Joint Final Environmental Impact Statement

Montanore Project

December 2015

Cabinet Mountains *Photo by M. Holdeman*

Volume 1

Summary

United States Department of Agriculture
Forest Service
Northern Region
Kootenai National Forest

Montana Department of
Environmental Quality

United States Department of Agriculture | **Forest Service** | **Kootenai National Forest** | **31374 US Highway 2 Libby, MT 59923-3022**

Montana Department of Environmental Quality | **PO Box 200901 Helena, MT 59620-0901**

File Code: 1950
December 15, 2015

Dear Interested Party,

The Kootenai National Forest (KNF) and the Montana Department of Environmental Quality (DEQ) have issued a Joint Final Environmental Impact Statement (Final EIS) for the Montanore Project, a proposed copper and silver underground mine located about 18 miles south of Libby near the Cabinet Mountains of northwestern Montana. A CD of the Joint Final EIS and appendices is enclosed. If you requested a hard copy it will be sent to you within approximately two weeks. The document can be downloaded from the Forest Service's web page (http://www.fs.usda.gov/projects/kootenai/landmanagement/projects) or the DEQ's web page (http://deq.mt.gov/eis.mcpx). The document will be available to view at the KNF Supervisor's office in Libby, Montana (MT), the DEQ office in Helena, MT, the Mansfield Library (the University of Montana), and local libraries in Libby, Heron, and Thompson Falls, MT, and Sandpoint and Clark Fork, Idaho.

The KNF and DEQ issued a Draft EIS for the Montanore Project on February 27, 2009, for public comment. In response to public comment, the agencies revised the mine alternatives (Alternatives 3 and 4) and transmission line alignments (Alternatives C, D, and E) and issued a Supplemental Draft EIS on October 7, 2011. On April 1, 2015, the KNF issued a Final EIS and a Draft Record of Decision (ROD) to provide for a pre-decisional objection process in compliance with 36 CFR 218. The Joint Final EIS includes responses to comments on the Draft EIS and Supplemental Draft EIS and incorporates changes based on those responses. The Joint Final EIS also includes revisions made as part of the Forest Service objection process. The document describes the Proposed Action and a number of alternatives to the Proposed Action. All action alternatives meet the purpose and need for the project (summarized in Section 1.2.3 of the Joint Final EIS). The document also describes the potentially affected environment and discloses the potential environmental consequences of implementing the Proposed Action or alternatives to the Proposed Action.

The KNF has identified Mine Alternative 3 (the Agency Mitigated Poorman Impoundment Alternative) and Transmission Line Alternative D-R (the Miller Creek Transmission Line Alternative) as its preferred alternatives in the Joint Final EIS. The KNF will set forth its final decision and rationale in its ROD. Pursuant to 40 CFR 1506.10, the KNF will issue its ROD no less than 30 days from the publication of the Notice of Availability of this Joint Final EIS in the Federal Register. Notice of the decision will be published in *The Missoulian* (Missoula, Montana), the paper of record for the KNF.

DEQ has identified Mine Alternative 3 and Transmission Line Alternative D-R as its preferred alternatives in the Joint Final EIS. DEQ will set forth its final decision and rationale in its ROD. Pursuant to ARM 17.4.620, DEQ may issue its ROD no less than 15 days from the transmittal of this Joint Final EIS to the public, the Environmental Quality Council, and the office of the Governor. DEQ has decided to issue its ROD no sooner than January 29, 2016. Notice of DEQ's mine and transmission line decisions will be posted on DEQ's website and included in the KNF's notice of its decision in *The Missoulian*.

Postcards will be sent notifying all those who received the Joint Final EIS that the agencies' RODs are available on the agencies' websites. Thank you for taking time to be involved with the Montanore Project. For more information, please contact one of the Project Coordinators: Lynn Hagarty, Kootenai National Forest, 31374 US 2, Libby, MT 59923-3022, 406-293-6211; or Craig Jones, Director's Office, DEQ, 1520 East Sixth Avenue, Helena, MT 59620-0901, 406-444-0514.

Sincerely,

Christopher S. Savage
Forest Supervisor
Kootenai National Forest

Tom Livers
Director
Montana Department of Environmental Quality

Encl.: CD: Joint Final EIS

Final Environmental Impact Statement For The Montanore Project

Kootenai National Forest
Lincoln County, MT

Lead Agencies:	USDA Forest Service, Kootenai National Forest Montana Department of Environmental Quality	
Cooperating Agencies:	U.S. