 stripping was completed and Phase 7 ore production began.

2.1.1.4. Waste Rock Storage Facilities

The Pat Hughes WRSF contained approximately 220 million tons of mostly (85 %) Type 2 waste rock at the end of 2010. Approximately 10 million tons of Type 2 waste rock and a stockpile of 17 million tons of Type 1 waste rock were added to the facility in 2011 and 2012. The Buckskin WRSF currently contains approximately 420 million tons of waste rock (~ 74 % Type 1) (Photo 2.1-7., Photo 2.1-8). The Type 2 waste rock in the Buckskin WRSF is not segregated because it was added to the facility before regulations required such segregation.

A sub-drain was constructed in the Pat Hughes and Buckskin drainages prior to the placement of the waste rock. The drains pass the estimated maximum flow in each drainage and are designed to function even after the facilities are completed. The Pat Hughes drain is a French drain with layers of sized coarse and durable rock. The Buckskin drain is a perforated culvert packed with coarse durable rock.

Photo 2.1-7. Buckskin and Pat Hughes WRSFs.
Pat Hughes WRSF (circled lower left), Buckskin WRSF (circled upper left center), view to northwest.

Photo 2.1-8. Pat Hughes WRSF.
View to south from the top of the facility showing active face at the south end of the facility (cross-valley fill).

2.1.1.5. Mill and Tailings Operations

Samples of drill cuttings are assayed prior to blasting to differentiate ore from waste rock, classify the waste rock (Type 1 or Type 2), and determine the grade of the ore. Ore from the pit is hauled by truck to the primary crusher, where it is reduced in size then transported to the mill and concentrator facility by an overland belt conveyer. The mill is fed by drawing from the bottom of the coarse-ore stockpile. At the mill the crushed ore is finely ground and mixed with water in semi-autogenous grinding (SAG) mills and ball mills (Photo 2.1-9). The ground ore/water slurry is placed in a series of cells with flotation reagents which cause the molybdenite particles to float to the surface and the waste material to sink to the bottom (Photo 2.1-10., Photo 2.1-11). A portion of the molybdenite concentrate is further concentrated to a very high purity (the percentage varies and is often customer-driven), ground to very precise particle sizes, and sold as High Performance Molybdenum for use as a high temperature lubricant and in specialized chemical applications. The remaining molybdenite concentrate is dried, bagged, and shipped to the Langeloth, Pennsylvania conversion plant where the concentrate is converted to technical grade molybdenum trioxide. Small additions of molybdenum trioxide during the production of steel, greatly improves the strength and durability of the steel. Most of the molybdenum trioxide is utilized in that form, but some is further converted to ferromolybdenum or pure molybdenum metal. The mine has historically recovered 88 to 90 percent of the molybdenum in the ore, but the current recoveries are approximately 92 percent and would be the same for all of the MMPO alternatives.

Photo 2.1-9. Two SAG mills (photo left) and one ball mill (photo right).

Photo 2.1-10. Column flotation cells.

Photo 2.1-11. Bluish molybdenum concentrate (not toxic).

After the molybdenite has been removed from the ore, the remaining ground rock slurry (tailings) is processed during the non-freezing months to remove most of the pyrite (potentially acid-generating) from the tailings. The tailings then flow through an above-ground pipeline to the TSF, approximately 7,000 feet to the north in the Bruno Creek drainage (Figure 2.1-3., Photo 2.1-12., Photo 2.1-13., Photo 2.1-14.), where the pyrite is piped separately and disposed of in a specific area of the TSF impoundment. In this specific area the pyrite remains under water and cannot oxidize.

The TSF embankment (dam) is constructed above a rock toe dam. The pyrite-reduced tailings pass through cyclone separators along the crest of the embankment where the coarse (sand size) material is separated from the fine ("slime") material and used in the continuing upward construction of the embankment. The fine tailings slurry from the cyclone separators is piped into the impoundment area behind the embankment where the solids settle out from the water forming a beach of settled solids near the embankment with a free water pond in the impoundment outward from the beach.

The embankment is raised each non-freezing season using coarse tailings to a height necessary to safely contain both the fine tailings slurry concurrently stored behind the embankment during the non-freezing season, and the volume of whole tailings (coarse + fine + pyrite) placed behind the embankment during the freezing months. During these months no cycloning or raising of the embankment occurs to avoid snow and ice entrapment in the embankment. Also, no pyrite separation occurs as the whole tailings are deposited approximately 600 feet upstream of the embankment, i.e., not exposed on the embankment or beach where the pyrite may readily oxidize.

Photo 2.1-12. TSF embankment.
Header pipeline, cyclones and embankment face, view to northeast.

Photo 2.1-13. TSF impoundment, view to north up Bruno drainage (filled).
Beach in foreground, tailings slimes pipelines at right.

Photo 2.1-14. TSF embankment face, view to northeast.

All water that contacts the impoundment (i.e., from the tailings slurry, precipitation or surface run-off) is captured at either the surface or toe of the impoundment and reused in the mill for grinding and flotation. Most of this water derives from the tailings slurry that separates from the solids to the surface of the impoundment. Most of the surface run-off intercepted by the impoundment is the flow from Bruno Creek upstream of the impoundment, except during the spring run-off when the flow is diverted into a pipeline that bypasses the impoundment and restores the water to the Bruno Creek channel downstream of the impoundment. At the end of Phase 6 the impoundment contained approximately 200 million tons of tailings, and the top of the embankment was 7,600 feet.

2.1.1.6. Water Management

Water management facilities include sedimentation ponds downstream of mine waste facilities in the Pat Hughes, Buckskin and Bruno Creek drainages; groundwater cut off walls in the Pat Hughes drainage; various surface water run-off diversion and collection systems; permitted outfalls, pit dewatering facilities; the SRD and impoundment; the pump-back system; a process water treatment plant (PWTP); freshwater, firewater and reclaim pump stations; and associated electrical power lines (Section 3.4). Note that TCMC has State water rights for all of the water used by the mine, including the water intercepted by the open pit, and that there would be no differences in these water rights under any of the MMPO alternatives.

All of the diversion ditches, the Mill Creek diversion/sediment interceptor pond, the Bruno Creek diversion berm, the two Bruno Creek sedimentation ponds, and the culverts (except the culvert that would be installed for the Phase 8 West Road) are designed to manage the 100 year/24 hour storm during mining. The culvert for the Phase 8 West Road would be designed to manage the 500 year/24 hour storm during mining. All of the other structures that intercept water are/would be designed to handle at least the 500 year/24 hour storm during mining, except the TSF which is designed to handle the probable maximum flood during both mining, reclamation, and post-reclamation.

All of the structures that would intercept water post-reclamation would be designed to manage at least the 500 year/24 hour storm, except diversion ditch culverts and the Buckskin Slope diversion channel (between the south side of the Buckskin WRSF and the open pit) would be designed to manage the 100 year/24 hour storm. However, the Buckskin Slope floodplain would manage the 500 year/24 hour storm, and the diversion ditches would manage the 500 year/24 storm even if the culverts washed out.

Sedimentation ponds (Photo 2.1-15.) are located downgradient of each of the WRSFs and the TSF to intercept run-off water and materials eroded from the faces of the WRSFs and the embankment (the sedimentation pond at the toe of the tailings embankment is termed the SRD). The sedimentation ponds are monitored and maintained to ensure that adequate storage capacity is maintained. Water may be discharged from the sedimentation ponds and related pipeline systems to five permitted NPDES discharge points (outfalls) in local drainages (Figure 2.1-1.); however, only Outfalls 001, 002, and 003 are currently used.

Drainage from the Buckskin WRSF is captured in an unlined sedimentation pond at the toe of the facility and either discharged to Thompson Creek at Outfall 001, or routed (gravity flow) via the Thompson Creek pipeline to the Cherry Creek storage tank/pump station, where the water is pumped to the mill for use as process water. The Buckskin sedimentation pond will be lined in the future as the pond leaks water; sediment is retained. Water from two natural springs near the mouth of Buckskin Creek is also diverted to the Thompson Creek pipeline for use at the mine. Water from the upper Pat Hughes drainage (above the main administration/crusher area) is collected before it comes into contact with waste rock. This water is pumped via the Pat Hughes diversion pump station around the WRSF to the Pat Hughes unlined sedimentation pond and either discharged at Outfall 002, or routed (gravity flow) to the Thompson Creek pipeline and to the Cherry Creek storage tank/pump station for use as mill process water. The Pat Hughes sedimentation pond does not leak water and sediment is retained. Run-off water from the main administration/crusher area is collected in an underground storm sewer with various collection points and settling ponds (that does not intercept any process effluent or sanitary sewage), and is also pumped to the Pat Hughes sedimentation pond. Run-off at the mill site is collected in a storm sewer system (which does not intercept any process effluent or sanitary sewage) that discharges to the TSF impoundment via an emergency overflow ditch.

Run-off from the mine access roads and intermittent flows from upper Bruno Creek (diverted in a pipeline around the TSF impoundment) are discharged at Outfall 003 on Bruno Creek near its confluence with S. Creek. Outfall 003 has no permitted effluent limitations, but must comply with all applicable water quality laws, BMPs, and certain monitoring requirements. Sediment generated by run-off from the Bruno Creek access road is controlled primarily by a series of silt-protected road windows, filter barriers, and two engineered sedimentation ponds in the lower Bruno Creek drainage prior to discharge at Outfall 003.

Perennial flow from Twin Apex Creek enters the Bruno Creek channel downgradient from the TSF pump-back station. Bruno Creek is a gaining stream (i.e., gains water from groundwater) from that location to Outfall 003. Two sedimentation ponds with decant structures are maintained on lower Bruno Creek.

Outfall 004 is on S. Creek just upstream of the mouth of Bruno Creek. The outfall may be used to discharge water collected by the SRD and transmitted (gravity flow) through the Bruno Creek pipeline. However, the water in the SRD is currently pumped back to the mill and reused. There is also a lined sump and pump-back system downgradient of the SRD in case any water should escape from the SRD. Any water intercepted by the sump would be pumped back to the SRD. The inlet of the Bruno Creek pipeline is at the pump-back station below the SRD. TCMC has never discharged at Outfall 004.

Outfall 005 is on the Salmon River a 200 feet upstream of the mouth of Thompson Creek. Outfall 005 may be used to discharge water from the open pit, the northeast abutment of the TSF, and the pump-back sump/station. TCMC has never discharged at Outfall 005.

The open pit intercepts groundwater, run-off water from adjacent areas, and precipitation into the pit. The pit dewatering system consists of several collection sumps at the bottom of the pit and dewatering wells. Water is pumped from the sumps and wells to the pit dewatering pump station, where the water is pumped to the pit dewatering booster station. The booster station pumps the water to the PWTP for use as fresh water in the milling process.

Approximately 2,500 gallons per minute (gpm) of water is used at the mine for dust control, drill water, fire protection, drinking water, etc. The PWTP was constructed in 2009 and treats water from the Buckskin and Pat Hughes WRSFs, springs along Buckskin Creek, and water from the open pit for use as process water in the mill. The mill uses approximately 7,200 gpm of which 4,500 gpm is recycled from the TSF pond, 1,000 gpm is recycled from the SRD, and 1,700 gpm is treated water from the PWTP. Approximately 80 gpm is withdrawn from two wells for potable water use only (~ 40 gpm from each well). One of the wells is near the crusher and the other well is next to the mill. If the amount of water intercepted by the mine and routed to the PWTP is insufficient, fresh water can also be pumped to the PWTP from the Salmon River in a pipeline along Thompson Creek (Figure 2.1-3). This water is withdrawn via an infiltration gallery (grid of perforated pipe) in the bed of the Salmon River 200 feet upstream of the Thompson Creek Bridge. The intercepted water is pumped to the mine via the Thompson Creek pipeline from a pump station next to the streambank.

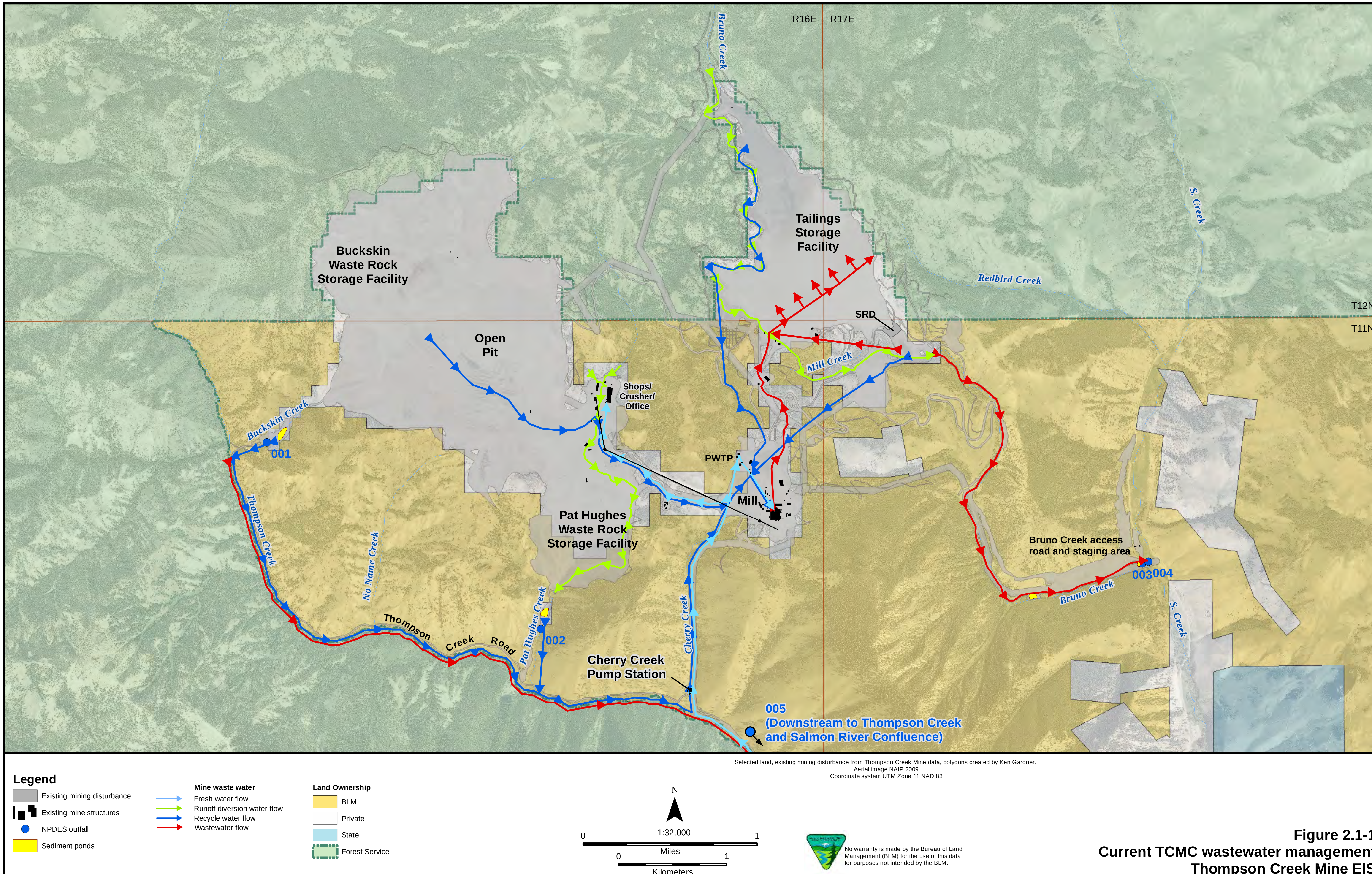


Figure 2.1-1
Current TCMC wastewater management
Thompson Creek Mine EIS

The PWTP uses hydrated lime to adjust the pH and then clarifiers and disc filters to remove suspended solids. Flocculent and coagulant are used in the clarifiers to promote solids removal. The solids or sludge from the clarifiers and disc filters are combined with the mill tailings for disposal in the TSF.

Systems of blanket and finger drains were constructed within and at the base of the TSF embankment to drain the embankment and maintain it in an unsaturated condition. Regardless, some water seeps into the soil and rock underlying the embankment. To control and monitor the quality of water at the site, two systems were constructed: 1) the SRD (sedimentation pond) to capture drain water, and 2) a network of wells to monitor ground water around the perimeter of the embankment. Water from the SRD is pumped back up to the top of the TSF or to the process water storage tank for the mill.

Sewage generated at the mine site is treated using a conventional septic tank and drain field system south of the mine change house. Sewage from the mill is piped to a holding tank and then pumped by the sewage lift station to the tailings pipeline for disposal in the TSF.

Photo 2.1-15. Sedimentation pond (SRD) below the TSF embankment.
View to southeast.

2.1.1.7. Environmental Controls and Monitoring

Operational (i.e., non-reclamation) environmental controls and monitoring activities at the mine include the following:

- Fugitive dust suppression and point source emission controls;
- Erosion, run-off, and sedimentation controls according to BMPs with discharge of collected water through permitted NPDES outfalls;
- Prevention and control of petroleum and chemical spills;
- Waste rock monitoring, classification, and management;
- Selective management of pyrite in the tailings and potentially acid-generating (Type 2) waste rock;
- Monitoring and reporting for multiple environmental media according to approved plans;
- Compliance with a road maintenance and transportation plan to protect surface water quality; and
- Stability monitoring of the TSF, pit highwalls, and WRSFs.

TCMC follows environmental compliance plans for each of these areas of environmental concern as part of the current MPO. The MPO also provides additional environmental protection measures. TCMC's Consolidated Environmental Monitoring Program for 2007-2012 (TCMC 2008a) is a part of the MPO that describes the annual environmental monitoring program related to biological conditions, air emissions, NPDES permit compliance, structural stability and dam safety, mine waste monitoring, and water quality monitoring. These plans and additional environmental protection measures, which would apply to all MMPO alternatives, are summarized below by resource.

Geologic Resources and Geotechnical Issues

A review of geologic formations and known paleontological resources was also conducted. Paleontological resources would be avoided until the Forest Service, BLM, or an agency-approved paleontologist conducts investigations as needed to determine the significance of the fossils. At the discretion of the Forest Service or BLM, these fossils would be avoided for a length of time that is reasonable (e.g., 45 days after notification to the authorized officer of such discovery) to allow agency personnel to conduct the investigations. TCMC would be responsible for the cost of these investigations, evaluations, and mitigations.

Soil Resources

Only the minimum areas necessary for mining would be disturbed. Under the MMPO action alternatives, soil growth medium (e.g., topsoil) would be salvaged from proposed disturbed areas where topography allows (i.e., not on slopes of the WRSFs and the TSF that are too steep for heavy equipment to operate) for use in reclamation. Approximately 8.5 acres of topsoil and alluvial material would be salvaged from the area of the Pat Hughes WRSF expansion

(Alternative M2) and approximately 4 acres from the No Name WRSF (Alternative M3) for construction of the under drains for these facilities.

Salvaged growth medium would either be transported to areas being reclaimed or stockpiled. Stockpiles would be protected from erosion by establishing a vegetation cover and using erosion control structures, as required (Photo 2.1-16). The stockpiles would be built and maintained with as little compaction as feasible. Growth medium would be applied during reclamation with minimal compaction and protected from erosion through revegetation, run-on controls, mulch, swales, terraces, silt fences, and other erosion control measures.

Vegetation, Forest Resources, and Invasive and Non-native Plants

Under the action alternatives, only the minimum amount necessary of vegetation and timber would be removed. TCMC would use any timber at the mine site (covered by mining claims) necessary for its operations without payment to the BLM or Forest Service pursuant to the General Mining Laws of the US (but TCMC has not had such use to date and does not foresee such use). All other timber would be disposed of by the BLM or Forest Service, with TCMC reasonably accommodating the agencies and/or their permittees in disposing of the timber. In many cases, to expedite timber removal, TCMC would voluntarily cut and deck the timber at its own expense to agency specifications. Non-merchantable timber, brush, and slash would be stockpiled for use as run-off and sediment control brush barriers along the downhill margins of disturbed areas. Small brush and slash would be incorporated in the topsoil when it is salvaged. Invasion of noxious weeds is minimized through monitoring and controlling noxious weeds under TCMC's weed control program. This program has been effective and adheres to Federal, State, and county regulations related to the application and use of selected herbicides. Records are kept related to completed reclamation work, weed control, and maintenance on disturbed sites.

Wildlife, Fish, and Aquatic Resources

Under the action alternatives, construction in stream channels would occur during low flows, and the channels and banks would be stabilized against erosion as part of the initial construction. Biological surveys would be conducted in areas prior to disturbance to identify any active nests for birds. Avoidance plans would be developed before these areas are disturbed.

Drivers would be required to report all collisions on the mine property involving wildlife (and people or property), and these incidents would be reported to the appropriate agencies. If appropriate, mitigation measures would be developed for areas with high collision rates to reduce the collision frequency, effects to wildlife and vehicle damage (to date there have been no such collisions). The mine operations would inherently accommodate wildlife movement (including migration) by virtue of the many areas of undisturbed habitat and reclaimed areas at the mine that provide migration routes around mine features such as the pit or faces of the WRSFs or the TSF. The haul roads would not be barriers to wildlife movement due to the relatively low traffic and slow speeds (e.g., 35 mph maximum).

Aquatic habitat monitoring is conducted in accordance with the Consolidated Environmental Monitoring Program (TCMC 2008a). There are two periphyton and macroinvertebrate sample sites each on Thompson Creek, S. Creek, and on the Salmon River that are monitored annually.

Fish are surveyed annually in Thompson Creek and S. Creek. Four sediment sampling stations are monitored annually to evaluate channel substrate, compare the composition of fine sediment upstream and downstream of the mine, and determine the amount of metals-loading in sediment downstream of the mine. One station upstream of the mine and one downstream of the mine are located on Thompson Creek and S. Creek.

Water Resources

Water quantity and quality environmental controls and monitoring are detailed in the Consolidated Environmental Monitoring Program (TCMC 2008a). Flow volumes are measured throughout the Thompson Creek drainage, including at monitoring sites on streams, at diversions, and below sedimentation ponds. Water quality monitoring is described in the Water Quality Monitoring Plan in TCMC (2008a). Water quality samples are collected at 34 surface water and 19 groundwater sites. The monitoring schedule includes daily, weekly, monthly, quarterly, semi-annual, and annual sampling events, each with their own set of parameters. Monitoring frequency of certain parameters is determined seasonally (according to stream flow conditions), with additional monitoring during spring run-off. Required monitoring includes water chemistry, water discharge flow rates, dilution ratio, effluent toxicity, sediment loading, and several field parameters such as pH, specific conductance, and temperature. Water monitoring for NPDES permit compliance also includes measuring the water quality of receiving streams at points above and below the NPDES discharge points. TCMC has also developed other operational plans to protect the quality of surface water and groundwater, including the following:

- Water Management Plan (Lorax 2012a) – includes long-term capture and treatment of drainage from the WRSFs and the TSF, along with management of the final pit lake level through pumping and treatment prior to discharge through the existing permitted NPDES discharge points (the plan was developed as part of the NEPA process for the project and is now considered part of the MMPO, and is described as part of Alternative M1 even though the plan has not been approved by the agencies);
- Spill Prevention, Control, and Countermeasures (SPCC) Plan (ARCADIS 2010) - developed to prevent spills of petroleum products and to minimize the risk of injury to employees and minimize damage to the environment in the event that a spill should occur; and
- Best Management Practices (BMP) Plan (TCMC 2010a) - designed to prevent or minimize the generation and the potential for the release of pollutants from the mine site to surface water and groundwater through normal and ancillary activities.

Wetlands, Floodplains, and Riparian Areas

Only the minimum areas necessary for mining would be disturbed. Boundaries and characteristics of all WUS (including wetlands and riparian areas) in the disturbance footprints of the MMPO alternatives have been delineated and described (Section 3.9). Run-off from planned disturbance upgradient of wetlands and riparian areas would be controlled to reduce transport of sediment and contaminants into the wetlands and riparian areas.

Air Quality

Fugitive dust would be managed according to the Fugitive Dust Control Plan (TCMC 2008b). Fugitive dust from traffic on unpaved haul and access roads would be controlled primarily by water sprayed by water trucks and speed limits. Dust suppressing chemicals such as magnesium chloride and calcium chloride would also be used on roads as needed. A wind fence has been constructed around the coarse ore stockpile and would reduce fugitive dust from the pile by approximately 90 percent.

Cultural Resources

The proposed disturbance areas for the MMPO alternatives were inventoried for cultural resources during recent baseline surveys. If unanticipated cultural materials, historic sites, or human remains are encountered during mining, TCMC would immediately notify the Forest Service or BLM authorized officer, and operations would be halted in the vicinity of the discovery until inspected by BLM, Forest Service, or an agency-approved archaeologist, and a mitigation plan developed, if necessary. Cultural resources would be avoided until the Forest Service, BLM, or an agency-approved archaeologist conducts investigations as needed to determine the significance of the finding. At the discretion of the Forest Service or BLM, these cultural resources would be avoided for a reasonable length of time (e.g., 45 days after notification to the authorized officer of such discovery) to allow the agency personnel to evaluate and determine the significance of the find.

Overburden Cover

The classification (Type 1 or Type 2) and handling of the overburden is described in Section 2.1.1.3.

Management of Hazardous Materials and Petroleum Products

Management of hazardous materials, hazardous wastes, and petroleum products would be performed in compliance with applicable Federal and State requirements. Approximately 55 gallons per year of hazardous waste (e.g., acetone) and petroleum waste (crushed oil filters and grease) would be removed from the mine by a contractor. Used oil is recycled off-site.

Inspections, Records, and Monitoring

During operations, daily inspections would be made by mine supervisory staff of all active operations to ensure compliance with conditions of approvals, applicable permits, and regulations. Records of these observations would be kept on-site in TCMC's environmental records.

Photo 2.1-16. Salvaged topsoil storage pile.
Effective sedimentation and erosion control structures, lower Pat Hughes drainage, view to south.

Regular inspections for the stormwater pollution prevention plan (SWPPP) and SPCC Plan would be conducted to document compliance with these plans and detect any conditions requiring modification to maintain compliance. All maintenance, repair, or modifications related to the SWPPP and SPCC plans would be documented in TCMC's on-site environmental records.

TCMC would continue to ensure that chemical analyses of sample of storm water, groundwater, soil, sediment, aquatic biota, vegetation, and surface water would be made as required by the Consolidated Environmental Monitoring Program (TCMC 2008a).

The mine would continue to be inspected by a variety of Federal and State agencies such as the EPA, Mine Safety and Health Administration (MSHA), BLM, Forest Service, IDWR, IDEQ, IDL, etc. The BLM and Forest Service typically inspect the mine several times per year to determine compliance with the approved MPO. In addition, the mine is regularly inspected by an interagency taskforce (defined by a Memorandum of Understanding [MOU]) composed of the BLM, Forest Service, IDWR, IDEQ, IDL, and Idaho Department of Fish and Wildlife (IDFW).

2.1.1.8. Reclamation

TCMC had reclaimed approximately 660 acres as of June 2011 (Figure 2.1-2., Photo 2.1-17., Photo 2.1-18). Concurrent reclamation activities during the last 30 years at the mine have been primarily removing non-native materials, recontouring, revegetation, and aesthetic measures such as boulder scattering. The primary goals of these efforts are to provide slope stability, and to return disturbed areas to a relatively natural function (e.g., vegetation to minimize soil erosion and maximize wildlife habitat) and appearance (e.g., would not be noticed by a casual observer). During the last 30 years, there has not been any slope failure of reclaimed areas and no additional recontouring has been necessary (Wall 2012). The overall result of the reclamation is such that a casual observer would not notice the site was once distinctly disturbed.

The 1979 Reclamation Plan (analyzed in the 1980 EIS) was revised and described in more detail in the 1999 Consolidated Reclamation Plan (EnviroNet 1999) (analyzed in the 1999 EIS). Further information specific to reclamation water management for the MMPO is in the Water Management Plan (Lorax 2012a). The Consolidated Reclamation Plan is summarized below.

Photo 2.1-17. Reclaimed area of the Buckskin WRSF.
Steep section (photo foreground) and moderately steep section (photo background). View to south.

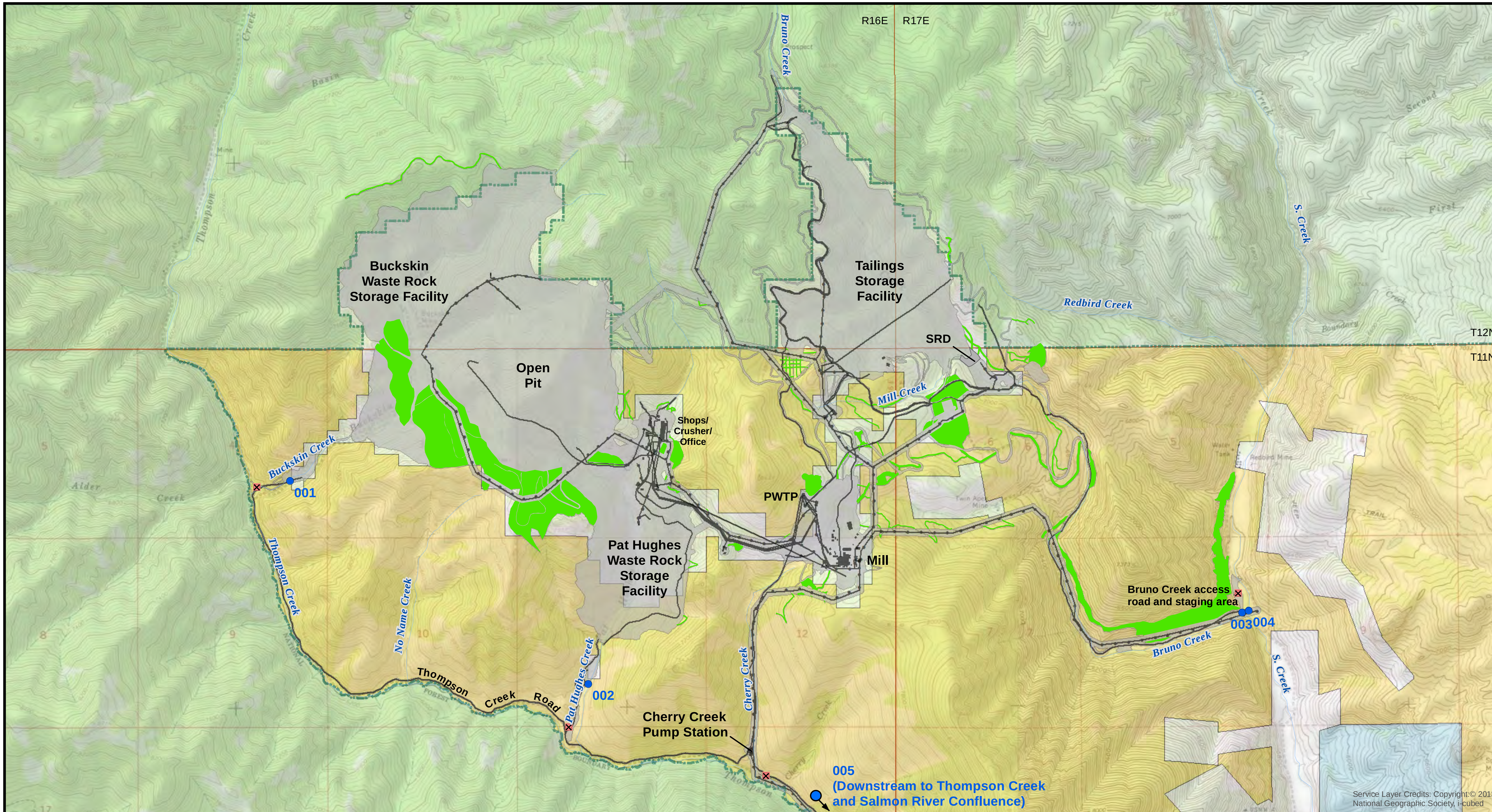
Photo 2.1-18. Reclaimed section of the Buckskin WRSF.
Reclaimed area is the slope in photo center. View to southeast.

Post-Mining Land Use Objectives

The overall goal of the Reclamation Plan is to reclaim the mine site to support wildlife habitats similar to those which occur adjacent to the site. Related objectives include hydrologic function, soil productivity, and aesthetics. The adjacent lands include steep to rolling slopes, rock outcrops, and gentle to flat open areas. The reclamation of the site would produce landforms which provide habitat features and increase the amount of habitat edge. The open pit would not be backfilled, but instead would be fenced and remain as a water storage facility.

The majority of the mine site and adjacent areas is transitional between sagebrush grassland and conifer forest, and reclamation of these areas would meet the objective of sagebrush (*Artemisia* spp.) and grasslands/conifer habitat. Landform features in this reclamation objective include generally flat to moderately sloping areas revegetated with a mix of grasses, forbs, shrubs, and coniferous trees. Portions of the site and adjacent areas provide elk and deer summer and winter range. Reclamation objectives for elk and deer habitat would also provide suitable habitat for small mammals, upland game birds and songbirds, raptors, mammalian predators, and reptiles.

Within and adjacent to the mine site there are disturbed areas of nearly barren rock on steep slopes, cliffs, and rocky outcrops (slopes of the open pit and WRSFs). Reclamation of these facilities would meet the objective of rocky slope habitat (provide terrestrial wildlife habitat).



Selected land, existing mining disturbance from Thompson Creek Mine data, polygons created by Ken Gardner.
Ownership data is at 1:24,000 and created and maintained by the Bureau of Land Management, Idaho State Office, Geographic Sciences.
Topographic background from USGS 7.5' Quadrangles 1:24,000 scale.
Coordinate system UTM Zone 11 NAD 83

Legend

- Existing mining disturbance
- Reclaimed areas
- NPDES outfall
- Gate
- Existing mine structures
- Existing power line
- Existing pipelines

Land Ownership

- BLM
- Private
- State
- Forest Service

N

1:32,000

0 — 1 Miles

0 — 1 Kilometers

No warranty is made by the Bureau of Land Management (BLM) for the use of this data for purposes not intended by the BLM.

Figure 2.1-2
Current reclaimed areas, June 2011
Thompson Creek Mine EIS

Landform features in this reclamation objective include moderate to steep rock or talus slopes revegetated with grasses, legumes, and low shrubs to minimize hiding cover for predators with varying boulder sizes for escape and nesting habitat. The target species for this reclamation objective are the bushy-tailed woodrat and the yellow-bellied marmot. Reclamation features for these species would attract other small mammals and predators.

Blue spruce (*Picea pungens*) and aspen (*Populus tremuloides*) occur in and around the mine site in moist areas. Willows (*Salix* spp.), cottonwoods (*Populus* spp.), alder (*Alnus* spp.), sagebrush, and grasses occur in riparian communities. Reclamation of these areas would meet the objective of wetlands/meadow habitat. Landform features in this reclamation objective include flat to moderate sloping areas, pits, and ponds revegetated with a mix of upland and shoreline species for forage and cover. The target species for this reclamation objective include waterbirds, passerines, beavers, small mammals, and predators.

Target wildlife species for this reclamation objective are salmonids found in both of these creeks. The focus of the special riparian habitat reclamation objective is to provide potential rearing habitat for juvenile fish and habitat for adult fish, passerines, waterfowl, and predatory species.

Facility Decommissioning

Towards the end of mining, stocks of materials such as fuels, lubricants, and reagents would be reduced to those necessary to complete mining. Excess materials would be returned to the suppliers or sold for use elsewhere whenever possible. Final stocks of chemicals that cannot be returned or used elsewhere would be properly packaged and disposed of off-site in permitted waste handling facilities. Tanks, pipes, pumps, vessels, sumps and other equipment or facilities using process chemicals would be cleaned and the residues disposed of in accordance with applicable regulatory requirements.

Buildings and structures (including power lines) not required for reclamation and maintenance of water management facilities would be dismantled and sold or demolished and the structural materials either sold or buried on-site in permitted, solid waste landfills. However, the administration building at the upper security gate would remain as a permanent site feature.

There would be one or two solid waste landfills at the mine site used for disposal of concrete, wood, piping material, etc. The landfill(s) would depend on the configuration of the WRSFs at reclamation, but the potential locations are the 7,250 foot bench of the Pat Hughes WRSF due to the proximity to the WRSFs that would require demolition, and the 7,600 foot bench of the Buckskin WRSF (Figure 2.1-3). TCMC has an industrial landfill permit for solid waste at the Buckskin WRSF.

All above-ground remaining materials, equipment, pipelines, culverts, and facilities would be removed to ground level and either sold as scrap or disposed of in the landfill(s). Subgrade facilities, including buried pipes, cable trays, sumps, sewers, etc. would be plugged at their surface openings and decommissioned in place to minimize surface disturbance. Concrete foundations would be broken down to ground level and removed to the landfill(s) or buried in place and covered with earth to form natural-looking landforms. Backfill used to achieve final grades and landforms at the former facilities locations would consist of at least 3 feet of non-acid-generating (Type 1) rock covered by approximately 1 foot of growth medium.

Open Pit

Access to the edge of the open pit would be restricted by berms and/or rock piles and/or bar gates at the access roads leading to the pit. Warning signs approximately 2 square feet of weather resistant, reflective material would be placed around the perimeter of the pit every 200 feet for public safety. A fence would not be installed around the open pit. Areas accessible for seeding along the top of the pit would be seeded by hand broadcasting. The pit slopes would continue to produce rock falls to the interior of the pit. The rock fall would initially be retained on the remaining pit catch benches, but would ultimately obliterate some of the benches yielding talus slope-like features. Water (groundwater and surface run-off) would naturally accumulate in the bottom of the open pit forming a lake. During reclamation of the TSF, the tailings water removed from the impoundment area would be piped to the open pit for disposal. During and after reclamation of the WRSFs, water from these facilities would also be piped to the open pit, after being treated with lime. These water flows to the open pit are further described in the following Water Management section. Long-term weathering of the pit slopes would continue to occur above the water level. Maintenance of the pit lake is also discussed in the Water Management section below.

Waste Rock Storage Facilities

Under all of the MMPO alternatives the WRSFs would be reclaimed in a similar manner (Figure 2.1-3.), except for the differences between Alternative M1 (Phase 7) and Alternative M2 and Alternative M3 (Phase 8) noted below. The reclaimed Buckskin facility would have three levels (benches) including the upper (8,100 to 7,900 feet); middle (7,900 to 7,630 feet); and lower (7,630 to 6,700 feet) (Phase 7 elevations – the Phase 8 elevations of the upper and middle benches would be somewhat higher). Although the 1979 MPO describes Type 2 waste rock at the surface and cells of Type 2 rock near the surface of the Buckskin WRSF, at the end of Phase 7 or Phase 8 all of the surface of the facility would be Type 1 rock (except for the lower bench slope) with no Type 2 cells within 150 feet of the margins or surface of the WRSF. The surface of the facility (benches and slopes, except the lower bench slope) would be graded to final contours to blend with surrounding topography and to divert run-off towards surface water diversion and collection ditches at the margins of the facility.

For Phase 7 the non-durable portions of the slopes of the upper and middle benches of the Buckskin WRSF would be graded to 2.5H:1V and the other portions would be left at the angle of repose (~ 1.5H:1V). For Phase 8 all of the slope between the upper and middle benches would be graded to 2.5H:1V, and the slope below the middle bench (which drains directly to the open pit) and the slope below the lower bench would be left at the angle of repose (Section 2.1.3.6). For Phase 7 all of the surface except the lower bench slope would be capped with 3 feet of volcanic Type 1 growth material, fertilized, and revegetated according to the revegetation plan. In addition, the lower 800 horizontal feet to the toe of the WRSF would be have only coarse, durable, non-volcanic material at the surface.

The growth medium would support the establishment of vegetation to stabilize the final surface and to provide evapotranspiration of precipitation thereby reducing the moisture available to infiltrate through the cover. Phase 8 portions of the top of the upper bench would be capped with 1 foot of Type 1 growth material (primarily volcanic waste rock mixed with stockpiled soil), scarified, fertilized, and revegetated (because all surfaces would be Type 1 waste rock). The remaining surface of the facility would be scarified, fertilized, and revegetated, except the slope below the middle bench would be capped with 3 feet of durable non-volcanic Type 1 rock (Doughty 2013). The lower bench slope was established in the late 1980s prior to classification of waste rock; therefore, this portion of the facility likely has a mixture of Type 1 and Type 2 waste rock and would remain in its current configuration due to its steepness, durable rock cover, and demonstrated stability.

The reclaimed Pat Hughes facility would have three benches: 7,250 to 7,000 feet, 7,000 to 6,750 feet, and 6,750 to 6,400 feet (Phase 7 elevations – the Phase 8 elevations would be somewhat higher and there would be four benches). The slope below each of these elevations would be left at the angle of repose (Phase 7) or graded to 3H:1V (Phase 8) and covered with durable Type 1 waste rock. The surface of the facility would be graded to final contours to blend with surrounding topography and to promote run-off to a surface water diversion and collection ditches at the margins of the facility. The surface would be covered with 1.5 feet of compacted volcanic material, 5 feet of Type 1 volcanic rock, capped with 1 foot of growth media, scarified as required, fertilized, and seeded according to the Revegetation Plan. The last 800 horizontal feet to the toe of the WRSF would have only coarse, durable, non-volcanic, Type 1 material at the surface. The compacted volcanic material would produce a low permeability layer that would reduce infiltration into the underlying waste rock. The overlying uncompacted volcanic waste rock layer would be a thermal barrier protecting the compacted layer from freeze/thaw and would also serve as a moisture storage layer to reduce infiltration and support the growth of vegetation.

The No Name WRSF (under Alternative M3 only) would have up to six benches. The WRSF would be reclaimed as described for the other two WRSFs, except that areas of the WRSF with Type 1 waste rock at the surface would be covered with 1 foot of growth media, scarified as required, fertilized, seeded, and areas of the facility with Type 2 waste rock at the surface would be covered with 1.5 feet of compacted volcanic material, 5 feet of Type 1 waste rock, capped with 1 foot of growth media, scarified as required, fertilized and seeded according to the Revegetation Plan.

TSF

The design plans for the reclamation of the TSF are in the original Tailings Closure Plan (SRK 1982). The plans were updated and are summarized in the Consolidated Reclamation Plan (EnviroNet 1999), and the plans were updated again in 2008 (WMC 2008). However, the reclamation of TSFs is the authority of the IDWR, and the IDWR does not approve reclamation design plans for TSFs until the time of final reclamation (but the IDWR must approve any change to the operating plan for a TSF before the change is implemented). Therefore, the most probable reclamation of the TSF is described in this section, e.g., as a slightly steeper embankment face has been approved for during mining, the reclaimed face would necessarily have the same slope (WMC 2008).

The final elevation of the TSF embankment (dam), without the reclamation cap, would be 7,646 feet under Phase 7 (7,742 feet under Phase 8) with a downstream slope of 2.75H:1V. The lowest elevation of the original ground surface below the crest of the embankment is 6,980 feet. Including 10 feet of reclamation cover, the height of the embankment would be 676 feet (Phase 7) or 772 feet (Phase 8). Near the end of ore milling, the surface of the tailings solids in the impoundment would slope downward (~ 0.5 percent) to the northwest from the embankment to the upstream end of the impoundment where the tailings water collects in a pond. However, prior to final mill shutdown, the surface of the tailings solids in the impoundment would be recontoured to reverse the slope to approximately 1 percent toward the embankment. This would be accomplished by ceasing the centerline construction along the embankment and instead discharging whole tailings in a pipeline to the upstream end of the impoundment. The resulting tailings water pond would be relocated from the far end of the impoundment area to the southwest corner of the impoundment. Additional recontouring of the surface of the impoundment would be minimal.

During the final 2 years of mining and during the recontouring of the surface of the impoundment, the impoundment area would be covered by a 7 foot thick layer of pyrite-reduced tailings solids. The current location in the impoundment where pyrite concentrate is disposed of (southwest corner) would eventually be covered. At that time (with mining complete or nearly complete), any residual amounts of pyrite concentrate would be disposed of in the bottom of the open pit. The impoundment area would then be covered (capped) with a 2 foot thick layer of inert material capable of supporting the growth of vegetation used for reclamation. This material would be Type 1 volcanic overburden that would be ground in the mill to form a slurry, and then delivered to the impoundment area using the TSF pipeline system. The downstream face of the embankment would be covered with inert, durable rock.

After the final grade is established for the surface of the impoundment, the water in the TSF pond would be removed from the impoundment and pumped to the open pit for disposal. The exposed tailings solids would be allowed to drain and consolidate to produce a dry surface that can support heavy equipment for reclamation. The channel for Bruno Creek would be re-established on the surface of the impoundment area and the existing Bruno Creek diversion structures and pipeline would be removed. The channel would be designed to allow for the average annual flow of Bruno Creek (10 cfs), with a minimum of 1 foot of freeboard and the maximum recorded flow for Bruno Creek (42 cfs) with 0.5 foot of freeboard. The average baseflow velocity of this channel would be approximately 3 to 4 feet per second. The channel design is further described in the Water Management section below.

The final surface of the impoundment would slope toward the southwest corner of the impoundment area. The final configuration of the embankment and impoundment area would have the capacity to store the 96 hour probable maximum flood waters from the upstream Bruno Creek watershed to a maximum stage elevation of 7,742 feet (Phase 8), conservatively assuming no outlet for surface flow from the impoundment, and leaving 10 feet of freeboard on the reclaimed embankment (WMC 2008). This design was checked with a scenario of a 100 year/24 hour rainfall event with 5.34 inches per day of snowmelt run-off (estimated maximum rain-on-snow run-off event) and found to contain the resulting run-off to a maximum stage elevation of 7,740 feet, leaving 12 feet of freeboard at the reclaimed embankment.

However, as described below in the Water Management section, the facility would be fitted with a spillway channel in the southwest corner of the impoundment so stormwater collected under either of these scenarios would actually be routed through the spillway during and after the flood event. The maximum depth of water stored behind the embankment would be less than calculated above, which also assumed no outlet.

The downstream slope (face) of the embankment would have benches every 100 feet in vertical elevation and slope towards the abutments to reduce the potential for run-off down the embankment face. The embankment face would be recontoured into the benches to maintain an overall slope of 2.75H:1V. Each bench would be sloped back to retain stormwater run-off from the bench. Three drainages (bench drainage, perimeter drainage, and tie in drainage) would be constructed along the embankment. The benches would be covered with 3 feet of inert, durable rock obtained from the TSF rock borrow areas (see below), 6 inches of growth medium, and revegetated. The embankment slopes between the benches would be covered with 3 feet of inert, durable rock from the TSF rock borrow areas.

The TSF seepage collection system would continue to function following reclamation, but at decreasing flow rates as no tailings slurry would be added to the impoundment and surface infiltration would be minimal due to the cap and surface water diversions (Bruno Creek). The SRD would remain in place and water collected in the SRD would ultimately be processed at the water treatment facility.

Two rock borrow areas are planned to provide the inert rock required to reclaim the facility. The first would be north of the southwest corner of the impoundment area, and the second (already used as a borrow pit) would be east of Bruno Creek downstream of the facility. Two growth medium borrow pits would also be excavated to provide the growth medium required for reclamation of the facility. The first would be west of the facility, and the second would be southwest of the embankment. Upon completion of reclamation, the four borrow pits would be reclaimed by scarifying and seeding with the final reclamation seed mixture.

Roads

Roads or road segments would be reclaimed as soon as they are no longer required for mining, reclamation activities (including long-term activities such as water management and maintenance, environmental monitoring, inspection of reclaimed areas), or general site access. The remaining roads would be substantially reduced in width (Table 2.1-1). Pioneer (2010a) provides a more detailed description of the road reclamation.

Approximately 25 miles (80 acres) of roads would be reclaimed across their full widths by scarifying, contouring to blend with (and shed water to) adjacent topography, spreading growth material along the road shoulders and cuts, and seeding the disturbed areas with the reclamation seed mixture to re-establish vegetation. Steep cut and fill slopes that could not be recontoured would be stabilized by terracing, rock placement, rip-rapping and/or revegetating with mulch to prevent erosion. Haul roads in proximity to or within the WRSFs would be incorporated (obliterated) within the WRSFs as the WRSFs are reclaimed.

Table 2.1-1. Principle road reclamation (miles).

Road	TCMC	BLM	Forest Service	Current Width (feet)	Reclaimed Width (feet)
Upper Buckskin access	3.1	0.0	0.0	40.0	14.0
Main access	2.3	3.9	0.0	40.0	14.0
Northeast access	0.2	2.1	0.9	24.0	12.0
Repeater and power line access	1.0	0.3	0.4	12.0	0.0
TSF access	2.1	1.2	5.4	20.0	12.0
Cherry Creek	0.4	1.5	0.0	20.0	12.0
TOTAL	**9.1**	**9.0**	**6.7**		

Revegetation Plan

Revegetation would be conducted to stabilize reclaimed surfaces with perennial vegetation communities and restored to a post-mining land use for multiple use management. Certified weed-free seed would be used. The successful revegetation would include the establishment of at least 70 percent of the ground cover found on adjacent reference areas for two full growing seasons after cessation of soil amendment or irrigation (IDAPA 20.03.02.140.11.b). The emphasis for the revegetation efforts in terrestrial areas would be development of vegetative cover that would mimic the vegetation in the surrounding area, stabilize ground surfaces, and establish wildlife habitat to meet the land use objectives of the overall reclamation plan.

When final grades are established on disturbed surfaces, growth medium would be placed, spread, and scarified to facilitate vegetation establishment. Samples of the growth medium would be analyzed for essential nutrients for plant growth, and mulch and fertilizer would be applied as appropriate. Seed would be applied with various methods depending on equipment accessibility and area configuration. Drill seeding is the preferred method and would be used on flat areas and areas with slopes that can be negotiated by the drill seeding equipment. In areas of steeper slopes, seed would be applied by broadcast methods.

Site preparation for seeding would occur in late spring, summer, and early fall when snow is not present at the site. Seeding would generally occur in the fall before snow cover but after daily temperatures are sufficiently low so germination does not occur. Seed placed in the fall can take full advantage of the moist spring conditions for germination and establishment. However, some seeding might occur in the spring.

In the 1980s, reclamation specialists from the Forest Service developed a vegetation seed mixture based on drought tolerant species. The mix had been tested on other reclamation projects within central Idaho (e.g., Blackbird Mine) with positive growth rates. The results of these efforts identified appropriate seed mixtures and soil amendments such that revegetation at the mine is now nearly always successful on the first attempt. That is, there are no distinct areas of bare soil or erosion such as rills or gullies, and wildlife regularly forage on reclaimed areas of the mine.

The current seed mixture varies somewhat year-to-year depending on the availability of seed species. The agencies would approve changes to this seed mixture based on seed availability, past success rates, and cost. Over the last 30 years TCMC has determined that an optimal seed application rate is 40 pounds per acre for drill seeding and 60 pounds per acre for broadcast seeding, with fertilizer rates of 250 to 500 pounds per acre depending on soil conditions. These seed and fertilizer rates would be used for concurrent and final reclamation unless changes were necessary to achieve the desired vegetation cover. The seed mixes consist only of native species or potentially non-invasive/sterile quick cover crops.

After seeding has established groundcover, shrubs (sagebrush and bitterbrush [*Purshia tridentate*]) and trees (primarily lodgepole pine [*Pinus contorta*]) would be hand-planted in selected areas designated for sagebrush/grasslands/woodlands habitat. Shrub seedlings would be raised from seeds collected on-site and tree seedlings would be obtained from a high-altitude seed source. Trees would be hand-planted in selected microsites on north or east aspects in patches to provide thermal and escape cover for wildlife. An average of 60 shrubs and 60 trees per acre would be planted. If an area is not conducive to shrub or tree growth it would not be planted. More planting would be done in locations farther from natural seed sources, with the assumption that areas near trees would have more natural regeneration.

Special riparian habitats would be established at the water management facilities that are required to operate during and after[3] reclamation: the sedimentation ponds below the WRSFs, the lower Bruno Creek drainage, and the SRD below the TSF. The vegetation species in these habitats would be willows, cottonwoods, alder, and a variety of grasses and emergent aquatic species that would either be planted or naturally established. The target wildlife species for this reclamation objective are salmonids found in both of these creeks. The focus of the special riparian habitat reclamation objective is to provide potential rearing habitat for juvenile fish and habitat for adult fish, passerines, waterfowl, and predatory species.

Post-reclamation Water Management

It is implicit in the Consolidated Reclamation Plan (part of the approved MPO for the mine through Phase 7) that no water would be discharged that would violate any Federal or State water quality laws, i.e., the water would be treated if necessary. Since then, as part of the NEPA process for the project, TCMC has developed more detailed plans for long-term water management (Lorax 2012a). These include long-term capture and treatment of drainage from the WRSFs and the TSF, along with management of the final pit lake level through pumping and treatment prior to discharge through the existing permitted NPDES discharge points. The details of this Water Management Plan are now considered part of the MMPO, and are considered part of Alternative M1 even though the Water Management Plan has not been approved by the agencies (Section 2.1.2).

[3] The facilities are described in the Consolidated Reclamation Plan as being removed after Phase 7, but would be necessary as part of the Water Management Plan for either Phase 7 or Phase 8.

During any short-term halts to mining, water from the mine site would be treated at the PWTP and discharged at NPDES Outfalls 002 or 005 (Figure 2.1-1). During any short-term halts to mining, water from the mine would be treated at the PWTP and discharged at Outfalls 002 or 005 (Figure 2.1-1.) or to the pit. The lower portion of the open pit would gradually fill with water to an elevation of 7,030 feet in an estimated 30 years for the Phase 7 pit and 70 years for the larger Phase 8 pit. The open pit would naturally collect surface run-off and groundwater. In addition to the natural water collected, the open pit would be used as a storage facility for the management of poor quality water collected at the WRSFs. This water would be piped from the WRSFs to a lime treatment plant prior to discharge to the pit to maintain neutral, moderate water quality within the open pit lake. Initial drainage water from the TSF would also be pumped to the pit lake. More details of these wastewater flows to the open pit are described below.

The water level in the open pit would rise to an elevation of approximately 7,030 feet where the level would be maintained through pumping as required to prevent the water from entering a historical adit (sealed) at approximately 7,040 feet. Water pumped from the pit would be treated either in a long-term water treatment facility or a modification of the existing PWTP to meet the NPDES limits for Outfall 005 (Salmon River). This treated water would be piped to Outfall 005.

The water management system includes run-off diversions, culverts, WRSF and TSF seepage collection facilities, sediment traps and run-off collection ponds, pump stations, pipelines, and associated electric power lines. These facilities would be decommissioned in phases as they were no longer needed during the reclamation program. The fate of the Buckskin and Pat Hughes sedimentation ponds would be decided based on water quality monitoring/effectiveness of the groundwater cutoff walls (see below).

Industrial water supply facilities including the Salmon River intake and piping system, and the Cherry Creek pump stations would be retained for use in long-term water management. Surface pipelines that are no longer required would be removed, and buried pipelines would be closed and left in place. As roads and other disturbed areas are reclaimed, ditches, sediment traps, ponds, and culverts would be removed and their surface disturbance reclaimed. Sediment ponds that are not required for long-term water management would be breached, recontoured, stabilized, and seeded.

Permanent diversion ditches would be fitted to the margins of the WRSFs to channel run-off around the WRSFs. The WRSFs would be recontoured to drain to their margins and to avoid ponding on their surfaces. Bruno Creek would be re-established across the reclaimed TSF. All permanent diversion ditches would be protected from erosion with riprap, gabions, vegetation or other means selected to ensure stability at the peak flow velocity for the ditch designs.

Pioneer (2010b) has provided location and design information for the WRSF diversion ditches post-reclamation (Section 2.1.4.6). The design for these ditches is the 500 year/24 hour storm, except for the Buckskin slope ditch which would be designed for the 100 year/24 hour storm (but the Buckskin Slope floodplain would manage the 500 year/24 hour storm). In general, for the Buckskin facility, a channel with a trapezoidal cross-section would be constructed along the north margin of the 8,100 foot bench (Buckskin perimeter channel) to carry run-off collected from the top of the bench and run-on from the adjacent natural slopes. The channel would be

6 feet wide on the bottom with 2H:1V side slopes and 3 to 6 feet deep. It would be lined with a 30 mil polyethylene membrane covered by 1 foot of earth. In flat reaches (less than 1 % slope) the channel surface would be stabilized with grass. For channel reaches with moderate gradients (1 to 6 %) the channel surface would be stabilized with grass and then covered with UV-stabilized, polypropylene reinforcement mat (North American Green P550 or equivalent). In high gradient reaches (> 6 % slope), the channel surface would be stabilized with 1 foot of earth covered by 2 feet of riprap cemented together with grout. The perimeter channel would normally discharge to the Buckskin drainage downstream of the dump. It would also be possible to connect the perimeter channel with the pit channel described below.

In the approximate center of the upper Buckskin bench another trapezoidal channel (Buckskin cross swale channel) would be constructed with the same design characteristics as the perimeter channel. The objective of this channel would be to convey stormwater away from the crest of the reclaimed upper bench slope to the perimeter channel. The Buckskin pit channel would drain to the open pit via a channel built down the former haul road from the Buckskin upper bench. This channel would have the same design characteristics as the perimeter channel but would be stabilized with cemented riprap through its entire length due to its gradient.

Run-on and run-off for the Pat Hughes WRSF would be handled in similar fashion to that described for the Buckskin WRSF. A perimeter channel having the same design characteristics as the Buckskin perimeter channel would be built along the east margin of the 7,250 foot bench. The design cross section would range from 6 to 12 feet in width on the bottom with 2H:1V side slopes and depths ranging from 5 to 9 feet. This channel would discharge to the Pat Hughes natural channel location at the bottom toe of the WRSF. A Pat Hughes upper cross swale channel would be installed back from and parallel to the southern edge of the 7,250 foot bench to convey stormwater away from the crest of the reclaimed Pat Hughes WRSF. This channel would have similar design characteristics to the above described channels and would have a trapezoidal cross section with a 3 foot wide bottom, 2H:1V side slopes, and 2 foot depth.

Water draining from the Pat Hughes WRSF would be collected in the pond downgradient from the facility and transferred through the Thompson Creek pipeline to the Cherry Creek booster pump station. From there it would be pumped uphill to a lime treatment plant adjacent to the open pit. Treated water from the plant would be discharged to the open pit lake. To ensure maximum collection of Pat Hughes facility seepage water, three groundwater cutoff walls (only one under Alternative M1), keyed into bedrock, would be constructed to limit groundwater discharge along Pat Hughes Creek and protect water quality in Thompson Creek.

Water draining from the Buckskin WRSF would be handled in similar manner to the Pat Hughes WRSF, with the exception that water from the Buckskin sedimentation pond may be discharged to Thompson Creek through NPDES Outfall 001 when flow in Thompson Creek exceeds 7 cfs. This practice would continue long term in compliance with all NPDES permit terms. In the event that Buckskin WRSF drainage water quality degrades to a level where seasonal discharge to Thompson Creek is not feasible, all drainage would be collected and routed through the Thompson Creek pipeline similar to the Pat Hughes WRSF. To protect groundwater quality downgradient from the Buckskin WRSF, one groundwater cutoff wall, keyed into bedrock, would be installed within the artesian groundwater zone at the base of the facility.

Flow from Bruno Creek would be routed in a channel constructed across the reclaimed TSF to a spillway in the southwest corner of the impoundment. The channel would have a trapezoidal cross section with a 6 foot wide bottom, 2H:1V side slopes, and 3 foot depth. The channel would have the capacity to pass approximately 230 cfs at bank-full conditions, which is greater than the 500 year/24 hour flood from the Bruno Creek watershed upstream of the TSF embankment. The channel would be lined with a polyethylene membrane liner and covered with 6 inches of earth and 12 to 18 inches of 1 foot median size riprap. The riprap is designed to withstand flow velocities of up to 10 cubic feet per second whereas the flow velocity in the channel at bank-full conditions is estimated to be less than 7 cubic feet per second.

The spillway channel would be excavated through native rock. The Bruno Creek channel through the impoundment would be routed to the spillway. Under normal conditions the water in the channel would flow unimpeded across the reclaimed surface of the TSF impoundment, i.e., the spillway would be designed to pass a maximum of 15 cfs of flow with no restrictions. Higher flows would be temporarily impounded to control flows through the spillway. The impoundment would have the capacity to temporarily store all the water collected during the probable maximum precipitation with freeboard.

The spillway would have a riprap-lined channel leading to a riprap-lined outlet channel. The outlet channel would lead to a natural drainage downhill from the TSF embankment into the Bruno Creek channel downstream of the TSF. This drainage would be protected from erosion under maximum flow by construction of an engineered channel. The engineered channel would have a trapezoidal cross section, 4 foot bottom width, 2H:1V side slopes, and minimum depth of 3 feet. The channel would be lined with a 2 foot thick blanket of 1 foot median size riprap.

Water draining from the toe drain system of the TSF embankment would continue to be collected in the SRD and downgradient pump-back wells for the long term. Upon initial TSF decommissioning, water flowing to the SRD would be pumped to the open pit to facilitate rapid flooding and submergence of the exposed mineralized intrusive rock. In addition, accumulated tailings water in the impoundment at initial decommissioning would also be pumped to the open pit in advance of reclamation of the tailings solids in the impoundment area. In the long term, water collected in the SRD impoundment and downgradient pump-back wells would be pumped to either a long-term water treatment facility or modify the existing PWTP. Treated water from this plant would meet the NPDES limits for Outfall 005 (Salmon River) and would be piped to this outfall for discharge.

Post-reclamation Environmental Monitoring

Post-reclamation monitoring would continue for water quality, geotechnical stability, revegetation success, and achievement of reclamation goals and objectives. The post-reclamation monitoring timeline differs between Alternatives M1 and M2 (Alternative M3 is the same as Alternative M2) (Table 2.1-3. and Table 2.1-6.), but under all alternatives the initial plans call for three monitoring periods – initial, interim, and post-reclamation – with the duration of each period being 5 years. However, adaptive management would be utilized to adjust these periods based upon the attainment of post-reclamation land use objectives.

The initial monitoring period would begin upon cessation of mining (molybdenum production). During Years 1 to 5 the comprehensive environmental monitoring program conducted during mining would continue, and all reclamation (except that completed concurrent with mining) would be completed. Monitoring of revegetation at Year 5 would determine if successful ground cover (e.g., 25 to 30 %) was established. If not, additional seed and/or soil amendments would be applied and monitored for success. During the interim monitoring period (Years 6 to 10) sediment-related water quality would be stabilizing and vegetation would become established. Water quality monitoring for sediment, monitoring of revegetation, and monitoring WRSF geotechnical stability would end, assuming slope stability and water quality objectives have been achieved. By the start of the post-reclamation monitoring period (Years 11 to 15) all reclamation would be completed and sediment-related effects to water quality are expected to have stabilized. However, adaptive management provides the opportunity to adjust monitoring periods based on the need to modify or maintain reclamation work in order to achieve reclamation goals. Adaptive management related to groundwater is described further in Section 4.21.

2.1.2. Alternative M1 – No Action

Alternative M1 is TCMC completing mining operations per the approved MPO; i.e., through Phase 7. The MPO was approved in 1980, but has since been modified many times during the last 30 years including a major modification in 1999 requiring a second EIS. The approved plan includes the reclamation plan (i.e., the Consolidated Reclamation Plan as modified). As described previously, the Water Management Plan is also considered part of Alternative M1 even though such plan has not been approved by the agencies. That is, the no action alternative does not preclude the agencies from administratively accepting a water management plan within the scope of the MPO, approving the associated reclamation costs, or accepting an additional financial guarantee for implementation of the Water Management Plan under Phase 7.

There are previously permitted (1980) areas of waste rock storage on Federal land that will not be used to complete Phase 7 (and would not be used under any of the other MMPO alternatives) (Figure 2.1-3). These areas are available because TCMC extracted more ore and less waste rock than originally planned. Using these areas for Phase 8 would not be economically, environmentally, or technically desirable. TCMC has no plans to use these areas as part of either Phase 7 or Phase 8. Therefore, these previously permitted areas will not be disturbed in Phase 7 and consequently are not analyzed under Alternative M1.[4]

The existing operations (Section 2.1.1.) disturb 2,822.6 acres, mostly owned by TCMC (Table 2.1-2., Figure 2.1-3). The limit of the Phase 7 pit and sustainable ore reached at the end of 2011. Phase 7 ore production (from the base of the pit and entirely within the existing surface disturbance) would be completed by the end of 2016, with much of the reclamation (Section 2.1.1.8.) and post-reclamation monitoring (Table 2.1-3.) being completed 10 to 15 years later. Final surface disturbance would include the addition of waste rock to the WRSFs and tailings to the TSF generated during Phase 7 ore production.

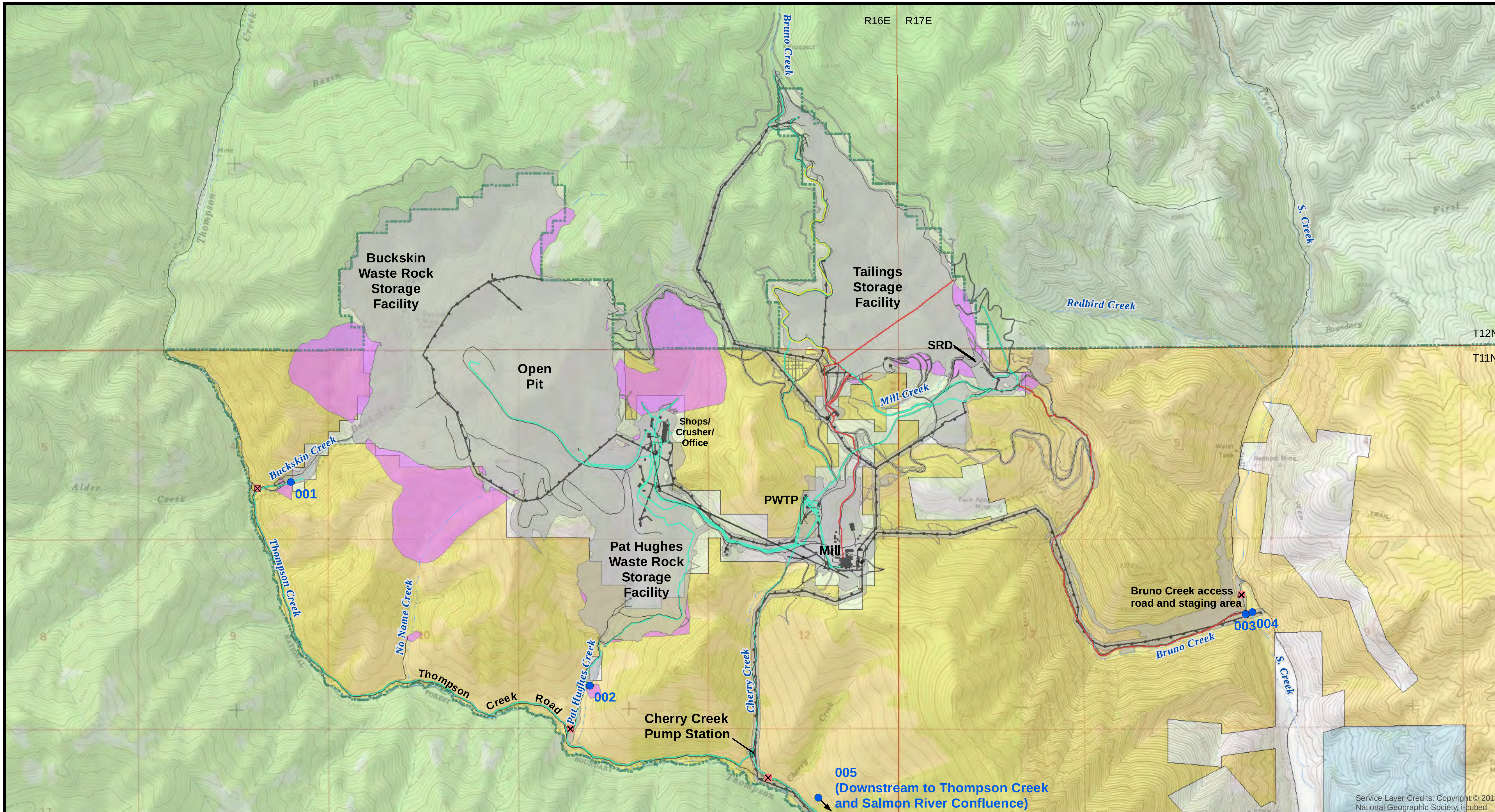
[4] Using these areas would require amendment of the Consolidated Reclamation Plan, as the reclamation of the areas is not described in that plan.

Under Alternative M1 the mine would produce an additional 76 million pounds of molybdenum during Phase 7. The mine produced approximately 24 million pounds of molybdenum in 2011 (relatively high ore grade of 0.128 percent molybdenum). Due to declining ore grade, the annual production would generally decrease to 12 million pounds (ore grade of 0.061 percent molybdenum) in March 2016 at the end of Phase 7. The molybdenum would be produced from approximately 54 million tons of proven and probable ore reserves averaging 0.091 percent molybdenum with a cutoff of 0.03 percent molybdenum. Under Alternative M1 the TSF would contain approximately 235 million tons of tailings with a pre-reclamation embankment elevation of 7,646 feet (7,656 feet post-reclamation).

Active water treatment is not described in the approved reclamation plan for Alternative M1, but would have to be incorporated into the current reclamation plan even if TCMC were to withdraw the proposed MMPO. That is, the approved reclamation plan requires any discharged water to meet all applicable laws and regulations, and active water treatment would be required. Therefore, active water treatment (described in Section 2.1.3.6.) is implicitly required.

Table 2.1-2. Existing surface disturbance (acres), Alternative M1.

Facility	TCMC	BLM	Forest Service
Buckskin WRSF	573.4	1.4	41.9
Pat Hughes WRSF	293.1	81.4	0.0
Open pit	491.2	0.0	0.0
TSF (estimated)	463.6	3.3	7.6
Operational area – other	253.5	122.6	1.1
Roads	38.4	73.9	44.3
Power line	62.5	138.4	83.6
Pipeline	14.5	29.3	2.8
Fiber optic cable	0.3	0.6	0.0
TOTAL	**2190.5**	**450.9**	**181.3**
	2,822.6		



Selected land, existing mining disturbance from Thompson Creek Mine data, polygons created by Ken Gardner.
Ownership data is at 1:24,000 and created and maintained by the Bureau of Land Management, Idaho State Office, Geographic Sciences.
Topographic background from USGS 7.5' Quadrangles 1:24,000 scale.
Coordinate system UTM Zone 11 NAD 83

Legend

- Existing mining disturbance
- Permitted but undisturbed
- NPDES outfall
- Gate
- Existing mine structures
- Existing power line
- Pyrite pipeline
- Tailings pipeline
- Water pipeline

Land Ownership

- BLM
- Private
- State
- Forest Service

N

1:32,000

0 Miles 1

0 Kilometers 1

No warranty is made by the Bureau of Land Management (BLM) for the use of this data for purposes not intended by the BLM.

Figure 2.1-3
MMPO Alternative M1 - No Action
Thompson Creek Mine EIS

Table 2.1-3. Post-reclamation monitoring, Alternative M1.

Monitoring	Years 1-5	Years 6-10	Years 11-15
Sediment sampling	X		
Aquatic biota and habitat	X	X	X
Surface water quality	X	X	X
Groundwater quality	X	X	X
Receiving stream	X	X	X
TSF area water	X	X	X
TSF geotechnical	X	X	X
TSF revegetation	X	X	
Waste rock geotechnical	X	X	
Waste rock revegetation	X	X	
Other revegetation	X	X	

2.1.3. Alternative M2 – MMPO as Submitted by TCMC

In December 2008 and January 2009 TCMC submitted an MMPO to the BLM, Forest Service, and other cooperating agencies. A revision to the MMPO was submitted in October 2009 (TCMC 2009). The MMPO describes Phase 8 mining (Alternative M2, the proposed action). The differences between this alternative and Alternative M1 are the following:

- The mine life would be 9 years longer;
- A section of power line would be relocated;
- The open pit would be deepened and widened to mine Phase 8 ore;
- The Buckskin and Pat Hughes WRSFs would be expanded and used to store Phase 8 waste rock;
- The TSF embankment would be raised and the TSF impoundment expanded to store the tailings produced from milling Phase 8 ore;
- The long-term water management plan (part of the reclamation plan) would be modified because of the size and configuration of the Phase 8 facilities and the need for water treatment to ensure WQSs are met (Lorax 2012a); and
- Two additional groundwater cutoff walls would be installed in the Pat Hughes drainage.

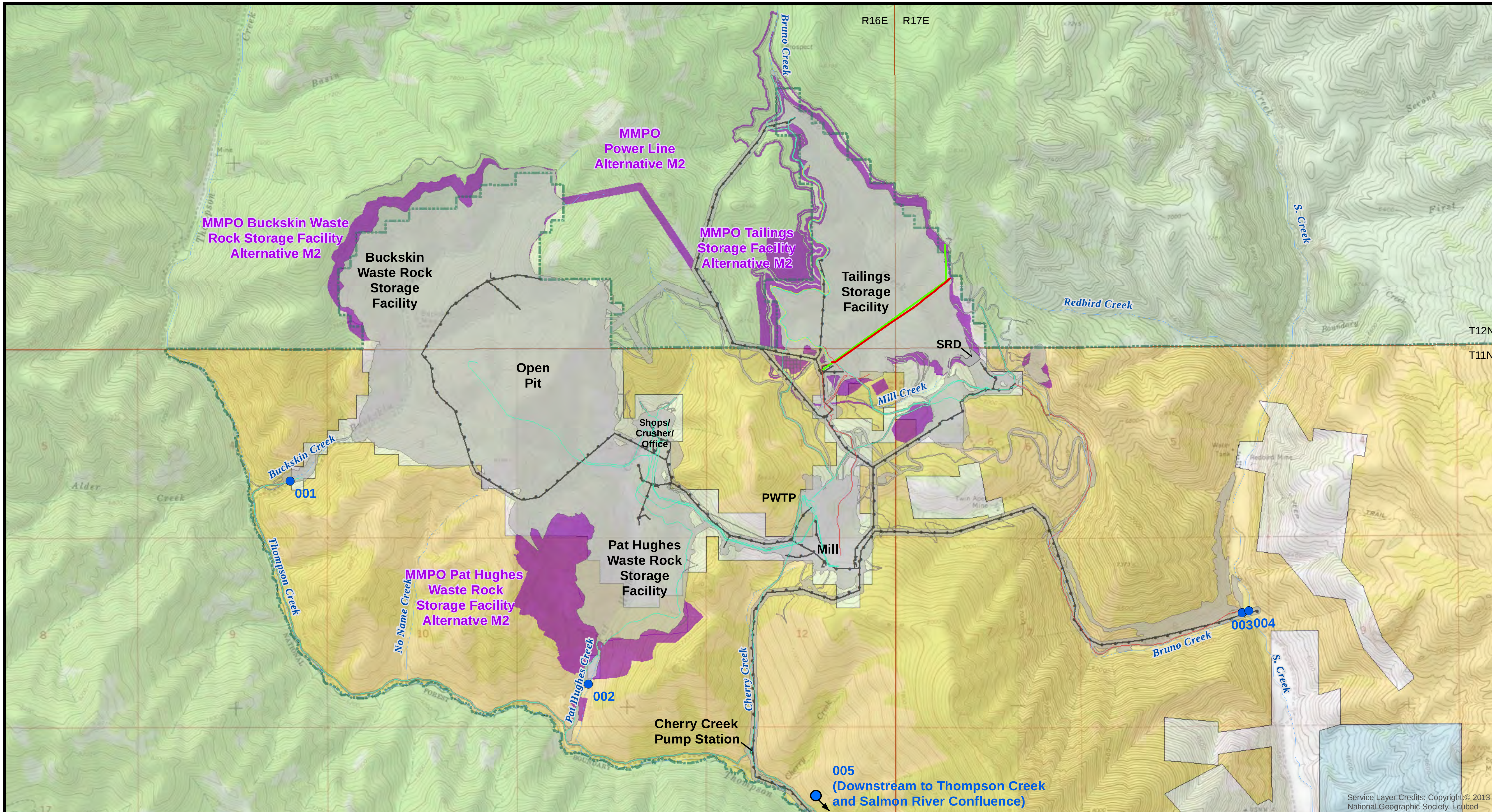
Under Alternative M2 there would be additional surface disturbance on 94.2 acres of TCMC land and 352.5 acres of Federal lands as compared to Alternative M1 (Figure 2.1-4., Table 2.1-4.,

Table 2.1-5). Of this disturbance, 3.36 acres of wetlands and 9,900 linear feet of stream channel designated as WUS would be subject to a 404 permit from the USACE.

Table 2.1-4. Additional disturbance, Alternative M2.

Facility	TCMC Additional (acres)	TCMC Total (acres)	BLM Addl. (acres)	BLM Total (acres)	Forest Service Addl. (acres)	Forest Service Total (acres)
Buckskin WRSF	8.0	581.4	0.0	1.4	54.4	96.4
Pat Hughes WRSF	19.0	312.1	170.9	252.3	0.0	0.0
Open pit	0.0	491.2	0.0	0.0	0.0	0.0
TSF (estimated)	52.2	515.8	8.7	12.0	21.4	29
Operational area – other	12.1	265.6	16.6	139.2	41.7	42.8
Roads	0.0	38.4	0.0	73.9	0.0	44.3
Power line	0.1	62.6	0.0	138.4	21.9	105.5
Pipeline	2.8	17.3	2.1	31.4	14.8	17.6
Fiber optic cable	0.0	0.3	0.0	0.6	0.0	0.0
TOTAL	**94.2**	**2284.7**	**198.3**	**649.2**	**154.2**	**335.6**

Includes Phase 8 mining operations proposed on currently unpermitted and permitted (1980) land



Legend

- Existing mining disturbance
- MMPO areas/Alternative M2
- Existing embankment crest
- Proposed embankment crest
- NPDES outfall
- Existing power line
- Pyrite pipeline
- Tailings pipeline
- Water pipeline

Land Ownership

- BLM
- Private
- State
- Forest Service

Selected land, existing mining disturbance from Thompson Creek Mine data, polygons created by Ken Gardner.
Ownership data is at 1:24,000 and created and maintained by the Bureau of Land Management, Idaho State Office, Geographic Sciences.
Topographic background from USGS 7.5' Quadrangles 1:24,000 scale.
Coordinate system UTM Zone 11 NAD 83

N

1:32,000

0 — 1 Miles

0 — 1 Kilometers

No warranty is made by the Bureau of Land Management (BLM) for the use of this data for purposes not intended by the BLM.

Figure 2.1-4
MMPO Alternative M2 - MMPO as submitted by TCMC
Thompson Creek Mine EIS

Table 2.1-5. Comparison of final disturbance between Alt. M1 and Alt. M2.

Facility	Alt. M1 TCMC (acres)	Alt. M2 TCMC (acres)	Alt. M1 BLM (acres)	Alt. M2 BLM (acres)	Alt. M1 Forest Service (acres)	Alt. M2 Forest Service (acres)
Buckskin WRSF	573.4	581.4	1.4	1.4	41.9	96.4
Pat Hughes WRSF	293.1	312.1	81.4	252.3	0.0	0.0
Open pit	491.2	491.2	0.0	0.0	0.0	0.0
TSF	463.6	515.8	3.3	12.0	7.6	29
Operational area – other	253.5	265.6	122.6	139.2	1.1	42.8
Roads	38.4	38.4	73.9	73.9	44.3	44.3
Power line	62.5	62.6	138.4	138.4	83.6	105.5
Pipeline	14.5	17.3	31.4	31.4	2.8	17.6
Fiber optic cable	0.3	0.3	0.6	0.6	0.0	0.0
TOTAL	**2190.5**	**2284.7**	**453**	**649.2**	**181.3**	**335.6**

2.1.3.1. Transportation, Access and Power

Under Alternative M2, 4,900 feet of an existing 24.9 kV power line on NFS land ("Phase 8 power line," Figure 2.1-4.) would be relocated on NFS land in the area northeast of the open pit. The relocation would be necessary because of expansion of the open pit. The relocated utility corridor (200 feet wide, 21.9 acres of surface disturbance) would be on a ridge between Bruno Creek and the head of Pat Hughes Creek, and would pass through the upper portion of the Buckskin drainage (basin) (Figure 2.1-4). The corridor would be periodically cleared of trees for fire protection, and a vehicle access route would be maintained within the corridor. The power line would require maintenance including the possible replacement of equipment on an as-needed basis during mining. The total widths of all mine transportation and utility corridors within the MMPO area would be the following: power lines (200 feet), roads (12 to 70 feet), fiber optic lines (30 feet), pipelines (40 feet).

2.1.3.2. Mining Operations

Under Alternative M2 molybdenum production would continue to 2025 (instead of 2016 under Alternative M1), with most reclamation completed 10 to 15 years later. The mine would produce an additional 131 million pounds of molybdenum as compared to Alternative M1. The molybdenum would be produced from approximately 143 million tons of proven and probable ore reserves averaging 0.073 percent molybdenum with a cutoff of 0.03 percent molybdenum. The MMPO would use the same facilities and transportation/access system as under Alternative M1 (Section 2.1.1).

The Phase 8 mining would occur in two subphases – Phase 8 West and Phase 8 East – for which there are detailed designs[5]. The Phase 8 West overburden removal began in 2012[6] (on TCMC land for which no Federal approval was required) at the end of the Phase 7 overburden removal, and would be completed in 2025; the bulk of the overburden would be removed by 2017 but 7 percent would be removed between 2018 and 2025. The Phase 7 ore removal would continue to approximately 2016 when the Phase 7 ore would be depleted. At that time, the Phase 8 West ore would be exposed. The mill would use the Phase 8 West ore from approximately 2016 until the Phase 8 West ore would be depleted in approximately 2025. The approximately 144 million tons of the Phase 8 West waste rock would be placed in the existing Buckskin and Pat Hughes WRSFs (Figure 2.1-4). The width of the overall slice of the Phase 8 West overburden that would be removed would vary from 500 feet at the southern end to 1,000 feet at the northern end, with an approximate height of 1,600 feet. Ore production from the Phase 8 West expansion would be approximately 68 million tons. The Phase 8 West pit expansion would be entirely on TCMC land.

The Phase 8 East overburden removal would begin 1 year after the start of the Phase 8 West overburden removal, and would progress concurrently with the Phase 8 West expansion until the Phase 8 East overburden removal was completed in 2022. The Phase 8 East waste rock would be placed in the existing Buckskin and Pat Hughes WRSFs. The overall slice of the Phase 8 East overburden that would be removed would be approximately 250 feet in width and 2,100 feet in height. Ore production from the Phase 8 East expansion would be approximately 31 million tons. The mill would use the Phase 8 East ore from 2014 when the ore would be first exposed to 2022 when the ore would be depleted. The Phase 8 East pit expansion would be entirely on TCMC land. The base of the pit under Alternative M2 would be at an elevation of 6,100 feet.

2.1.3.3. Waste Rock Storage Facilities

Under Alternative M2 263.5 million tons of waste rock would be removed and stored in the Buckskin (upper Buckskin) (107.7 million tons) and Pat Hughes (lower Pat Hughes) (155.8 million tons) WRSFs (Figure 2.1-4). These areas were selected for haul road accessibility (e.g., distance and gradient), low mineral potential, and geotechnical requirements. The expansion of the WRSFs would occur on both private and Federal land (Table 2.1-3). The Pat Hughes sediment control pond (sedimentation pond) would be relocated to the base of the final toe of the Pat Hughes WRSF.

2.1.3.4. Mill and Tailings Operations

Milling the Phase 8 East and Phase 8 West ore would require additional tailings storage capacity, which would be accomplished by raising and partially re-aligning the TSF embankment crest compared to that at the end of Phase 7 (Figure 2.1-3., Figure 2.1-4). The embankment is constructed of sand deposited by the header pipeline along the length of the crest of the

[5] The analysis of Alternative M2 is of full Phase 8 development and is not dependent on the currently proposed subphases of Phase 8 development.

[6] TCMC suspended Phase 8 overburden removal in October 2012 due to depressed molybdenum prices and the need to maximize cash earnings for TCMC's parent company. However, TCMC intends to restart the overburden removal when molybdenum prices increase (TCMC 2012a). Therefore, the timing of completion of the Phase 8 components (and their effects) could be delayed. Such is just one example of how the projected dates of mining activity listed herein are necessarily approximate.

embankment (Section 2.1.1.5). In this case, to address a topographic low section in the eastern abutment upgradient of the existing crest, the pipeline would be angled to the northeast to build a section of the crest on top of the eastern abutment, filling in the topographic low section. The angled crest would be approximately 1,000 feet long, 200 feet wide, and up to 100 feet above the original ground surface (Golder 2012). This modification is expected to be approved by the IDWR prior to the completion of the EIS, and this modification was also evaluated by the agencies as part preparing this DEIS. Therefore, this modification is considered to be part of Alternative M2 and Alternative M3. The modification would increase the capacity of the TSF by 100 to 125 million tons, which would provide adequate space for the tailings produced during Phase 8. The TSF is permitted to store approximately 240 million tons of tailings through the end of Phase 7 (Alternative M1), and approximately 335 million tons at the end of Phase 8 (Alternative M2).

The TSF embankment would be raised to 7,742 feet before reclamation (from 7,646 feet at the end of Phase 7) to provide sufficient storage in the upgradient impoundment (filling the Bruno drainage). The embankment would continue to be constructed of sand from cycloned tailings deposited by the header pipeline (Golder 2008**)**. To reduce the downgradient surface disturbance and the amount of sand required for embankment construction, the downgradient embankment slope would be increased from 3H:1V to 2.75H:1V. The elevation of the rock toe embankment underlying the lower face of the embankment would be raised to 6,960 feet.

2.1.3.5. Environmental Controls and Monitoring

TCMC would utilize the same environmental controls and monitoring under Alternative M2 as would be used under Alternative M1 (Section 2.1.1). TCMC has a BMP Plan (TCMC 2010a) and SPCC Plan (ARCADIS 2010) that superseded its initial pollution prevention plan. The goal of these plans is to prevent or minimize the generation and the potential for release of pollutants from the mine site. The BMP Plan includes the types of monitoring proposed to track the effectiveness of the various environmental protection measures. Additionally, an Adaptive Groundwater Management Plan (Lorax 2012b) was developed that includes the water management strategies and mitigation necessary to minimize the MMPO effects to water resources.

2.1.3.6. Reclamation

Reclamation would generally be the same for Alternative M2 (Phase 8) as it would be for Alternative M1 (Phase 7) (Section 2.1.1.8.), except as summarized in this section. Note that the active water treatment described in this section is not described in the approved reclamation plan for Alternative M1, but would have to be incorporated into the current reclamation plan even if TCMC were to withdraw the proposed MMPO. That is, the approved reclamation plan requires any discharged water to meet all applicable laws and regulations, and active water treatment would be required. Therefore, active water treatment is implicitly required.

At the end of Phase 8, the Buckskin WRSF would consist of an upper and middle bench between 8,200 to 7,600 feet and a lower bench at 7,600 to 6,650 feet elevation. The face (slope) between the upper benches would be graded to 2.5H:1V. All of the surface of the facility would be Type 1 waste rock (except the lower bench face), and there would be no cells of Type 2 waste rock within 150 feet of the surface. A portion of the surface of the upper bench would be capped with 1 foot of growth material and revegetated. The rest of the upper bench and all of the middle bench would be graded (no soil cap), scarified (ripped), and revegetated, except the slope below the other middle bench which drains directly to the open pit would remain at the angle of repose (~ 1.5H:1V) and would be capped with 3 feet of durable Type 1 rock (Doughty 2013).

At the end of Phase 8, the Pat Hughes WRSF would have four benches at 7,850 to 7,350 feet; 7,350 to 7,000 feet; 7,000 to 6,750 feet; and 6,750 to 6,250 feet elevation. The highest bench (7,850 feet) would be comprised of all Type 1 volcanic materials and would be largely removed at final reclamation and used for cover material. The slope between the 7,350 and 7,000 foot benches would be recontoured to a slope of 3H:1V as would the slope between the 7,000 and 6,750 foot benches. The slope downhill from the 6,750 foot bench would remain at angle of repose. All slopes would be covered with durable, non-volcanic, Type 1 waste rock.

The final configurations of the TSF impoundment, embankment, and spillway are described in the Phase 8 Tailings Impoundment Reclamation Plan and Cost Estimate (WMC 2008). The reclamation of the TSF under Alternative M2 would be the same as that under Alternative M1 (Section 2.1.1.8.), except the footprint of the facility would be slightly larger, the final reclaimed height of the embankment would be 7,752 feet instead of 7,656 feet, and the spillway would be constructed through native rock at an elevation of 7,722 feet.

All modifications to the long-term water management plan would be consistent with the existing NPDES permit, which sets limits for the allowable discharges of all constituents of potential concern. The permit would be renewed over time pursuant to 40 CFR 122, and the limits would be expected to change in the long term.

As part of Alternative M2, TCMC would either construct a long-term water treatment facility or modify the existing process water treatment plant (PWTP). TCMC would also, on a long-term basis, collect water from the WRSFs and TSF and route this water to the open pit and eventually to the water treatment facility. These inputs would inundate the pit at an accelerated rate to an elevation of 7,030 feet to minimize oxidation of the pit walls. The water level in the pit would be maintained at this elevation to avoid the potential of water leaving the southeast end of the pit via an exploration adit (sealed), and to maintain a cone of depression, i.e., keep groundwater flowing into the pit to minimize the potential for mine-affected waters to affect off-site groundwater. The cutoff walls, which would be installed during operations, would remain in place throughout reclamation.

The sedimentation ponds below the WRSFs and the SRD and pump-back sump/station below the TSF would be maintained as permanent features to collect drainage from these facilities, which would be pumped through pipelines to the open pit, and eventually to the water treatment plant. The treated water would then be discharged via pipelines to either Outfall 002 at the confluence of Pat Hughes Creek and Thompson Creek, or Outfall 005 near the confluence of Thompson Creek and the Salmon River (Figure 2.1-4). The difference under Alternative M2 in the post-reclamation monitoring as compared to that under Alternative M1 is that some monitoring could continue for longer durations (Table 2.1-6).

Table 2.1-6. Post-reclamation monitoring, Alternative M2.

Monitoring[1]	Years
Sediment sampling	5+
Aquatic biota and habitat	16+
Surface water quality	16+
Groundwater quality	16+
Receiving stream	16+
TSF water	15+
TSF geotechnical	15+
TSF revegetation	10+
Waste rock geotechnical	10+
Waste rock revegetation	10+
Other revegetation	10+

[1] beyond that of Alternative M1

2.1.4. Alternative M3 – No Name Waste Rock Storage Facility

This alternative is similar to Alternative M2, except that the No Name WRSF would contain approximately 115 million tons of waste rock on 232.9 acres of currently undisturbed BLM land (Photo 2.1-19., Photo 2.1-20). The WRSF would include a downgradient sedimentation pond. The location is economically favorable for waste rock storage due to the proximity of the No Name drainage to the open pit and a level to downgradient loaded haul. Accordingly, under Alternative M3, less waste rock would be placed in the Buckskin and possibly the Pat Hughes WRSFs, and these WRSFs would have smaller overall footprints than under Alternative M2 (Figure 2.1-5., Table 2.1-7). Under Alternative M3, compared to Alternative M2, there would be an additional 0.02 acres of disturbance in wetlands and an additional 5,563 linear feet of designated WUS subject to a 404 permit from the USACE.

Table 2.1-7. Comparison of (final) disturbance between Alt. M3 and Alt. M2.

Facility	Alt. M2 TCMC (acres)	Alt. M3 TCMC (acres)	Alt. M2 BLM (acres)	Alt. M3 BLM (acres)	Alt. M2 Forest Service (acres)	Alt. M3 Forest Service (acres)
No Name WRSF	0.0	0.6	0.0	232.9	0.0	0.0
Buckskin WRSF	581.4	573.4	1.4	1.4	96.4	42.4
Pat Hughes WRSF	312.1	299.0	252.3	237.3	0.0	0.0
Open pit	491.2	491.2	0.0	0.0	0.0	0.0
TSF (estimated)	515.8	515.8	12.0	12.0	29	29
Operational area – other	265.6	265.6	139.2	139.2	42.8	42.8
Roads	38.4	38.4	73.9	73.9	44.3	44.3
Power line	62.6	62.6	138.4	138.4	105.5	105.5
Pipeline	17.3	17.3	31.4	31.4	17.6	17.6
TOTAL	**2284.4**	**2263.9**	**648.6**	**866.5**	**335.6**	**281.6**

Includes mining operations proposed on currently unpermitted and permitted (permitted in 1980) land.

2.1.5. MMPO Alternatives Comparison/Exposure to Risk

Each alternative relies on engineered systems to contain the waste rock and tailings, and to manage the water that contacts the mine in perpetuity.[7] In particular, the post-reclamation water management would be required to assure that water leaving the mine would meet the current WQSs. The waste rock and tailings storage facilities would safely withstand the maximum credible earthquake under all of the MMPO alternatives (Section 4.2.1). However, the water management system consists of a series of collection points, pipelines, pump stations, and treatment plants. These facilities, during operations of 100s years or more, could be subject to equipment failures (e.g., pipeline rupture), human error (e.g., a valve improperly opened), or extended power outages (e.g., earthquake damages to the regional electricity grid). Such problems may be inevitable over the course of 100s of years or more, and could result in the release of untreated water to the environment.

It is not possible to predict how such problems would occur or what the consequences would be, as such would depend on what water was released, where and how much water was released, and

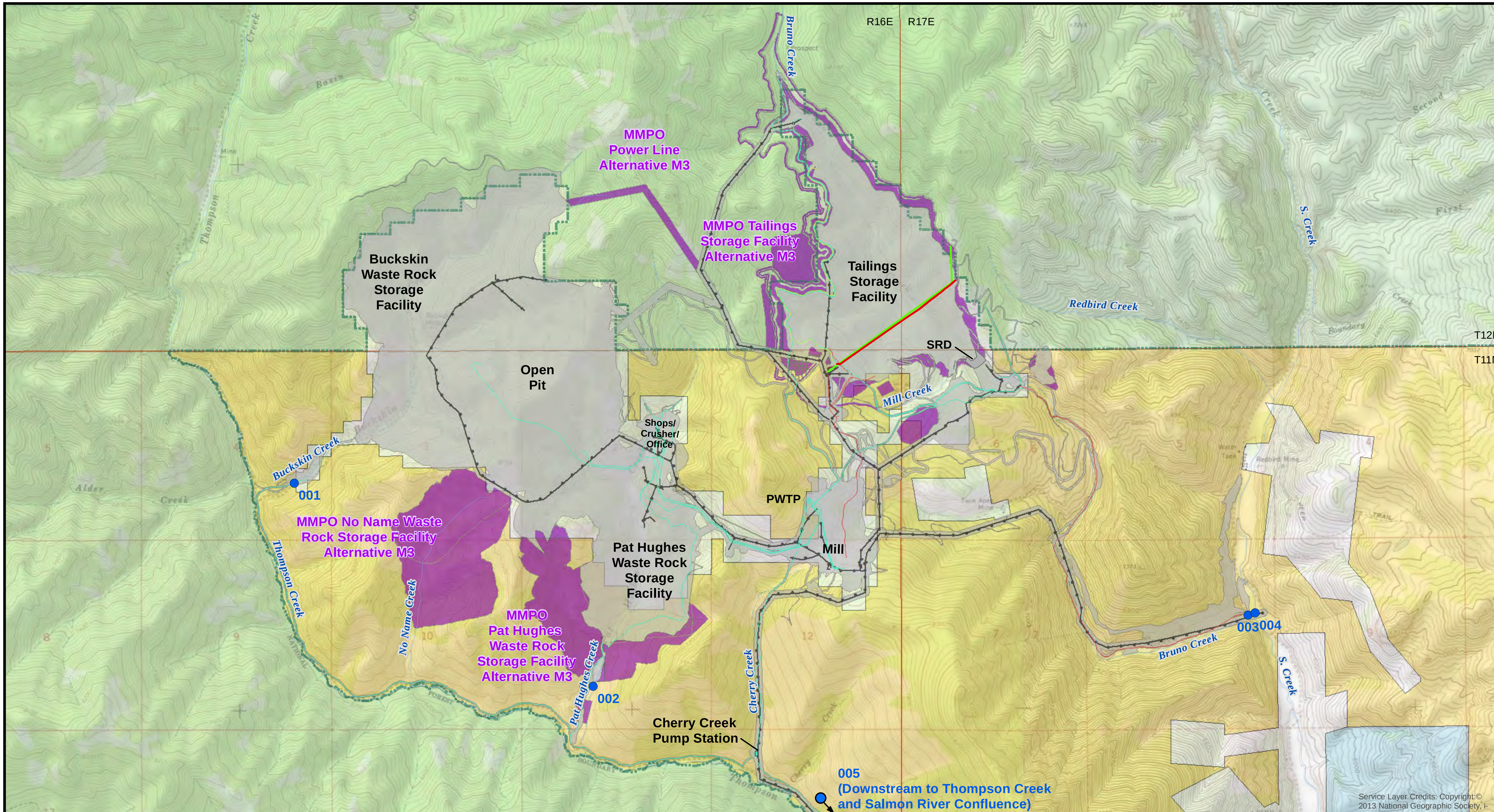
[7] very long, indefinite time period of 100s of years or more, e.g., the drainage from the waste rock and tailings storage facilities could not have elevated concentrations of metals forever – there are finite amounts of metals available for preferential dissolution due to the relatively fine particle sizes (increased surface areas) in the waste rock and tailings storage facilities

the duration and timing of the release. However, in the worst case, the release of untreated water could cause exceedances of acute WQSs in sections of Thompson Creek, S. Creek, and Bruno Creek. There would be no material difference in such risk (probability and consequence) between Alternative M1 and Alternative M2 for which water with similar chemistry would be treated by essentially the same facilities. In the case of Alternative M3, the risk would be slightly greater due to the addition of a new source of water to be treated (new WRSF) and the additional water collection and transport facilities to connect the new source to the main facilities. However, the primary effect would be to Thompson Creek, which could also be affected by the release of untreated water under Alternative M1 or Alternative M2 (the Buckskin, No Name, and Pat Hughes tributaries to Thompson Creek would be part of the mine water management system under the respective MMPO alternatives, and not natural streams).

The environmental effects of the MMPO alternatives are described in detail in Chapter 4; Section4.1 includes the definition of the magnitudes and durations of effects specific to each resource. The key environmental effects of the MMPO alternatives are compared below (Table 2.1-8).

Photo 2.1-19. No Name drainage, view to southwest.

Photo 2.1-20. No Name drainage, view to northwest.



Legend

- Existing mining disturbance
- MMPO areas/Alternative M3
- Existing embankment crest
- Proposed embankment crest
- NPDES outfall
- Existing power line
- Pyrite pipeline
- Tailings pipeline
- Water pipeline
- BLM
- Private
- State
- Forest Service

Selected land, existing mining disturbance from Thompson Creek Mine data, polygons created by Ken Gardner.
Alternative data from Thompson Creek Mine drawing files and converted to shapefiles.
Ownership data is at 1:24,000 and created and maintaned by the Bureau of Land Management, Idaho State Office, Geographic Sciences.
Topographic background from USGS 7.5' Quadrangles 1:24,000 scale.
Coordinate system UTM Zone 11 NAD 83

N
1:32,000
0 Miles 1
0 Kilometers 1

No warranty is made by the Bureau of Land Management (BLM) for the use of this data for purposes not intended by the BLM.

Figure 2.1-5
MMPO Alternative M3 - No Name WRSF
Thompson Creek Mine EIS

Table 2.1-8. Effects comparison, MMPO alternatives.

Indicator	Alternative M1	Alternative M2	Alternative M3
GEOLOGIC RESOURCES AND GEOTECHNICAL ISSUES			
Molybdenum production	Increase in world molybdenum production of 73 million pounds (short-term, moderate effect)	Increase in world molybdenum production of 204 million pounds (short-term, moderate effect)	Same as Alternative M2
Molybdenum reserves	Decrease in world molybdenum reserves by 73 million pounds (short-term, minor effect)	Decrease in world molybdenum reserves by 204 million pounds (short-term, minor effect)	Same as Alternative M2
Paleontological sites	No change to existing conditions	No change to existing conditions	No change to existing conditions
SOIL RESOURCES			
Soil productivity	No change to existing conditions	336.0 acres of permanent effects (negligible to moderate) and 112.1 acres of temporary effects (negligible to moderate)	477.6 acres of permanent effects (negligible to moderate) and 112.1 acres of temporary effects (negligible to moderate)
VEGETATION, FOREST RESOURCES, AND INVASIVE AND NON-NATIVE PLANTS			
Area of special status[1] plant habitat disturbed	No change to existing conditions	448.1 acres of suitable sensitive plant habitat disturbed (no records of occurrence); may affect individual plants but would not cause a trend towards listing	589.7 acres of suitable sensitive plant habitat disturbed (no records of occurrence); may affect individual plants but would not cause a trend towards listing
Area of forest habitat disturbed	No change to existing conditions	364.1 acres forest habitat (2,357 mbf)[2] harvested (long-term, moderate effect)	459.7 acres forest habitat (2,988 mbf) harvested (long-term, moderate effect)

Indicator	Alternative M1	Alternative M2	Alternative M3
Change in carbon sequestration	No change to existing conditions	No effect on existing conditions	No change to existing conditions
RANGE RESOURCES			
Change in AUMs[3]	No change to existing conditions	4 % decrease (long-term, minor effect)	6 % decrease (long-term, minor effect)
WATER RESOURCES			
Water quality - turbidity, concentrations of suspended sediment, and COCs	During mining/after cutoff wall installation: decreased concentrations of most constituents in Thompson Creek; increased concentrations of some constituents over time would still meet WQSs[4] with the exception of copper for the upper estimate (long-term, moderate effect); negligible effect to Thompson Creek, Bruno Creek, and S. Creek from sediment delivery After mining: increased concentrations of constituents in S. Creek, but would be within WQSs except for cadmium for the upper estimates; discharge from Outfall 005 to the Salmon River would need to meet all NPDES permit limits	During mining/after cutoff wall installation: decreased concentrations of most constituents in Thompson Creek; increased concentrations of some constituents over time would meet WQSs with the exception of copper for the upper estimate (long-term, moderate effect); negligible effect to Thompson Creek, Bruno Creek, and S. Creek from sediment delivery After mining: increased concentrations of constituents in S. Creek; would be within WQSs except for cadmium for the upper estimates; discharge from Outfall 005 to the Salmon River would need to meet all NPDES permit limits	Same as Alternative M2

Indicator	Alternative M1	Alternative M2	Alternative M3
Water quantity - discharge	During mining/after cutoff wall installation: negligible or minor reduction in flow in Thompson Creek After mining: negligible effects to flow in Bruno Creek and S. Creek; negligible to minor effects to flow in Salmon River (depending on flow) due to cessation of removal of water for mine processes	During mining: negligible to minor reduction in flow in Thompson Creek and S. Creek from cutoff walls After mining: negligible effects to flow in Bruno Creek and S. Creek; negligible to minor effects to flow in Salmon River (depending on flow) due to cessation of removal of water for mine processes	Same as Alternative M2
WILDLIFE RESOURCES			
Area of disturbance to high value wildlife habitat	No change to existing conditions	Decrease of 364 acres of suitable or marginally suitable habitat with long-term, negligible to minor effect on sensitive wildlife species; long-term, minor effect on wide-ranging species; short-term, minor effect to winter range; negligible effect on migration	Decrease of 598 acres of suitable or marginally suitable habitat with long-term, negligible to minor effect on sensitive wildlife species; long-term, minor effect on wide-ranging species; short-term, minor effect to winter range; negligible effect on migration
Water quantity/quality effects on wildlife	Negligible effects from changes to water quantity; negligible effect to birds from ingestion of pit water	Negligible effects from changes to water quality; negligible effects to birds from ingestion of pit water	Same as Alternative M2
Noise disturbance	No change to existing conditions	Negligible (temporary) effect during construction of WRSFs	Same as Alternative M2
Wildlife mortality from traffic (road kill)	No change to existing conditions	No effect on existing road mortality, but 9 additional years of effect of mine traffic on road mortality	Same as Alternative M2

Indicator	Alternative M1	Alternative M2	Alternative M3
FISH AND AQUATIC RESOURCES			
Aquatic habitat	Negligible effect to existing conditions	Negligible effect to aquatic habitat in Salmon River; long-term, moderate effect to aquatic habitat in Thompson Creek and S. Creek	Same as Alternative M2
Fish populations	Negligible effect to existing conditions	Negligible effect to fish populations in Salmon River; long-term, moderate effect to aquatic habitat in Thompson Creek; long-term, minor to moderate effects to fish populations in S. Creek	Same as Alternative M2
Bioaccumulation	Negligible effect to existing conditions	Negligible chance of bioaccumulation of selenium in Thompson Creek	Same as Alternative M2
Macroinvertebrate organisms	Negligible (selenium bioaccumulation) to minor (reduced overall taxa richness) effects on macroinvertebrate organisms	Minor effects to Thompson Creek and S. Creek macroinvertebrate organisms for the best estimates; moderate effects for the upper estimates	Same as Alternative M2
WETLANDS, FLOODPLAINS, AND RIPARIAN AREAS			
Area of wetlands	No change to existing conditions	Fill or burial of 3.36 acres of jurisdictional wetlands (0.43 acre filled by Phase 8, 2.93 acre filled by reclamation); mitigation would result in no net effect	Fill or burial of 3.40 acres of jurisdictional wetlands (0.47 acre filled by Phase 8, 2.93 acre filled by reclamation); mitigation would result in no net effect

Indicator	Alternative M1	Alternative M2	Alternative M3
Length of stream channel	No change to existing conditions	9,900 feet (10 % of the stream channel) of WUS[5] filled (5,502 feet filled by Phase 8, 4,397 feet filled by reclamation); mitigation would result in no net effect	15,505 feet (50 % of the stream channel) of WUS filled (11,108 feet filled by Phase 8, 4,397 feet filled by reclamation); mitigation would result in no net effect
AIR QUALITY, NOISE, AND CLIMATE CHANGE			
Quantities of air pollutants	No change to existing conditions	No effect to existing quantity of air pollutants, but the existing quantity of air pollutants related to the mine would persist for an additional 9 years	Same as Alternative M2
Noise levels	No change to existing conditions	No effect to existing noise levels but the current noise levels related to the mine would persist for another 9 years	Same as Alternative M2
Climate change	No change to existing conditions	No effect to climate change and no effect of climate change to the project	No effect to climate change and no effect of climate change to the project
VISUAL (AESTHETIC) RESOURCES			
VQO and VRM classification	No change to existing conditions	The visual disturbance would meet the current visual classifications at all KOPs[6] except KOP 6; the Pat Hughes WRSF would not meet the VRM Class II objective (long-term, moderate to major effect)	The visual disturbance would meet the current visual classifications at all KOPs except KOP 6 and KOP 2; neither the Pat Hughes nor No Name WRSF would meet the VRM Class II objective (long-term, moderate to major effect)

Indicator	Alternative M1	Alternative M2	Alternative M3
LAND USE AND RECREATION			
Recreational access	No change to existing conditions	Negligible effect to recreational access	Negligible effect to recreational access
ROS[7] classification	No change to existing conditions	No change to ROS classification	No change to ROS classification
Special Designations	No change to existing conditions	Negligible effect to Challis ERMA	Negligible effect to Challis ERMA
SOCIOECONOMIC FACTORS			
Local economy	No change to existing conditions	No change to the current local economy, except the economic effects of the mine on the local economy would extend an additional 9 years	Same as Alternative M2
Molybdenum supply and prices	No change to existing conditions	No effect to current molybdenum supply or prices, except the effects of the mine on supply and prices would extend an additional 9 years	Same as Alternative M2
Financial risk to agencies and taxpayers	Financial risk would be mitigated by financial guarantees	Financial risk would be mitigated by financial guarantees	Financial risk would be mitigated by financial guarantees
TRIBAL TREATY RIGHTS AND INTERESTS			
Area of unoccupied Federal land	No change to existing conditions	< 1 % decrease (minor, permanent, adverse)	Same as Alternative M2
Cultural resource sites	No change to existing conditions	Prehistoric site component (10CR758; not eligible for the NRHP) would be inundated by the expansion of the TSF (long-term, minor, adverse effect)	Same as Alternative M2

Indicator	Alternative M1	Alternative M2	Alternative M3
Effects to natural resources utilized by tribes	Summarized in the sections for the other resources	Summarized in the sections for the other resources	Summarized in the sections for the other resources
CULTURAL RESOURCES			
Cultural resource sites	No change to existing conditions	Prehistoric site component (10CR758; not eligible for the NRHP) would be inundated by the expansion of the TSF (long-term, minor, adverse effect)	No change to existing conditions
TRANSPORTATION, ACCESS, AND PUBLIC SAFETY			
Molybdenum spills due to vehicle accidents	No change to existing conditions	No effect to current threat of spills, but the current potential for spills would extend additional 9 years	Same as Alternative M2
HAZARDOUS MATERIALS AND SOLID WASTE			
Threat of releases of hazardous materials and petroleum products	No change to existing conditions	No effect to threat of releases, but the current potential for releases would extend additional 9 years	Same as Alternative M2

[1] Threatened, Endangered, Proposed, Candidate, and Sensitive (special status)
[2] mbf = 1,000 board feet
[3] animal unit months (AUMs)
[4] water quality standards (WQSs)
[5] waters of the US (WUS)
[6] key observation point (KOP)
[7] recreational opportunity spectrum (ROS)

2.1.6. Monitoring and Mitigation

The Consolidated Environmental Monitoring Program (part of the MMPO) (TCMC 2008a), describes the diverse elements of the environmental monitoring conducted annually by and for TCMC. The purpose of the monitoring program is to document compliance, identify potential noncompliance, and detect favorable and unfavorable trends in environmental conditions. The scope of this program includes ground and surface water sampling, biological monitoring, stream sediment monitoring, water discharge permit compliance monitoring, embankment structural and stability monitoring, mine waste monitoring, action response requirements for water quality management, a formal Quality Assurance Program, and formal reporting procedures for environmental monitoring (TCMC 2008a).

As part of the environmental effects analysis, the agencies have identified certain mitigation measures that could be applied to reduce the environmental effects of the MMPO alternatives:

- An analysis of the compliance of the MMPO alternatives with the requirements of the CWA is provided as Appendix 2A (HDR 2014a). As part of the MMPO and as required by the CWA, TCMC proposes to mitigate effects to wetlands and streams on project lands by conducting wetland mitigation according to the Wetland and Stream Mitigation Plan (HDR 2014b, Appendix 2B). Some of this mitigation would occur on the Broken Wing Ranch, which would require an easement to the USACE ensuring the long-term preservation of the mitigation, e.g., grazing, mowing or otherwise negatively affecting the mitigation area would be prohibited. In such case, the BLM would accept the ranch with such easement. TCMC proposes to mitigate effects to wetlands and streams on TCMC land along S. Creek by establishing 5.5 acres of wetlands and enhancing 9,996 linear feet of S. Creek;

- Establish additional water quality monitoring sites to better monitor background water quality at Redbird and Bruno creeks; and

- Include whitebark pine seedlings in the revegetation of surface disturbance at the highest elevations of the mine.

Adaptive management provides a mechanism for agencies to determine if and when it is necessary or advisable to require adjustment of operating procedures, mitigation measures, and/or monitoring in response to concerns identified through monitoring. Adaptive management approaches are effective in ensuring that permit and authorization requirements are met while providing sufficient flexibility to take preventative or remedial action if environmental concerns arise. Adaptive management, such as those set forth in *National Best Management Practices for Water Quality Management on National Forest System Lands* (USDA 2012, p. 78) would be utilized in conjunction with monitoring periods (Table 2.1-3. and Table 2.1-6.) to ensure reclamation goals are met. For example, if through monitoring the goals of long-term water management were not being met (e.g., exceedances of WQSs) the IDEQ would require a study to define the potential concerns. Such study could lead to administrative changes in the long-term water management plan including additional groundwater cutoff walls, additional water treatment, groundwater pumping, etc.

2.1.7. MMPO Alternatives Considered but Eliminated From Further Analysis

The range of reasonable alternatives for mining, and especially for an existing mine, is inherently limited due to the fixed location of rare ore bodies, and the world-wide competition which typically requires mining by the most economical method for a mine to be economically feasible. The range of alternatives is even more limited when evaluating an existing mine, as is evident by the summaries of some of the alternatives considered but eliminated from further analysis for the project.

Locating Mining and Milling Facilities Elsewhere

There is no technologically feasible alternative for relocating the open pit because mining must occur at the ore body, and the mill facilities must be as near the ore body as possible for obvious economic reasons. Furthermore, it would be cost prohibitive ($100s million) to relocate the mill facilities. In addition, the WRSFs, TSF, and mill were sited and constructed in their current locations after the 1980 EIS for the mine evaluated a wide range of alternatives and selected the current locations as the optimum alternative. There is no environmental reason to move the facilities elsewhere, and relocating the mill would cause substantial surface disturbance at the new location.

Underground Mining

It would not be feasible technologically or economically at this point in the mine life to mine the Phase 8 ore body by underground methods, store waste rock or tailings underground, or to relocate other support facilities underground. Underground mining is technologically and economically preferable when the ore body is too deep or inaccessible for open pit mining and removal of the overburden for an open pit is too expensive. This is not the case for the Thompson Creek Mine where most of the overburden required to mine the Phase 8 ore will already have been removed by previous mining phases, so only the incremental overburden required to expose the Phase 8 ore requires removal. Additionally, underground mining is typically applicable only in cases where the grade of the ore is relatively high (~ 0.3 % molybdenum), and not for lower grade ore bodies (~ 0.08 % molybdenum), such as the Phase 8 ore at the mine.

Using August 2012 commercial mine cost data and cost models (InfoMine 2012a), the least expensive underground mining technique is block caving. If such technique could be applied to the Thompson Creek ore deposit, the typical production of 30,000 tons per day of ore would require a capital cost of approximately $115,000,000 for adit entry or $165,000,000 for shaft entry. The block caving operating cost would be approximately $8.15 per ton of ore for adit entry or $9.50 per ton of ore for shaft entry. The life-of-mine open pit operating cost is $1.42 per ton of material (overburden and ore) (Marek and Lechner 2011). Therefore, it would not be economically reasonable at current or realistic future molybdenum prices to convert the mine from surface to underground block caving operations as this would involve a capital cost of more than $100,000,000 and an operating cost at least $10,000,000 per year more than that of the current surface mining operations.

Concurrently Backfilling Open Pit

Concurrently backfilling portions of the open pit with waste rock or tailings would reduce the volume of material placed in the WRSFs or the TSF, incrementally reducing their height and their areas, compared to that under Alternative M2. However, the pit walls are uniformly steep and the ore body always occurs on the sides and floor of the pit. Therefore, there is no place in the pit to store waste material during mining, i.e., placing waste material in any portion of the pit would prevent the extraction of the underlying ore body. In addition, there would be substantial physical safety hazards from trying to simultaneously mine and backfill in the close confines of the pit floor. Concurrent backfilling is generally feasible only when mining a series of pits sequentially such that the waste material from an active pit may be placed into a previously mined pit.

Backfilling the Open Pit

Relocating waste rock from the WRSFs (or tailings from the TSF) back to the open pit after molybdenum production ceases would reduce the size of the WRSFs (or the TSF), and reduce the depth and/or area of the open pit. To be meaningful, the pit would need to be filled or WRSFs would need to be substantially removed, i.e., operating the mine in reverse. The cost to backfill the pit at the end of Phase 7 and Phase 8 would be $318 million and $655 million, respectively (TCMC 2012b). Such costs are not economically feasible, e.g., the Phase 8 cost would be greater than the net present value of the mine at a 10 percent discount rate and a molybdenum price of $12.50 per pound (Marek and Lechner 2011). Also, filling the pit with waste rock would cause uncertain environmental effects (e.g., changes in the hydrologic balance, pore water chemistry of the waste rock filling the pit, etc.) with less control of the waste rock. In addition, backfilling the pit would preclude mining low-grade resources that might become economic at some point in the future – pits are regularly restarted after decades of inactivity.

Basin Creek Waste Rock Storage Facility

The Basin Creek drainage, the next drainage north of the Buckskin drainage, was considered for construction of a WRSF. Under this alternative the height increase and lateral expansion that would occur in the WRSFs under all of the MMPO alternatives would be reduced. However, placing waste rock in the Basin Creek area would involve a long uphill haul from the open pit that would be substantially more expensive than adding this volume of waste rock to the WRSFs involved in any of the MMPO alternatives. The surface disturbance of a new WRSF in Basin Creek would also be greater than the new surface disturbance of the WRSFs in any of the MMPO alternatives. In addition, a new WRSF in Basin Creek would also affect a new watershed that would not be affected under any of the MMPO alternatives.

Full Realignment of the TSF Embankment with Upstream Raise

Raising the height of the impoundment for the Phase 8 tailings storage requires increasing the height of the embankment to an elevation of 7,742 feet, which is greater than a topographic low spot on the ridge at the northeast abutment. Under the full re-alignment alternative, a new centerline embankment would be constructed across the entire width and on top of the existing impoundment upstream of the embankment. The result would be an impoundment on top of an impoundment, with the upper impoundment shifted upstream of the existing impoundment producing a stair-step pattern. Such "upstream" construction would eliminate the elevation constraints at the northeast abutment.

Construction of upstream TSF impoundments is widely practiced in the global mining industry but requires sufficient consideration of stability, particularly under seismic loadings, to ensure that the upstream embankment has suitable foundation strength to ensure long-term stability. Idaho regulations (IDAPA 37.03.05 Item 045.01.b) prohibit upstream construction of TSF impoundments unless the embankment and tailings density is 60 percent or greater during seismic loading. The tailings facility engineers for TCMC do not believe the density of the embankment and tailings at the mine during seismic loading could be reasonably assured to be less than 60 percent (Golder 2008).

New TSF Downstream of Existing TSF

Under this alternative, a new centerline raise TSF would be developed downstream of the existing TSF near the existing SRD. The embankment of the new TSF would have a crest elevation of 7,174 feet and would be combined with a raise of the existing TSF to 7,726 feet. Part of the Phase 8 tailings would be deposited in the new TSF, and the balance of the tailings would be stored behind the existing TSF (with a raised embankment).

The construction of an entirely new TSF would require consideration of all the design and construction details for foundation preparation, embankment drainage, embankment construction, and monitoring of the existing embankment. The existing SRD would need to be eliminated and a new one constructed downstream of the new TSF. The embankment drainage facilities for the existing TSF would need to be modified and integrated into the new TSF. There would be additional disturbance to the Bruno Creek watershed downstream of the existing TSF along with an incremental raise, and concurrent watershed disturbance upstream of the existing TSF.

Disposing of Mill Tailings or Mine Overburden through Off-site Utilization

An alternative was considered in which tailings sand (with the pyrite removed, also known as tailings slimes) and/or waste rock would be shipped off-site for commercial uses, which would reduce the ultimate size of the tailings and WRSFs. However, there is no local market for any meaningful amounts of such material, and the low unit value of the material precludes shipping meaningful amounts of the material to other more distant markets. There is no known commercial use of tailings slimes, there is no local market for any meaningful amounts of such material, and the low unit value of the material precludes shipping meaningful amounts of the material to other markets. Therefore, this alternative was not economically feasible.

Waste Rock Buttress of Tailings Storage Facility Embankment

The agencies asked if TCMC had considered using some of the Type 1 waste rock produced during Phase 8 to help buttress the TSF embankment. The rock toe embankment at the base of the TSF embankment would be raised to 6,960 feet during the construction of the Phase 8 TSF embankment; however, the downstream sand slope of the embankment would still be steepened to 2.75 H:1 V from the current 3 H:1 V. To reduce the sand volume required to raise the embankment to the required Phase 8 elevation, TCMC could use Phase 8 Type 1 waste rock to further raise or otherwise buttress the rock toe embankment. However, all of the Type 1 waste rock would be necessary for reclamation of the WRSFs and, therefore there would not be sufficient Type 1 waste rock to buttress the embankment. In addition, the amount of sand produced from cycloning the tailings would be insufficient to fill in the area behind an enlarged rock buttress. Furthermore, a new road would be necessary to haul waste rock to the base of the embankment, which would incur substantially higher capital and operating costs and require disturbing substantial new area. Moreover, the review of the stability of the TSF (e.g., KP 2012) indicates no need for additional buttressing.

2.2. Land Disposal Alternatives

The BLM objectives used to guide the land disposal alternatives include the following:

- Ensure compliance with the BLM Challis Field Office RMP;
- Provide for efficient administration of lands by the BLM, e.g., increase block ownership and not result in small isolated areas ("islands") or narrow strips of BLM land; and
- Satisfy the equal value and public interest requirement of the FLPMA.

It is important to note that the boundaries and conditions of the selected[8] and offered lands described in the land disposal alternatives are necessarily approximate. However, the BLM believes the selected and offered lands have equivalent fair market value, and that under all land disposal alternatives there would be sufficient fair market value of the selected and offered lands to allow for adjustments to the boundaries and/or conditions of the lands for value equalization, acceptable title, or other administrative concerns.

Equal Value

The FLPMA requires that lands being exchanged be of equal (fair market monetary) value. To achieve this, all reasonable efforts must be made to equalize the value by adding or excluding lands and/or by making a cash equalization payment, up to 25 percent of the value of the public lands leaving Federal ownership (43 CFR 2201.6). This requirement ensures that the exchange is fair, despite the inevitable difference in the areas of the offered and selected lands, since not all land is worth the same dollar amount per acre.

Public Interest, Land Management, and Resource Values

The FLPMA requires that the public interest would be well served by a land exchange. In considering whether an exchange is in the public interest, the FLPMA directs the Secretary to "give full consideration to better Federal land management and the needs of State and local people, including needs for lands for the economy, community expansion, recreation, areas, food, fiber, minerals, and fish and wildlife..." The Secretary must also find "that the values and the objectives which Federal lands or interests to be conveyed may serve if retained in Federal

[8] "selected" and "offered" are used from the perspective of the proponent, i.e., the selected land is the BLM land desired by TCMC

ownership are not more than the values of the non-Federal lands or interests and the public objectives they could serve if acquired" (FLPMA Section 206(a)).

Mutual Agreement on Configuration of Exchange Lands

Since Federal land exchanges are discretionary, both the BLM and the exchange applicant must agree to the configuration of the selected and offered lands. Therefore, the Interior Board of Land Appeals has determined that "in conducting an environmental review of a proposal to exchange public for private land, BLM need not consider the alternative of conveying other land if it is not desired by the private party involved in the exchange and conveyance of such land would not satisfy the purpose of the exchange" (124 IBLA 44 [1992]). The land disposal alternatives are restricted to those configurations of selected and offered lands that are mutually acceptable to the exchange proponent and the BLM, and thus would satisfy the purposes of both TCMC in proposing the exchange and the BLM in responding to the land exchange proposal.

2.2.1. Alternative L1 – No Action

The BLM would not approve the land exchange proposal or any of the other land disposal alternatives, and would not amend the Challis RMP to identify the selected land as suitable for disposal under the FLPMA (Section 1.4). There would therefore be no change to the current land status: the Broken Wing Ranch (813 acres) and Garden Creek property (80 acres) would remain privately owned, and the selected land (~ 5,100 acres) would remain as BLM land (Figure 1.2-1., Figure 1.3-1). Since none of the MMPO alternatives are affected by any of the land disposal alternatives, under Alternative L1 the mine would continue operations on a combination of private, BLM, and NFS land as described in MMPO Alternative M1, M2, or M3 depending upon the agency decisions for the MMPO alternatives (Section 2.1.2).

TCMC could sell the offered lands to another party. The Broken Wing Ranch would probably continue to be used as private ranch (irrigated agriculture and cattle) with no public access to the property. Commercial sales of quartzite talus would likely continue, and some property adjacent to the Salmon River or along Lyon Creek could be sold and developed for residential/recreational use.

2.2.2. Alternative L2 and Alternative L2-B – Land Exchange Proposal

The BLM would amend the Challis RMP to identify the selected land as suitable for disposal under the FLPMA, and would approve the land exchange proposal. These actions would be made pursuant to all other applicable laws (e.g., Section 202 of the FLPMA for land use plans and Section 206 of the FLPMA for land exchanges), regulations (e.g., 43 CFR 1600 for land use plans and 43 CFR 2200 for land exchanges), and policy (e.g., the BLM Land Use Planning Handbook [BLM 2005a] and BLM Land Exchange Handbook [BLM 2005b]). TCMC would thus acquire a tract of BLM (selected) land, including both surface and mineral estates on up to approximately 5,000 acres, at the mine site. The US would acquire two tracts of privately owned (offered) land, including both surface and mineral estates on up to approximately 900 acres that would be administered by the BLM. The selected land comprises all Federal land in Sections 1 to 4, 9 to 12, T. 11 N., R. 16 E. and Sections 5 to 8, T. 11 N., R. 17 E., B.M. in Custer County, Idaho (Figure 1.2-1., Figure 2.2-1).

However, as an example of the minor adjustments that might occur, the BLM may exclude Federal land outside the disturbance footprint of existing mining disturbance or the MMPO disturbance footprint along the east boundary of the selected land.

The offered lands consist of two tracts owned by TCMC: the Broken Wing Ranch, 6 miles northeast of Clayton in Custer County, Idaho; and the Garden Creek property, 16 miles south of Pocatello in Bannock County, Idaho (Figure 2.2-2). Descriptions of the selected and offered lands and the reasonably foreseeable[9] uses of the lands are provided below. A description of provisions that would apply to all land disposal action alternatives is also provided below and in Section 2.2.7. Alternative L2-B is a sub-alternative to Alternative L2 specific to the Broken Wing Ranch (Section 2.2.2.2).

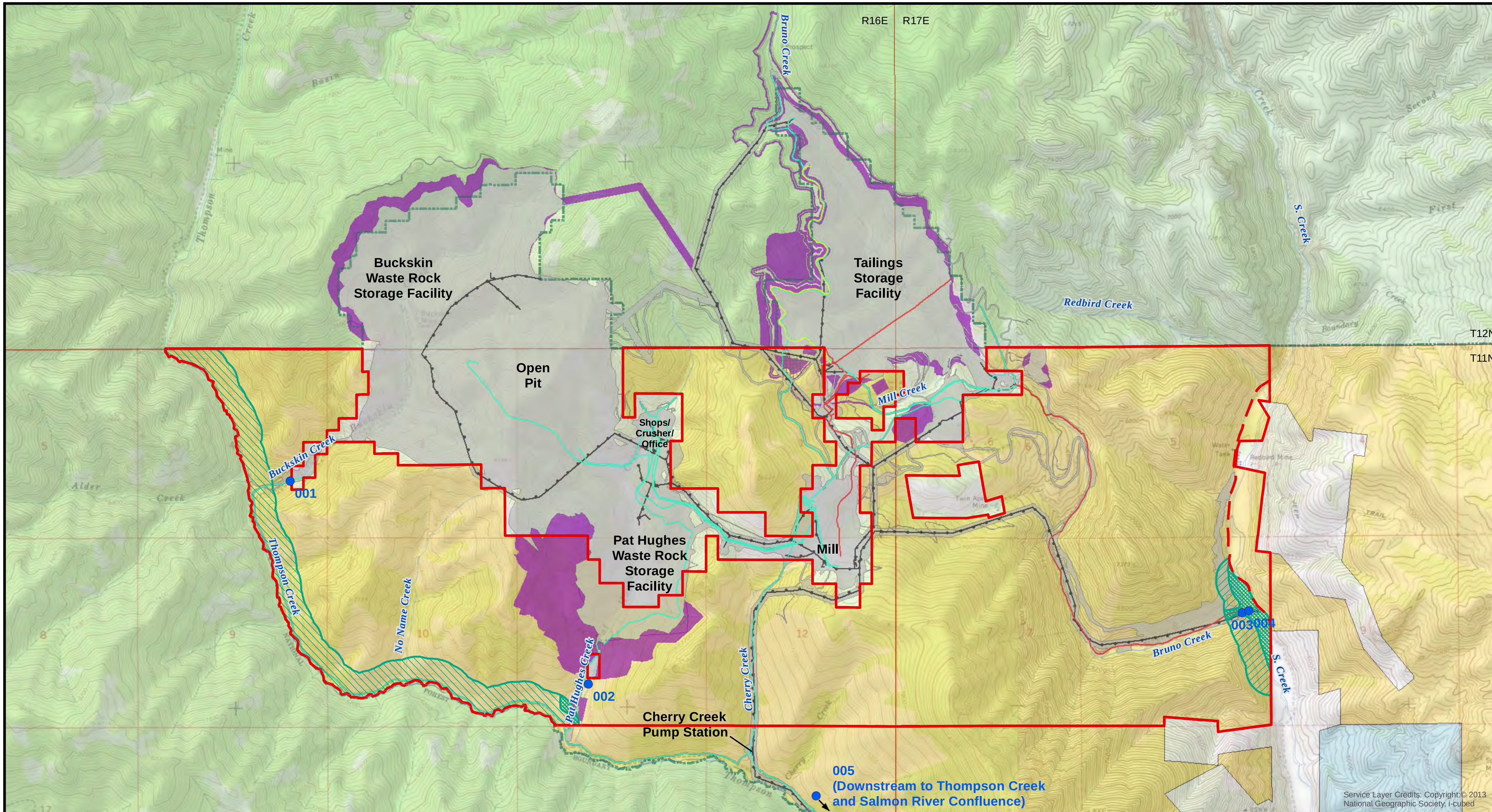
2.2.2.1. Selected Land

The selected land (~ 5,100 acres) is either undeveloped, forested land (Photo 2.2-1., Photo 2.2-2.) or is already used for mining (Photo 2.2-3., Photo 2.2-4., Photo 2.2-5). All of the land is covered by mining claims owned by TCMC. Mining currently disturbs 451 acres of the selected land including a widely distributed network of sedimentation ponds, access roads, and power line and pipeline corridors (Figure 2.1-3., Table 2.1-2). The additional disturbance of the selected land under the MMPO alternatives would be 198.3 acres under Alternative M2, and 416.1 acres under Alternative M3. There would not be any additional disturbance of the selected land under Alternative M1. If the BLM were to no longer administer a portion of the MPO for the mine (Section 1.4.), the interagency taskforce (less the BLM) would continue to inspect the mine along with separate inspections by the other Federal and State agencies, including two land management agencies (Forest Service and IDL).

TCMC has stated that it has no current intention to use any of the selected land for mining, including mineral exploration, apart from the activities identified in the MMPO alternatives (Section 2.1). That is, TCMC would not mine differently under any of the MMPO alternatives if the selected land were owned by TCMC or if the selected land continued to be Federal land. In addition, internal and public scoping and a mineral potential report (Gardner 2008) have not identified any mining activities that would reasonably be expected to occur on the selected land, apart from those identified in the MMPO alternatives.

TCMC does not have post-reclamation development plans for the selected land should TCMC acquire it. In addition, water treatment reclamation activities on some of the land could occur many decades after mining ceases in 2025. Therefore, speculation concerning post-reclamation uses of the land by TCMC might include retaining ownership or sale to a private party, or perhaps donation to Custer County or a university; the land could also be burned by wildfire. Regardless, what might happen to the selected land upon completion of mine reclamation is not reasonably foreseeable and too speculative to evaluate in detail in this DEIS.

[9] For the purpose of this DEIS *reasonably foreseeable* is a few decades. Actions occurring 50 to 100 years in the future are highly uncertain and add unnecessary speculation to the analysis. Hence, Federal land use plans are for periods of 20 years, and long-range mine planning is typically limited to 20 to 40 years in the future. In the case of cumulative effects analysis (Chapter 5), reasonably foreseeable typically means only proposed projects.



Legend

- Alternative L2 selected land
- Modified east boundary
- Existing mining disturbance
- MMPO areas/Alternative M2
- Thompson Creek easement area
- S. Creek easement area
- Easement exclusion area
- NPDES outfall
- Existing power line
- Pyrite pipeline
- Tailings pipeline
- Water pipeline

Land Ownership

- BLM
- Private
- State
- Forest Service

Selected land, existing mining disturbance from Thompson Creek Mine data, polygons created by Ken Gardner.
Ownership data is at 1:24,000 and created and maintained by the Bureau of Land Management, Idaho State Office, Geographic Sciences.
Topographic background from USGS 7.5' Quadrangles 1:24,000 scale.
Coordinate system UTM Zone 11 NAD 83

N

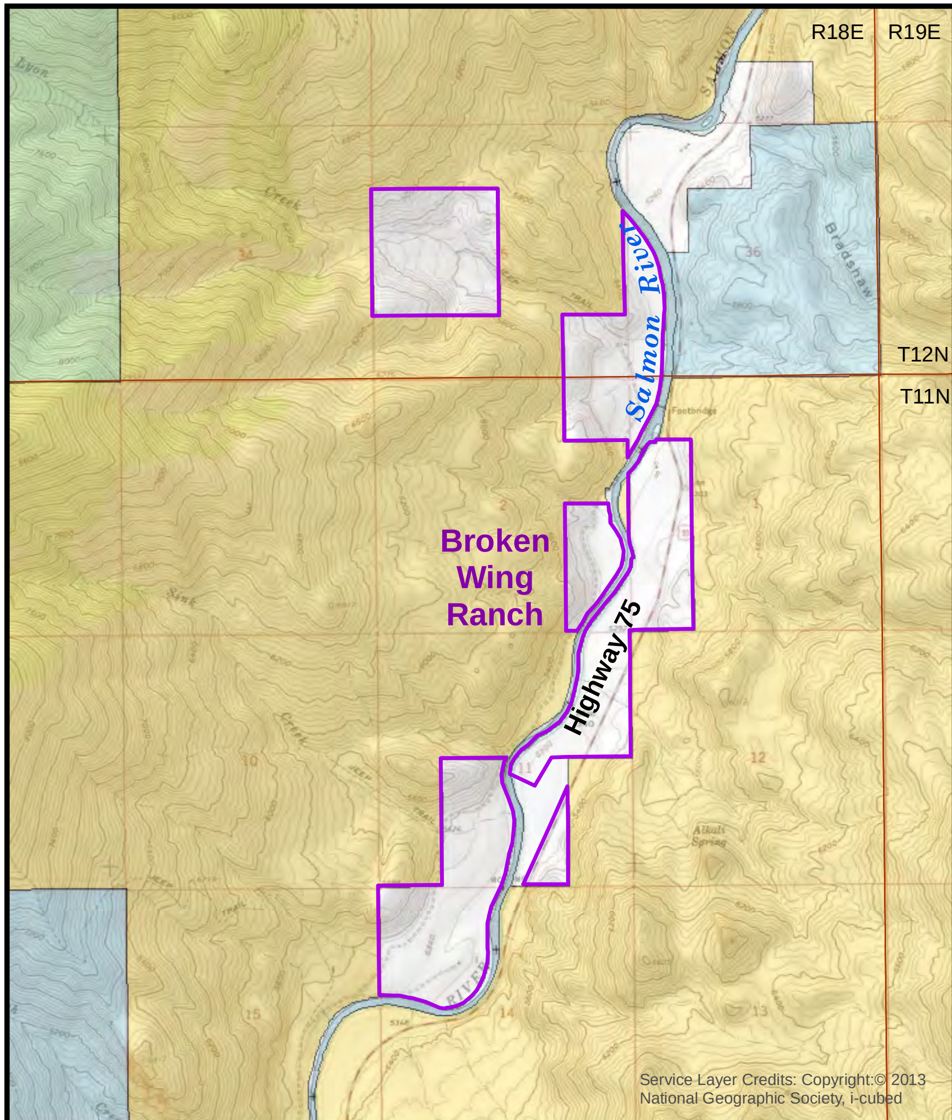
1:32,000

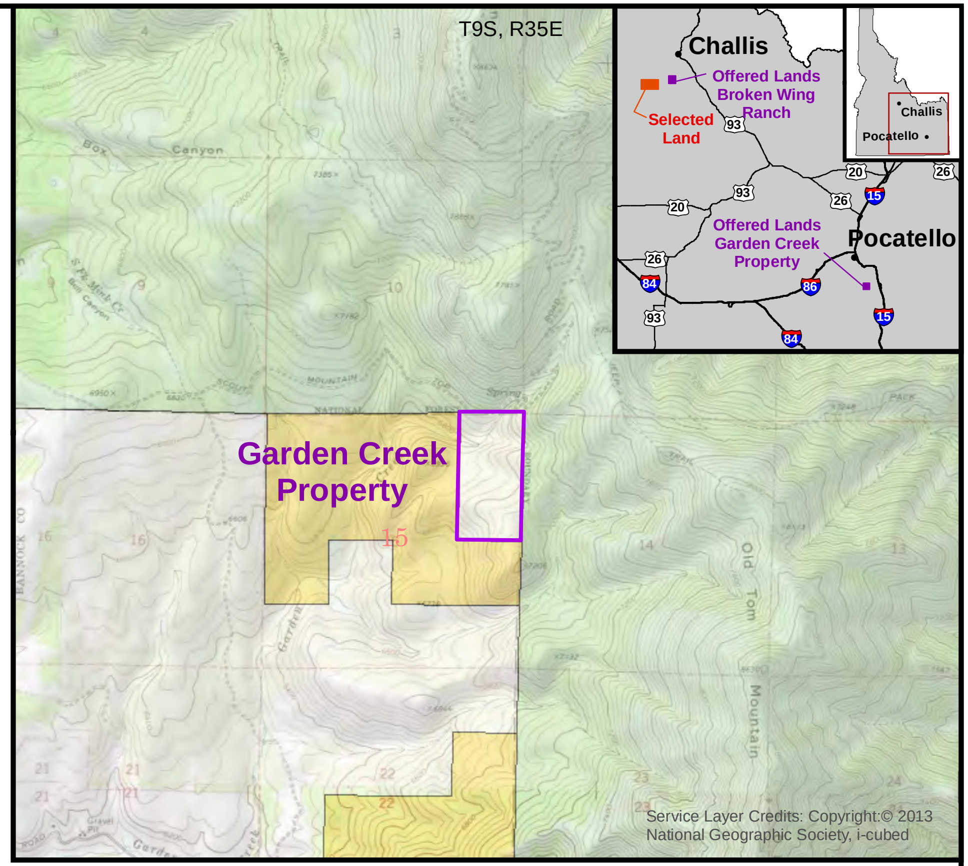
0 Miles 1

0 Kilometers 1

No warranty is made by the Bureau of Land Management (BLM) for the use of this data for purposes not intended by the BLM.

Figure 2.2-1
Land Disposal Alternative L2 - Land exchange proposal, selected land
Thompson Creek Mine EIS





Legend

Offered lands

Land Ownership

BLM

Private

State

Forest Service

Offered lands from Thompson Creek Mine data, polygons created by Ken Gardner.
Ownership data is at 1:24,000 and created and maintained by the Bureau of Land Management, Idaho State Office, Geographic Sciences.
Topographic background is USGS 1:100,000-scale metric Topographic Maps.
Coordinate system UTM Zone 11 NAD 83

N

1:48,000

0 Miles 1

0 Kilometers 1

Figure 2.2-2
Land Disposal Alternative L2 - Land exchange proposal, offered lands
Thompson Creek Mine EIS

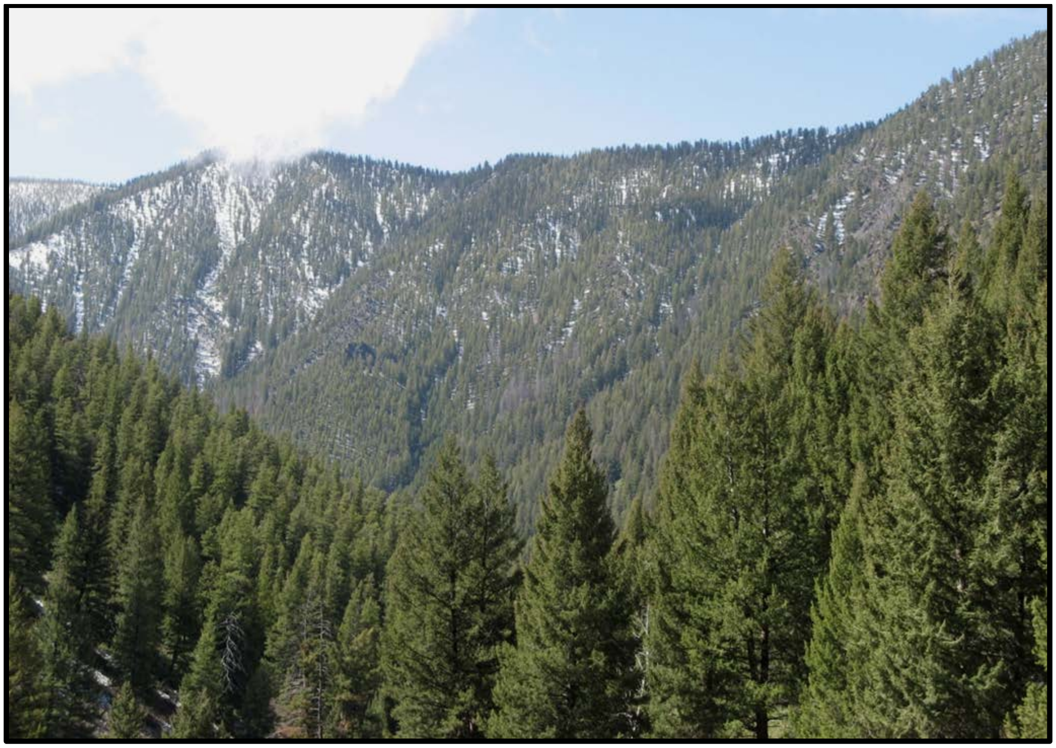


Photo 2.2-1. Selected land from Bruno Creek access road, view to southwest.

Photo 2.2-2. Selected land from lower Pat Hughes drainage, view to northwest.

Photo 2.2-3. Selected land south of the Pat Hughes WRSF, view to north.

Photo 2.2-4. Selected land surrounding Bruno Creek access road, view to west.

Photo 2.2-5. Selected land below base of TSF impoundment.
Temporary tailings containment ponds and timbered ridge in photo center, view to southeast.

2.2.2.2. Offered Lands – Broken Wing Ranch

The Broken Wing Ranch consists of 813 acres of irrigated agricultural fields, rangeland, ranch structures, and a historic homestead in Custer County. The ranch includes 4.4 miles of Salmon River frontage as well as various streams including Lyon Creek (Photo 2.2-6. through Photo 2.2-11).

Alternative L2

The ranch would be managed generally according to the recommendations of the BLM Idaho Falls District RAC (BLM 2009b), which categorizes the ranch into nine management parcels with specific management recommendations for each parcel. However, because the management parcels do not all correspond to surveyed areas of land, for the purposes of this DEIS the parcels are assigned to seven surveyed subparcels (BWR-1 through BWR-7) (Figure 2.2-3., Table 2.2-1).

The BLM policy is to avoid obtaining structures not necessary for the BLM mission. Therefore, as part of the land exchange, TCMC would donate to Custer County the Lyon Creek Bridge and the Lyon Creek and Sink Creek ranch houses/outbuildings. However, the historical structures on the ranch would be acquired by the BLM. The structures would include 2.5 acres (county minimum parcel size) of land around each house, and appropriate easements for access. For liability reasons, Custer County would not allow public use of the bridge. However, the BLM would have administrative access to use the bridge (as well as administrative access under the FLPMA to all BLM land, despite any public restrictions).

Access to the ranch by public vehicles from SH 75 would be by traveling 2.0 miles north on Poverty Flat Road, 1.0 mile north on Sink Creek Road, and 0.7 mile south on Lower Sink Creek Road to the main ranch road on the west side of the Salmon River. The main ranch road leads 2.4 miles to the Lyon Creek ranch house (Figure 2.2-3). Several areas along the ranch road would be widened for parking, and a few sections of the road would be re-aligned (including reducing the grade in one or two places) so that vehicles would avoid the irrigated fields (e.g., 1,200 feet of road would be bladed across the flat ground at the base of the hill around the north edge of the southernmost circular pivot) and would be able to easily pass pivots, hay storage areas, fence lines, etc.

The BLM would make the ranch available for grazing (~ 800 acres of irrigated fields and rangeland), and would authorize grazing for 27 AUMs in the Lyon Creek "Graham Field" meadow. The meadow would be grazed according to an existing conservation plan for the ranch sponsored by Custer Soil and Water Conservation District: up to 200 cow/calf pairs for 3 to 5 days (0.62 AUMs/acre, WSLM 2012). The season of use would be either 1) during 3 to 5 days during the first week in May, or 2) during 3 to 5 days during mid- to late-October or the first week in November.

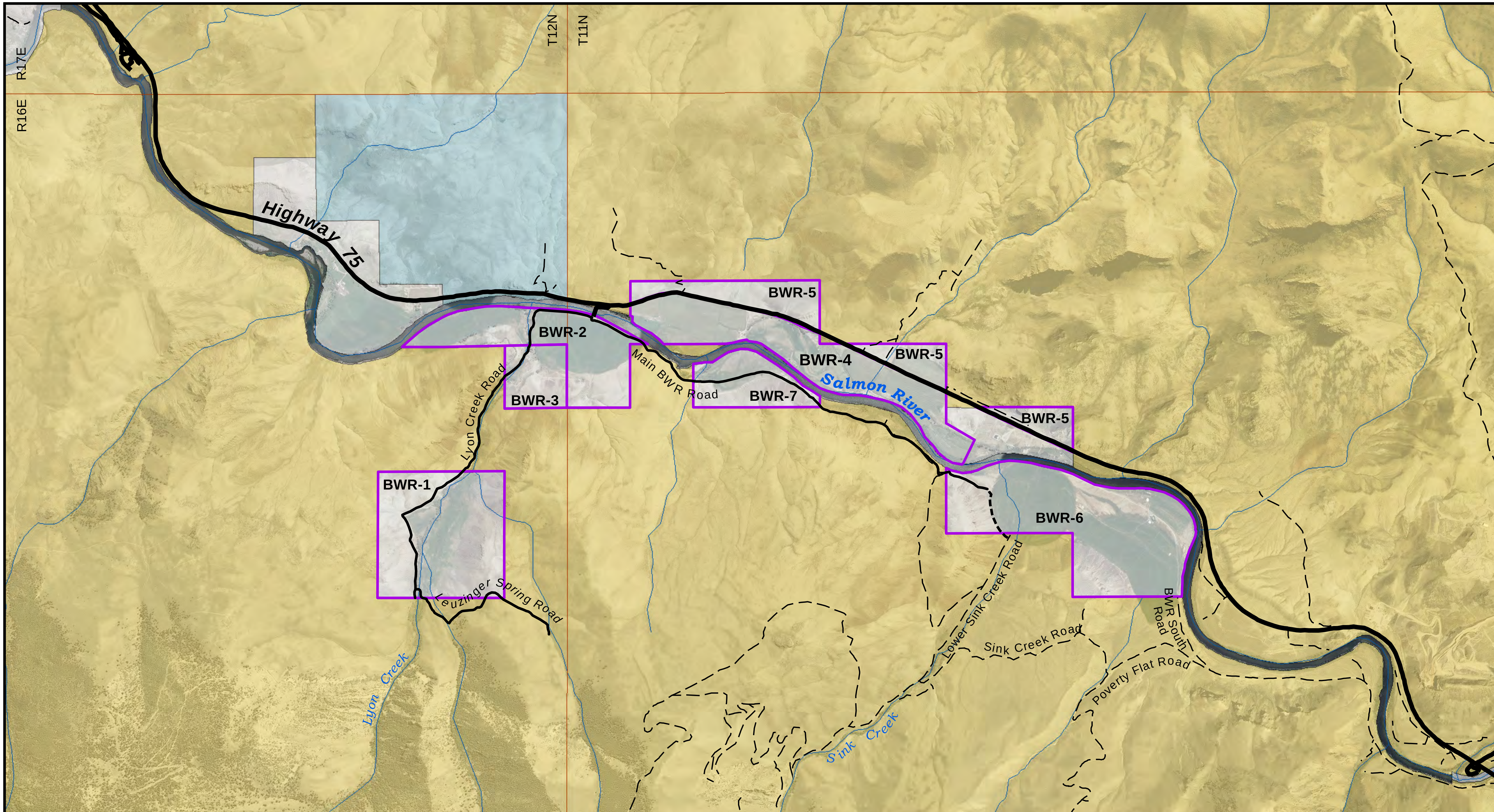
For the rest of the irrigated fields on the ranch, the potential stocking rate would be 3,040 AUMs (Table 2.2-1., Table 2.2-2).[10] However, at times the BLM would not graze BWR-7. Therefore, based on past grazing, the BLM would authorize approximately 2,400 AUMs[11] (79 % of the available forage from the irrigated fields), or approximately 2,280 AUMs[12] during the times BWR-7 was not grazed. The season of use would be from September 15 to May 15 with up to 300 cows. Grazing would incorporate terms and conditions to ensure conformance with 43 CFR 4180 (fundamentals of rangeland health) and consistency with the Challis RMP.

The non-motorized access in the Lyon Creek drainage would begin at or near the Lyon Creek ford by the Lyon Creek ranch house. Firearm discharge safety zones would be established around the two ranch houses, but hunting and shooting would otherwise (generally) be allowed in the same manner as is allowed on other Federal lands. However, the public would not be allowed in the cultivated fields during the growing season (e.g., mid-April through mid-October) to avoid damage to crops. The dilapidated trailer on the east side of the Salmon River would be demolished and removed, and the driveway and former trailer site would be used for parking and river access.

[10] 813 acres on ranch subparcels; 424 acres cultivated; 389 acres rangeland - 20 acres disturbed - 6.8 acres riparian shrubland = 362 acres rangeland; cultivated land on each subparcel x ~ AUMs/acre/subparcel = 3,038 AUMs

[11] 300 cows x 243 days / 30.41666 days/month = 2,396.7 AUMs

[12] The AUMs typically made available from BWR-7 are 54 acres x 0.32 irrigated x 7 AUMs/acre = 121 AUMs.



Legend

- Broken Wing Ranch
- Main Broken Wing Ranch access
- Main Broken Wing Ranch access (not yet constructed)
- 2WD road (Highway 75)
- Primitive road
- Stream

Land Ownership

- BLM
- Private
- State
- Forest Service

NEPA parcels for the Broken Wing Ranch from Thompson Creek Mine data, polygons created by Ken Gardner.
Ownership data is at 1:24,000 and created and maintaned by the Bureau of Land Management, Idaho State Office, Geographic Sciences.
Aerial image NAIP 2009
Coordinate system UTM Zone 11 NAD 83

N

0 1:24,000 4,000
Feet
0 1
Kilometers

No warranty is made by the Bureau of Land Management (BLM) for the use of this data for purposes not intended by the BLM.

Figure 2.2-3
Land disposal alternatives - Broken Wing Ranch NEPA subparcels
Thompson Creek Mine EIS

Photo 2.2-6. Broken Wing Ranch, Salmon River frontage, view to south.

Photo 2.2-7. Broken Wing Ranch, Salmon River frontage, view to east.

Photo 2.2-8. Broken Wing Ranch, Lyon Creek, view to south.

Photo 2.2-9. Broken Wing Ranch, view to east from upper Lyon Creek meadow.

Photo 2.2-10. Broken Wing Ranch, Lyon Creek meadow, view to south.

Photo 2.2-11. Broken Wing Ranch, upper Lyon Creek meadow.
BLM land north of meadow. View to west.

Table 2.2-1. Broken Wing Ranch RAC parcels and subparcels.

Subparcel ID	RAC Parcel ID(s)	(acres)	Current Land Use(s)	RAC Proposed Land Use
BWR-1	A	160	• apple orchard • grazing; no fences to separate the private land from adjacent BLM land, but the meadow (“Graham Field,” 42.9 acres) was fenced in 2012 • historic structures including rock wall and cabin • contains portion of key access road to Lyon Creek drainage	• manage for wildlife and fisheries • access would be non-motorized only; walking/ bicycling trail, except for administrative use • increase water efficiency and quality – put more water into Lyon Creek for fisheries/riparian vegetation, but maintain meadow • grazing from adjacent BLM would likely continue to occur (meadow has subsequently been fenced with conservation easement established) • historic structures features would be candidates for cultural interpretive sites in collaboration with Custer County, Boise State University, Idaho Department of Parks and Recreation, and others; • if BWR-1 not acquired in fee simple, would need public access easement for access road
BWR-2	B	110	• primarily irrigated (wheel line and pivot) agriculture • pole barn • contains portion of key access road from Lyon Creek Bridge or Poverty Flat Road	• continue agricultural use • remove pond to eliminate fish barrier • if BWR-2 not acquired in fee simple, would need public access easement

Subparcel ID	RAC Parcel ID(s)	(acres)	Current Land Use(s)	RAC Proposed Land Use
BWR-3	C	39	• main (Lyon Creek) residence • apple orchard, garden, other fruit trees • homestead cabin • contains portion of key access road to Lyon Creek drainage	• facility would serve as Field School for Boise State University and partners, or others for environmental programs and outreach • continue in irrigated (pivot) agriculture • if BWR-3 not acquired in fee simple, would need public access easement
BWR-4	D, E, F; portion G	143	• Maraffio homestead with historic structures • modern (dilapidated) Maraffio residence (trailer on east side of the Salmon River) • irrigated (wheel line) agriculture • small portions adjacent to Challis Wild Horse and Burro Management Area	• some preservation of structure(s) could be done • demolish and remove the modern Maraffio residence • would continue in irrigated (wheel line) agriculture (Parcels E, G) • north end and central portions are possible sites for the Idaho Department of Parks and Recreation or another agency to develop campground, interpretive site, or other recreational facility that generates revenue
BWR-5	I; portions of D, E, F, G	98	• bare ground except wheel line agriculture at southern end • small portions adjacent to Challis Wild Horse and Burro Management Area	• continued agricultural use
BWR-6	H; portion of G	209	• primarily irrigated (pivot) agriculture • Sink Creek residence • contains portion of key access road	• continued agricultural use • Sink Creek residence would serve as ranch manager housing; contains possible site (between pivots) for the Idaho

Subparcel ID	RAC Parcel ID(s)	(acres)	Current Land Use(s)	RAC Proposed Land Use
				Department of Parks and Recreation or another agency to develop campground, interpretive site, or other recreational facility that generates revenue • if BWR-6 not acquired in fee simple, would need public access easement
BWR-7	No RAC parcel	54	• no uses except grazing • patchy flood irrigation • contains portion of key access road	• would be rested from grazing and subjected to weed eradication • if BWR-7 not acquired in fee simple, would need public access easement

Alternative L2-B

In addition to the RAC-recommended management of the ranch (Alternative L2), a sub-alternative for ranch management has been developed (Alternative L2-B). The sub-alternative is evaluated in Chapter 4 under the headings for Alternative L2; in general the effects would be the same, so only the resources that would be affected differently from Alternative L2 are described.

Alternative L2-B would be the same management as under Alternative L2, except 1) there would be no grazing at the ranch (on the fenced fields), 2) the cultivated fields would be actively converted to native vegetation, and 3) motorized access would be allowed in the Lyon Creek drainage to near the western edge of BWR-1 (where there are existing areas to park and turn around longer vehicles). The irrigated portions of the ranch (~ 400 acres) would actively be converted to native vegetation, except for the Lyon Creek meadow. The conversion would require approximately 3 years, and would consist of having a full-time ranch manager plow and/or use herbicide to kill the vegetation in the cultivated fields and roads, seed the fields with a native seed mixture, operate the existing irrigation systems, and manage an aggressive invasive and non-native plant (weed) eradication program. After 3 years the manager would also remove all of the ranch equipment except the fences. There would be a high probability of successful conversion, i.e., self-sustaining native vegetation, no excessive soil erosion/loss, and no major weed infestations (Redick 2013).

Table 2.2-2. Broken Wing Ranch subparcels, selected resources.

Subparcel	Resource Values			
	Wetlands, Floodplains and Riparian Areas	Vegetation, Forest Resources, and Non-native and Invasive Plants	Range Resources	Cultural and Paleontological Resources
BWR-1	21.46 acres wetland 0 miles Salmon River riparian/floodplain	5.2 acres riparian vegetation 24 % agricultural pasture	5 AUMs/acre (meadow)	CH-1521 Graham Homestead (eligible)[2]
BWR-2	1.09 acres wetlands 1.0 miles Salmon River riparian/floodplain	5.0 acres riparian vegetation 68 % agricultural pasture	8 AUMs/acre	None
BWR-3	0.61 acre wetland 0 miles Salmon River riparian/floodplain	3.4 acres riparian vegetation 16 % agricultural pasture	8 AUMs/acre[1]	CH-1520 Gini Homestead (eligible)[2] 37-4918 bridge (unevaluated)[2]
BWR-4	10.65 acres wetlands 1.3 miles Salmon River riparian/floodplain	4.8 acres riparian vegetation 88 % agricultural pasture	5-8 AUMs/acre	CH-1519 Maraffio Homestead (eligible)[2]
BWR-5	0 acres wetlands 0 miles Salmon River riparian/floodplain	0 acres riparian vegetation 13 % agricultural pasture	5-8 AUMs/acre	10CR990 talus pits (unevaluated)[2] 10CR988 lithic scatter (eligible)[2]
BWR-6	1.26 acres wetlands 1.4 miles Salmon River riparian/floodplain	3.8 acres riparian vegetation 69 % agricultural pasture	8 AUMs/acre[1]	37-17040 Sink Creek cribbing (eligible)[2]
BWR-7	1.91 acres wetlands 0.6 miles Salmon River riparian/floodplain	3.3 acres riparian vegetation 32 % agricultural pasture	7 AUMs/acre	None

[1] typical amount when irrigated (but not currently irrigated)
[2] NRHP status

2.2.2.3. Offered Lands – Garden Creek Property

The Garden Creek property consists of 80 acres of undeveloped, forested land south of Pocatello in Bannock County (Figure 2.2-2., Photo 2.2-12., Photo 2.2-13). Under Alternative L2 the Garden Creek property would be managed under the BLM Pocatello RMP with no site-specific management provisions for the property.

Photo 2.2-12. Garden Creek property, view to northeast.

Photo 2.2-13. Garden Creek property, view to southeast.

2.2.3. Alternative L3 – Land Sale

The BLM would amend the Challis RMP to identify the selected land as suitable for disposal by sale under Section 203 of the FLPMA. The US would not obtain any of the offered lands. The selected land would be sold by a direct (non-competitive) sale to TCMC, a modified competitive sale (TCMC would be identified as the bidder authorized to meet the high bid), or a competitive sale (the highest bidder would receive title to the property). In the first case the sale would be at the appraised fair market value pursuant to Section 203 of the FLPMA and all other applicable laws, regulations (e.g. 43 CFR 2710).

2.2.4. Alternative L4 – Reduced Area Land Exchange, Fee Simple

The BLM would amend the Challis RMP to identify approximately 3,600 acres of the selected land (rather than ~ 5,100 acres) as suitable for disposal, and the BLM would approve a land exchange in which TCMC would acquire approximately 3,600 acres of the selected land (Figure 2.2-4). The US would correspondingly acquire an equivalent fair market value (~ 30 % less by area) of the offered lands. To balance the reduced value of the selected land, the US would not acquire the Garden Creek property and/or lower priority portions of the Broken Wing Ranch.

To give the decision maker reasonable flexibility in choosing the portions of the offered lands that would best serve the public interest, while maintaining similar fair market values of the selected land and offered lands, for purposes of this EIS the ranch was subdivided into subparcels (Figure 2.2-3., Table 2.2-2). The offered lands that the US would acquire would be administered by the BLM as described under Alternative L2 or Alternative L2-B (Section 2.2.2).

2.2.5. Alternative L5 – Reduced Area Land Exchange, Easement

The BLM would amend the Challis RMP to identify all of the selected land (~ 5,100 acres) as suitable for disposal under the FLPMA. The BLM would approve the land exchange proposal, but with approximately 1,500 acres of the selected land protected by a conservation easement held by the BLM (Figure 2.2-5). This alternative, a variation of Alternative L4, would result in a more compact land jurisdiction pattern in the vicinity of the mine, and would protect a block of the selected land on which mining activities are not foreseen and would not occur under the MMPO alternatives.

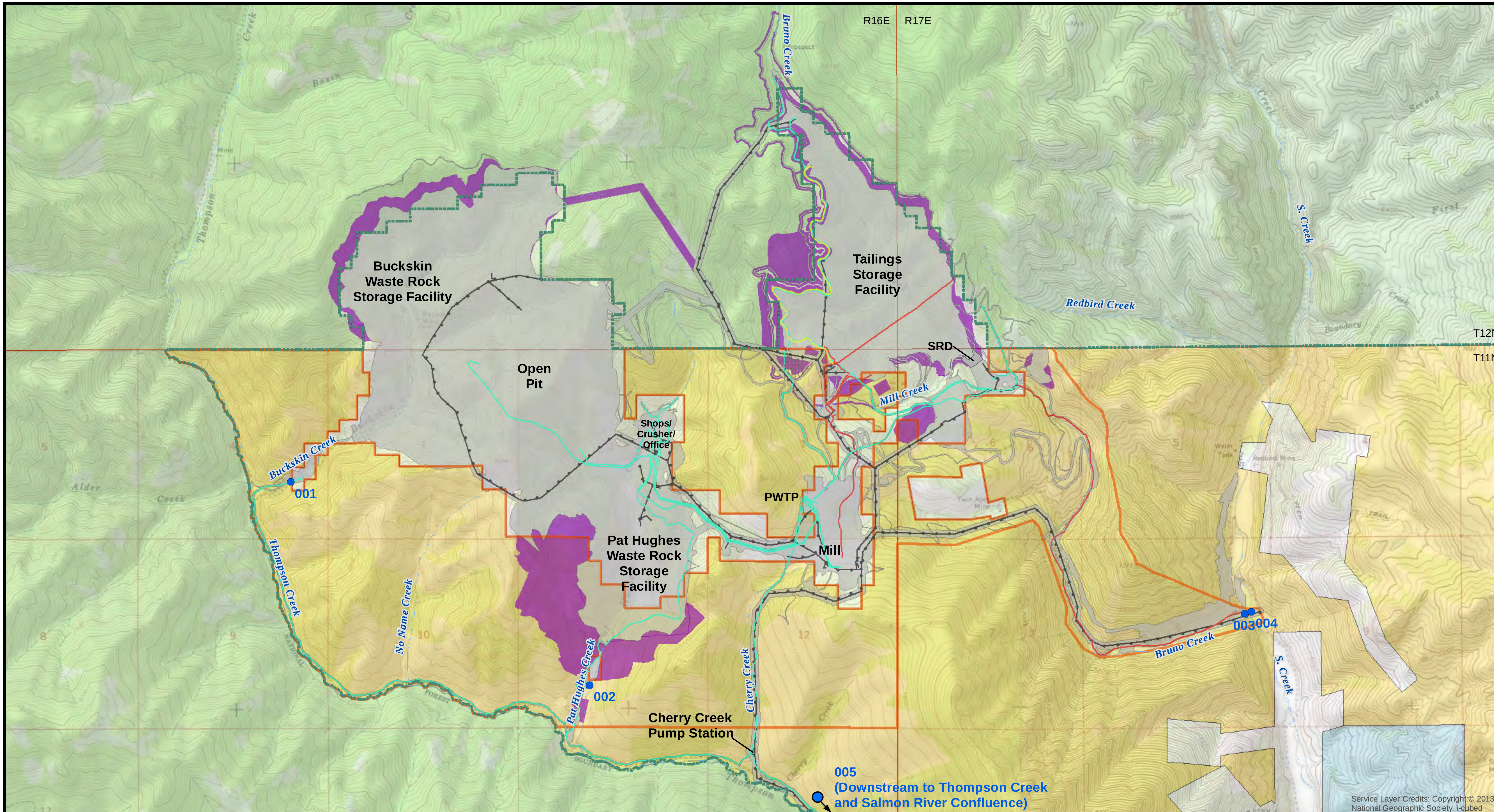
TCMC would therefore acquire the selected land, and the US would acquire most of the offered lands. However, unlike Alternative L2, approximately 1,500 acres of the selected land would be protected by a conservation easement requiring the land to remain essentially in its current condition, e.g., no residential development or mining. The lesser fair market value of the offered lands due to the easement would require eliminating either the Garden Creek parcel and/or certain subparcels of the Broken Wing Ranch from the land exchange, but to a lesser extent than under Alternative L4. That is, compared to Alternative L2, the US would acquire approximately 30 percent less (by fair market value) of the offered lands under Alternative L4 and approximately 10 percent less under Alternative L5. The offered lands that the US would acquire would be administered by the BLM as described in Alternative L2 or Alternative L2-B (Section 2.2.2).

2.2.6. Features Common to All Land Disposal Alternatives

Under all the land disposal alternatives the selected land would be utilized for mining as described for whichever MMPO alternative would be selected by the agencies.

2.2.7. Land Disposal Action Alternative Provisions

The seven following provisions would occur at or before title transfer under all of the land disposal action alternatives, unless under Alternative L3 the selected land was sold to a party other than TCMC. In such case, only the seventh provision would occur. The land disposal provisions were developed as part of the scoping process with input from TCMC prior to effects analysis, and are evaluated in the subsequent effects analysis as part of the action alternatives (as opposed to “mitigation” measures applied to an identified effect with subsequent re-analysis). The provisions would be donations from TCMC and would not affect the fair market value of the selected and offered lands.



Legend

- Alternative L4 selected land
- Existing mining disturbance
- MMPO areas/Alternative M2
- NPDES outfall
- Existing power line
- Pyrite pipeline
- Tailings pipeline
- Water pipeline

Land Ownership

- BLM
- Private
- State
- Forest Service

Selected land, existing mining disturbance, and Phase 8 expansion areas from Thompson Creek Mine data, polygons created by Ken Gardner.
Ownership data is at 1:24,000 and created and maintained by the Bureau of Land Management, Idaho State Office, Geographic Sciences.
Topographic background from USGS 7.5' Quadrangles 1:24,000 scale.
Coordinate system UTM Zone 11 NAD 83

N

1:32,000

0 — 1 Miles

0 — 1 Kilometers

No warranty is made by the Bureau of Land Management (BLM) for the use of this data for purposes not intended by the BLM.

Figure 2.2-4
Land Disposal Alternative L4 - Reduced area land exchange
Thompson Creek Mine EIS

1. *South Butte Road Access*
   TCMC would grant public access along two sections of the South Butte Road, which passes through private property owned by TCMC (Figure 2.2-6). This grant would formalize the public access that TCMC has allowed on the road since 1981. Such a grant would ensure future public access to approximately 7,000 acres of Federal and State lands that are now essentially inaccessible to the public, apart from the South Butte Road, due to rugged topography and the lack of public access via other roads.

2. *Twin Apex Property Access*
   The BLM would grant the owners of the Twin Apex property access to their property via the Bruno Creek Road, and TCMC would modify its exclusive right-of-way (granted by the BLM) for Bruno Creek Road to allow such access (Figure 2.2-6).

3. *Thompson Creek Road Access*
   The existing public access along the upper Thompson Creek Road would be retained by the US (Figure 2.2-7).

4. *Management for Big Game Including Provisions for Public Access*
   TCMC would allow non-motorized access to the selected land though the Idaho Department of Fish and Game Access Yes Program with the exception of the land that drains into Bruno Creek, Buckskin Creek, Pat Hughes Creek and Cherry Creek (Figure 2.2-8). The restricted areas are for the safety of both the public and TCMC employees. The restricted areas would be posted at appropriate access points with maps explaining and delineating the restricted areas.

5. *S. Creek Grazing Allotment, Saturday Mountain Pasture*
   TCMC would grant administrative access to the BLM and its permittees to use roads on property owned by TCMC to reach the Saturday Mountain Pasture (Figure 2.2-6). The grant would provide access to these parties of approximately 2,500 acres of Federal and State lands (excluding the selected land) that are now essentially inaccessible to these parties due to rugged topography and the lack of legal access on existing roads.

6. *Challis East Subdivision Trail Access*
   TCMC would grant public access (motorized or non-motorized) via a trail within a 20 foot wide easement along one side of the perimeter of property owned by TCMC in the Challis East Subdivision provided that trail access is also acceptable to the subdivision property owners and/or the local government. The trail would provide a connection to the Lombard Trail around Blue Mountain, and could ultimately be part of a new trail system envisioned to the Salmon River (Figure 2.2-9).

7. *Thompson Creek and S. Creek Conservation Easement*
   TCMC[13] would grant the BLM a conservation easement for the following areas: 1) the area of the selected land within ⅛ mile of the centerline of Thompson Creek (~ 4 miles of stream length, ~ 280 acres), and 2) the area of the selected land within ⅛ mile of the

[13] or another owner if the selected land was sold to a party other than TCMC under Alternative L3

centerline of the portions of S. Creek within the selected land (~ ½ mile of stream length, ~ 70 acres) (Figure 2.2-1).

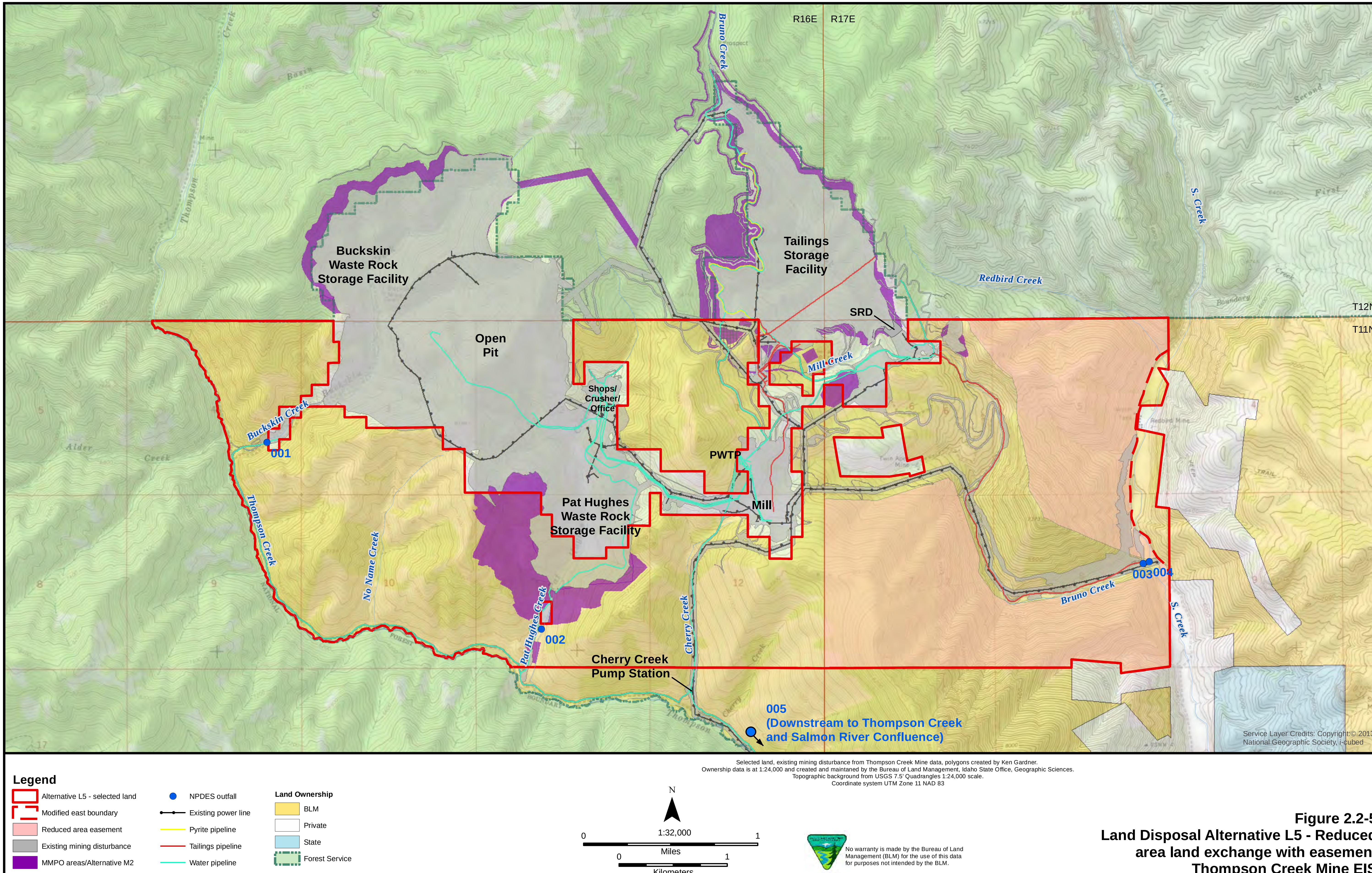
The general purpose of the Thompson Creek and S. Creek easement would be to preserve, protect, enhance, and restore the conservation values of Thompson Creek and S. Creek in perpetuity including the open-space, scenic and relatively natural features and values of the property, as well as the ESA-designated critical habitat for Chinook salmon, bull trout, and steelhead. In particular, the easement would conserve the diversity of ESA-listed resident and anadromous fish species native to the Upper Salmon watershed.

The easement would allow for the use, repair, and replacement of the existing roads, power lines, pipelines, irrigation ditches, etc. within the easement area, and for unforeseen mine operations (e.g., extensions of power lines or pipelines for long-term water management) which would not materially degrade the riparian values for which the easement would be intended to protect. The easement would also exclude an area in the lower Pat Hughes Creek drainage (~ 5 acres) and two areas near S. Creek (each ~ 5 acres) in which new mine operations would either occur as part of Phase 8 or could potentially occur in the foreseeable future. The easement would otherwise prohibit new surface disturbance such as residential development. Any projects with new disturbance would need to be accepted by the BLM prior to implementation to ensure the disturbance would conform to the easement.

As livestock grazing is not currently permitted along Thompson Creek on BLM land, the easement would prohibit grazing within the easement area along Thompson Creek. Any grazing within the easement area along S. Creek would conform to the grazing requirements of the Challis RMP which has been determined to be in conformance with the INFISH/PACFISH standards and guidelines for riparian areas (INFISH 1995, PACFISH 1995).

2.2.8. Land Disposal Alternatives Comparison

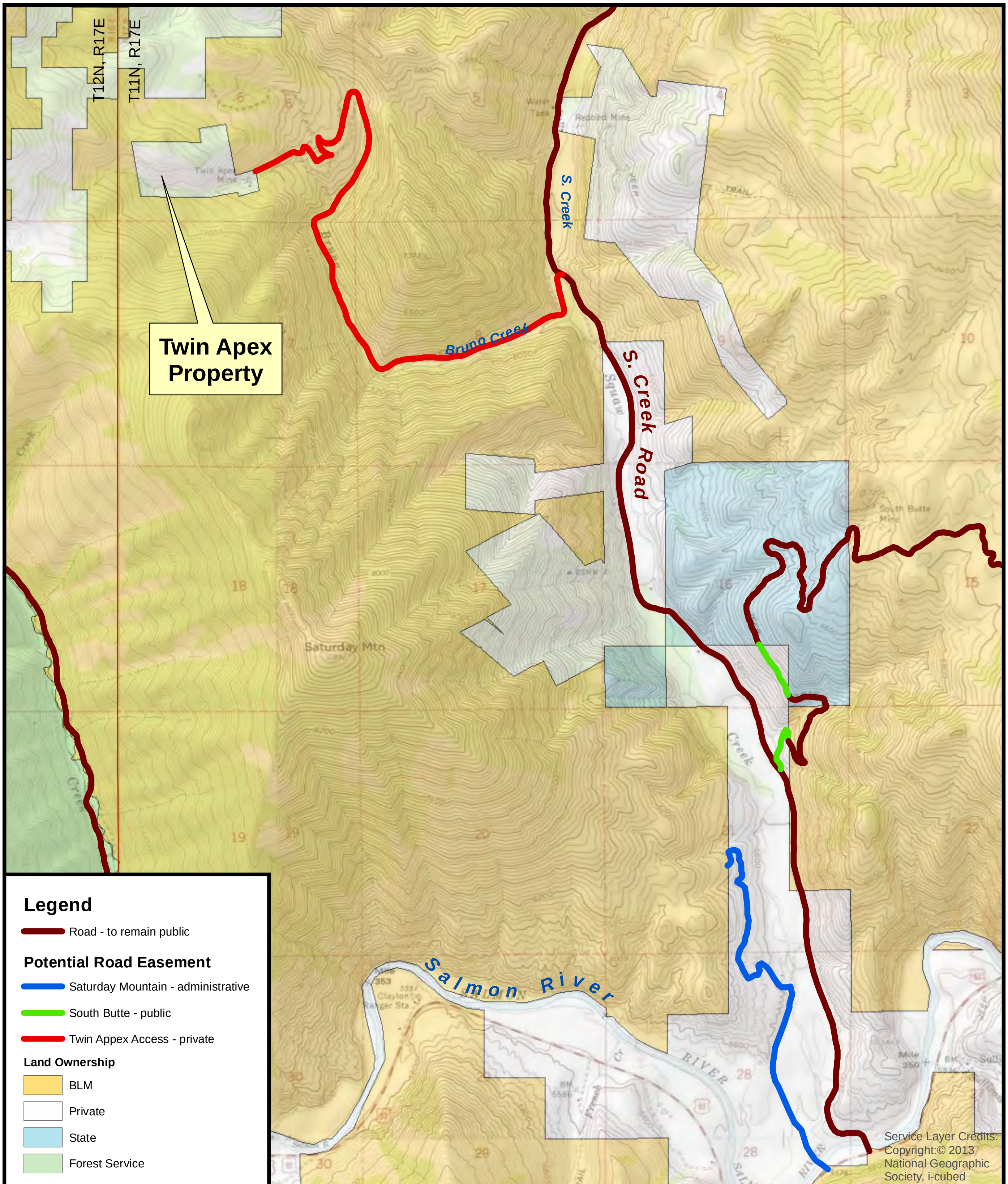
The environmental effects of the land disposal alternatives are described in Chapter 4, and some of the key effects are summarized below (Table 2.2-3).



Selected land, existing mining disturbance from Thompson Creek Mine data, polygons created by Ken Gardner.
Ownership data is at 1:24,000 and created and maintained by the Bureau of Land Management, Idaho State Office, Geographic Sciences.
Topographic background from USGS 7.5' Quadrangles 1:24,000 scale.
Coordinate system UTM Zone 11 NAD 83

No warranty is made by the Bureau of Land Management (BLM) for the use of this data for purposes not intended by the BLM.

Figure 2.2-5
Land Disposal Alternative L5 - Reduced area land exchange with easement
Thompson Creek Mine EIS



Potential Road Easement data developed by Ken Gardner, BLM.
Ownership data is at 1:24,000 and created and maintained by the Bureau of Land Management, Idaho State Office, Geographic Sciences.
Topographic background from USGS 7.5' Quadrangles 1:24,000 scale.
Coordinate system UTM Zone 11 NAD 83

N

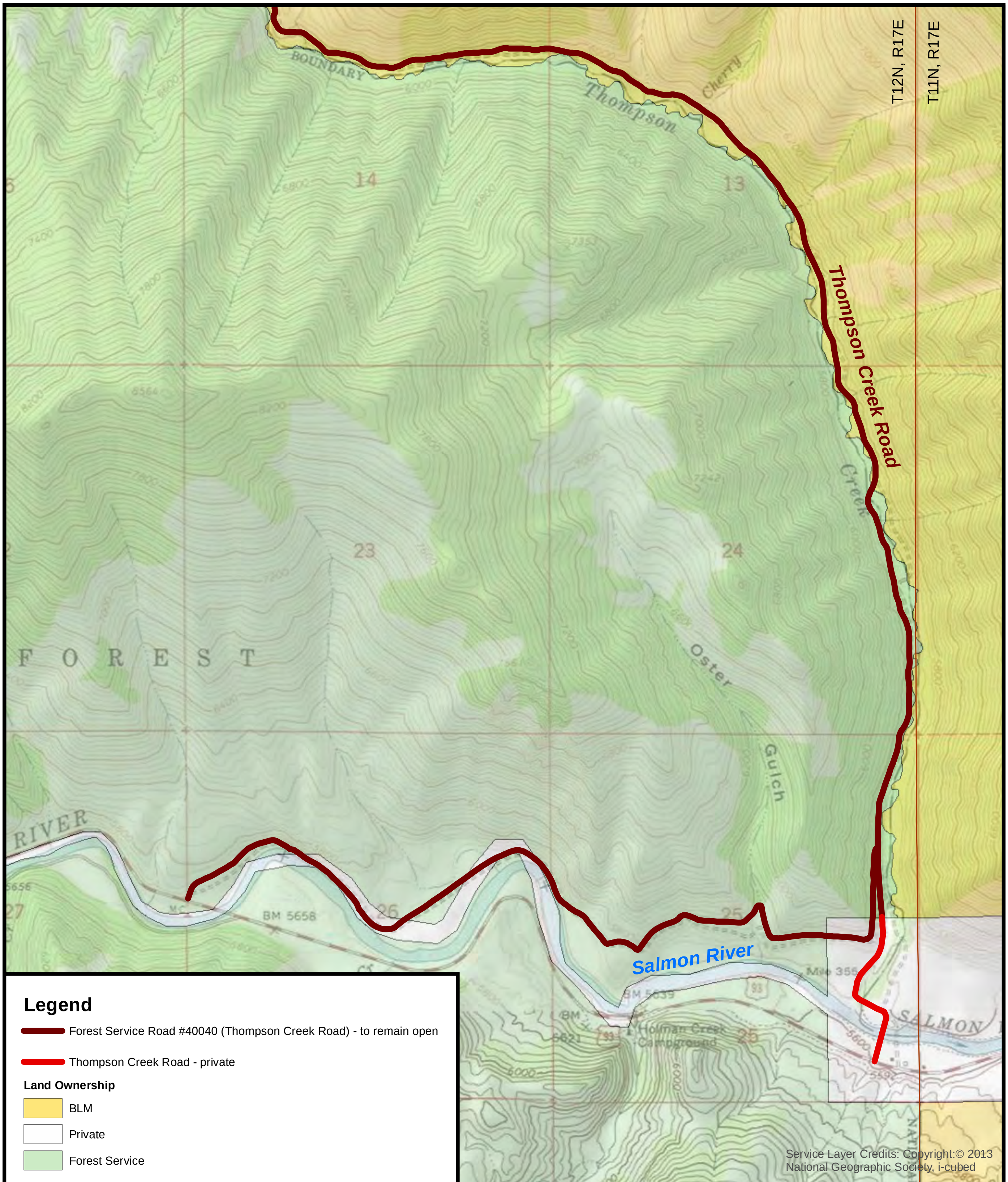
1:36,000

0 Miles 1

0 Kilometers 1

No warranty is made by the Bureau of Land Management (BLM) for the use of this data for purposes not intended by the BLM.

Figure 2.2-6
Land disposal alternatives - potential easement on existing roads
Thompson Creek Mine EIS



Potential Road Easement data developed by Ken Gardner, BLM.
Ownership data is at 1:24,000 and created and maintained by the
Bureau of Land Management, Idaho State Office, Geographic Sciences.
Topographic background from USGS 7.5' Quadrangles 1:24,000 scale.
Coordinate system UTM Zone 11 NAD 83

No warranty is made by the Bureau of Land Management (BLM) for the use of this data for purposes not intended by the BLM.

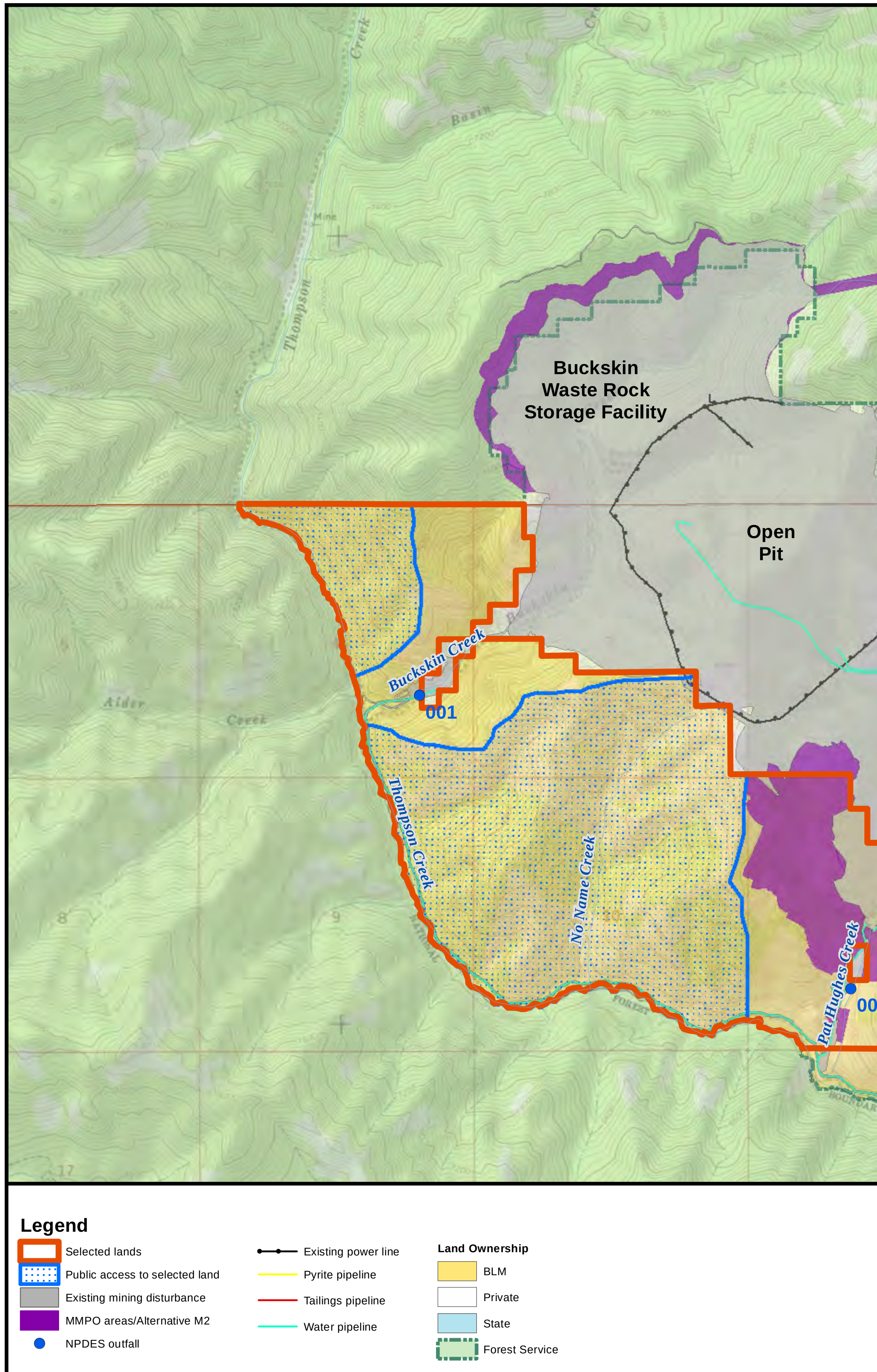
N

1:24,000

0 0.5 Miles

0 1 Kilometers

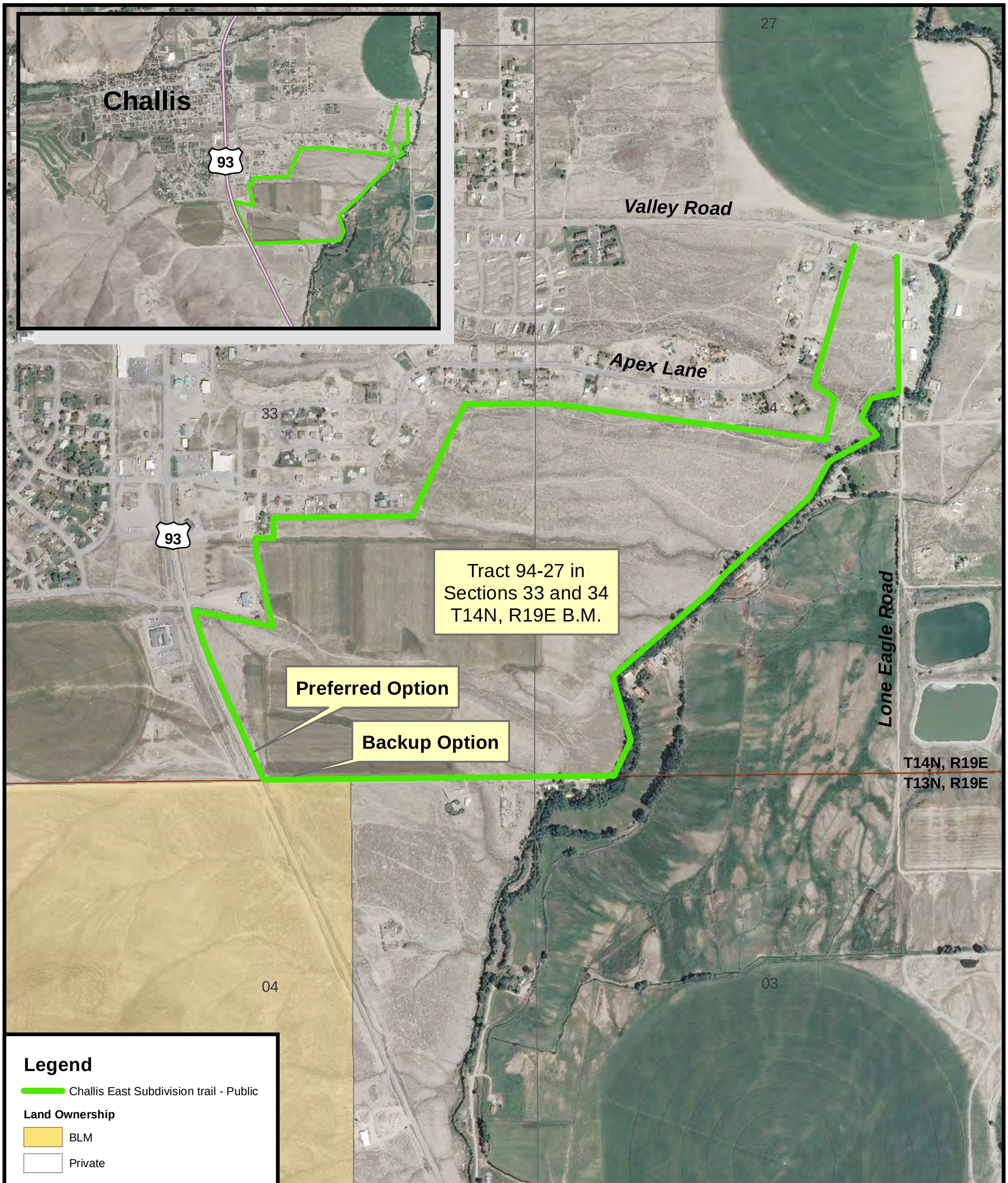
Figure 2.2-7
Land disposal alternatives -
Thompson Creek road access
Thompson Creek Mine EIS



Selected land, existing mining disturbance from Thompson Creek Mine data, polygons created by Ken Gardner.
Ownership data is at 1:24,000 and created and maintaned by the Bureau of Land Management, Idaho State Office, Geographic Sciences.
Topographic background from USGS 7.5' Quadrangles 1:24,000 scale.
Coordinate system UTM Zone 11 NAD 83

No warranty is made by the Bureau of Land Management (BLM) for the use of this data for purposes not intended by the BLM.

Figure 2.2-8
Land disposal alternative - public access to selected land
Thompson Creek Mine EIS



Potential Road Easement data developed by Ken Gardner, BLM.
Ownership data is at 1:24,000 and created and maintained by the Bureau of Land Management, Idaho State Office, Geographic Sciences.
Aerial image NAIP 2009
Coordinate system UTM Zone 11 NAD 83

No warranty is made by the Bureau of Land Management (BLM) for the use of this data for purposes not intended by the BLM.

N

1:12,000

0 — 1,000 Feet

0 — 400 Meters

Figure 2.2-9
Land disposal alternatives - trail easement, Challis East Subdivision
Thompson Creek Mine EIS

Table 2.2-3. Effects comparison for the land disposal alternatives.

Indicator	Alternative L1	Alternative L2	Alternative L3	Alternative L4	Alternative L5
GEOLOGIC RESOURCES AND GEOTECHNICAL ISSUES					
Saleable, locatable or leasable mineral availability	No change to existing conditions	Negligible effect to mineral availability	Same as Alternative L2	Same as Alternative L2	Same as Alternative L2
SOIL RESOURCES					
Acres or % of area of soil compaction, change to productivity, erosion potential	No change to existing conditions	No effects to the selected land. Small areas of soil at ranch could become compacted from parking areas, campgrounds. Under L2-B ~ 52 % of the soil at the ranch would be altered by the conversion to native vegetation.	No effects to the selected or offered lands	No effects to the selected land. Effects to the offered lands would be the same as Alternative L2, except land removed from the transaction would not be subject to potential limited soil compaction from development.	No effects to the selected land. Effects to the offered lands would be the same as Alternative L4.
VEGETATION, FOREST RESOURCES, AND INVASIVE AND NON-NATIVE PLANTS					
Area of special status plant habitat	No change to existing conditions	365 acres of occupied or potentially occupied special status plant habitat on ranch would come under BLM administration	No change to existing conditions	Same as Alternative L2, except the area would change to achieve equal value	Same as Alternative L2, except the area would change to achieve equal value
RANGE RESOURCES					
Area of suitable grazing lands	No change to existing conditions	Decrease of 80 % of suitable grazing lands (major, long term) on selected land	Same as Alternative L2	Decrease of 71 % of suitable grazing lands (major, long term) on selected land	Same as Alternative L2

Indicator	Alternative L1	Alternative L2	Alternative L3	Alternative L4	Alternative L5
Change in AUMs	No change to existing conditions	Decrease of 80 % of AUMs (major, long term) on selected land	Same as Alternative L2	Decrease of 69 % of AUMs (major, long term) on selected land	Same as Alternative L2
WATER RESOURCES					
Water quality (no indicators)	No change to existing conditions	No effect to selected land or Garden Creek property Negligible effect to Salmon River due to sediment delivery from BLM-recommended management such as campground or boat launch; riparian improvements would cause negligible reduction in sediment delivery to Salmon River	No change to existing conditions	Effects would be the same as Alternative L2, except the effects related to subparcels (~ 30 % less by fair market value compared to Alternative L2) that would not be acquired by the US which would not occur	Effects would be the same as Alternative L2, except the effects related to subparcels (~ 10 % less by fair market value compared to Alternative L2) that would not be acquired by the US which would not occur
Water quantity (change in flow)	No change to existing conditions	No effect to selected land or Garden Creek property No change to flow or volume associated with water rights on Broken Wing Ranch	No change to existing conditions	Same as Alternative L2	Same as Alternative L2
WILDLIFE RESOURCES					
Area of special status wildlife habitat	No change to existing conditions	No change to existing conditions	No change to existing conditions	No change to existing conditions	No change to existing conditions

Indicator	Alternative L1	Alternative L2	Alternative L3	Alternative L4	Alternative L5
Hunting pressure	No change to existing conditions	Increased hunting pressure (long-term, minor effect)	No change to existing conditions	Increased hunting pressure (long-term, minor effect)	Increased hunting pressure (long-term, minor effect)
FISH AND AQUATIC RESOURCES					
Amount of suitable habitat	No change to existing conditions	No effect to Garden Creek property; net increase in both suitable habitat and designated critical habitat under BLM jurisdiction	Decrease of 5.3 miles of occupied designated critical habitat under BLM jurisdiction; however, no new disturbance would occur adjacent to streams	Same as Alternative L2	Same as Alternative L2
Habitat quality	No change to existing conditions	No effect to selected land or Garden Creek property; long-term, moderate beneficial effect to aquatic habitat in Lyon Creek and Salmon River	No change to existing conditions	Same as Alternative L2	Same as Alternative L2
WETLANDS, FLOODPLAINS, AND RIPARIAN AREAS					
Area of wetlands	No change to existing conditions	49.69 acres of wetlands would leave Federal jurisdiction; 37.68 acres of wetlands would enter Federal jurisdiction; improvements to riparian areas along Salmon River on the ranch	49.69 acres of wetlands would leave Federal jurisdiction	21.72 acres would leave Federal jurisdiction; unknown area would enter Federal jurisdiction, but would probably be less than 37.68 acres	Same as Alternative L4, except slightly more wetlands would probably enter Federal jurisdiction

Indicator	Alternative L1	Alternative L2	Alternative L3	Alternative L4	Alternative L5
AIR QUALITY, NOISE, AND CLIMATE CHANGE					
Change in noise at ranch and in Lyon Creek	No change to existing conditions	Minor increase in noise due to agricultural activities	No change to existing conditions	Same as Alternative L2	Same as Alternative L2
VISUAL (AESTHETIC) RESOURCES					
Changes in scenery	No change to existing conditions	Subtle visual changes to ranch due to BLM administration	No change to existing conditions	Same as Alternative L2	Same as Alternative L2
LAND USE AND RECREATION					
Area of Federal land	No change to existing conditions	Net decrease of 4,300 acres of Federal land in the BLM Challis Field Office area (negligible effect); net increase of 80 acres in the BLM Pocatello Field Office area (negligible effect)	Net decrease of 5,100 acres of Federal land in the BLM Challis Field Office area (negligible effect)	Decrease of 3,600 acres of Federal land in the BLM Challis Field Office area (selected land); increase of 880 acres less ~ 30 % by fair market value in The BLM Challis and Pocatello Field Office areas	Decrease of 5,100 acres of Federal land in the BLM Challis Field Office area (selected land); increase of 880 acres less ~ 10 % by fair market value in the BLM Challis and Pocatello Field Office areas
Recreational use	No change to existing conditions	Negligible effects due to reduced access to some portions of selected land; public recreation opportunities increased on ranch and Garden Creek property	Same as Alternative L2	Negligible effects due to reduced access to some portions of selected land; public recreation opportunities increased on ranch but less than Alternative L2	Negligible effects due to reduced access to some portions of selected land; public recreation opportunities increased on ranch, less than Alternative L2 but more than Alternative L4

Indicator	Alternative L1	Alternative L2	Alternative L3	Alternative L4	Alternative L5
SOCIOECONOMIC FACTORS					
Tax revenue	No change to existing conditions	Negligible effects to tax revenue	Same as Alternative L2	Same as Alternative L2	Same as Alternative L2
BLM revenue	No change to existing conditions	Negligible effects to BLM revenue	Same as Alternative L2	Same as Alternative L2	Same as Alternative L2
TRIBAL TREATY RIGHTS AND INTERESTS					
Area of unoccupied Federal land	No change to existing conditions	< 1 % decrease in unoccupied Federal land (minor, permanent, adverse)	Same as Alternative L2	Same as Alternative L2	Same as Alternative L2
CULTURAL RESOURCES					
Cultural resource sites	No change to existing conditions	5 NRHP-eligible and 2 potentially eligible sites would come under BLM management (on ranch)	No change to existing conditions	The effect to cultural resource sites would be similar to Alternative L2, but the number of sites would depend on which subparcels were acquired by the US	The effect to cultural resource sites would be similar, but the number of sites would depend on which subparcels were acquired by the US
TRANSPORTATION, ACCESS, AND PUBLIC SAFETY					
Access to grazing allotments	No effect on existing conditions	Access to grazing would increase	No change to existing conditions	Same as Alternative L2	Same as Alternative L2
HAZARDOUS MATERIALS AND HAZARDOUS AND SOLID WASTE					
Chance for releases or dumping on ranch	No effect on existing conditions	Minor increase in potential for dumping (because public land)	No change to existing conditions	Same as Alternative L2	Same as Alternative L2

2.2.9. Monitoring and Mitigation

The BLM would document the baseline condition of the lands subject to conservation easements granted to the BLM. The BLM would monitor these lands (e.g., annual field inspections) to ensure the lands remain in compliance with the easements. In the case of the land disposal action alternatives, the mine would continue to be inspected by a variety of Federal and State agencies, less the BLM[14] (Section 2.1.1.7).

2.2.10. Financial Guarantee

Under the land disposal action alternatives the mine might no longer be subject to the BLM surface management regulations for mining – some facilities such as the Cherry Creek pump station are not on the selected land and would remain on BLM land, but such facilities might be authorized under the FLPMA instead of the General Mining Laws of the US and the BLM surface management regulations. In such case, the financial guarantee(s) held by the BLM would be replaced with an equivalent financial guarantee(s) held by the IDL. However, the IDL may not have the authority to hold a financial guarantee for long-term water quality or other long-term, post-mining maintenance. Consequently, any ROD approving the land exchange would be conditional on TCMC establishing an irrevocable trust fund or other funding mechanism with the IDL for such long-term water treatment or other long-term requirements. The trust fund or funding mechanism would be identical or similar to that required by 43 CFR 3809.552(c) (Section 1.9.21., Section 4.13.4).

2.2.11. Land Disposal Alternatives Considered but Eliminated from Further Analysis

Additional Alternatives for Offered Lands

The BLM considered reducing the area of the selected land to only that land on which surface disturbance would occur under the MMPO alternatives. However, such would produce a spider-web of intertwined BLM and private lands that could not reasonably be managed, e.g., “islands” and long, narrow, irregular strips of land. Alternative L4 is the most reasonable “minimal area” alternative.

The BLM could develop additional land disposal alternatives involving private lands other than those offered by TCMC. Such alternatives would provide other options for the BLM to obtain private lands which possess resource qualities considered to be of substantial value to the public, e.g., wetlands in the Chilly Slough locality or other private land containing perennial streams. However, the BLM cannot require a proponent to offer a particular property, and will not evaluate a land exchange for which the proponent does not reasonably control offered lands with a fair market value similar to that of the selected lands. For these reasons, it is outside the scope of the project to evaluate a land disposal alternative with private lands other than those offered by TCMC.

[14] Mine inspections and enforcement actions are administrative matters and not NEPA issues. Consequently, the MMPO and land exchange proposed by TCMC must be evaluated in the NEPA process as described by the proponent. For example, the analysis may not speculate “What if the proponent does not abide by the terms and conditions of an approved plan of operations?”

Return Broken Wing Ranch Passively to Native Vegetation

Under this component of all of the land disposal action alternatives, the Broken Wing Ranch would be returned to native vegetation with no irrigated agriculture and all existing roads would be reclaimed. The irrigation equipment would be removed and the ranch would be ploughed and/or treated with herbicide and seeded with native vegetation. However, 100 years of agriculture has fundamentally altered the chemistry of soil at the ranch, and experience in Custer County has shown that such attempted conversions lead to substantial noxious weed infestations and increased soil erosion within a few years unless major replanting and weed eradication efforts are made each year for decades. An active conversion to native vegetation is analyzed in this DEIS as Alternative L2-B (sub-alternative to Alternative L2) (Section 2.2.2).

Move Selected Land Boundary 500 yards East and North of Thompson Creek

This alternative, obtained from public scoping, was proposed to allow cattle grazing of the riparian habitat along Thompson Creek to continue to be permitted by the BLM. Under this alternative the boundary of the selected land would be moved 500 yards east and north of the centerline of Thompson Creek, leaving a 500 yard wide strip of BLM land between private land and the Forest Service boundary along the centerline of Thompson Creek. Creating such a long and narrow strip of BLM land would distinctly conflict with the fundamental land management objective of obtaining/maintaining block ownership for efficient and practicable land management (Section 2.2). Similarly, but with a goal to protect the Thompson Creek riparian area, the agencies considered if a strip of land (⅛ mile wide) could be incorporated into the adjacent SCNF (i.e., the land would continue to be part of a relatively large block of Federal land, but administered by the Forest Service under Forest Service laws and regulations). However, this alternative would require an act of Congress to modify the boundary of the SCNF. The agencies also considered that the strip of land (⅛ mile wide) could remain Federal land under BLM laws, regulations, the Challis RMP, etc., but the Forest Service would administer the strip of land on behalf of the BLM. This variation of the alternative would be administratively cumbersome to the point where the alternative would not be feasible (e.g., perpetual interagency agreements; Forest Service personnel would need to learn BLM laws, regulations, applicable guidance, etc).

Reduced Area Land Exchange, Conservation Easement Strategy

Under this alternative the selected land would be reduced from approximately 5,100 acres to 3,600 acres as under Alternative L4. However, instead of correspondingly reducing the fair market value of the offered lands by reducing their area, their fair market value would be correspondingly reduced via a conservation easement, e.g., substantial public access and land preservation conditions on large portions or all of the Broken Wing Ranch. The offered lands would thus comprise fee simple title to the Garden Creek property and a perpetual conservation easement running with the ranch (or portions of the ranch with fee simple title offered for the remaining area of the ranch depending on the necessary fair market value). That is, TCMC would own the ranch with greatly reduced fair market value, and the BLM would own a conservation easement with great public value. Upon completion of such land exchange, TCMC would probably sell its remaining ownership in the ranch to another private party, and the BLM would be responsible for administering the easement. However, the complexities of trying to establish the “arm’s length” fair market value of such easement, the challenges in long-term management of a conservation easement, and the probable elimination of the recreation site and Boise State University field station options make this alternative technically impractical and not desirable by the BLM.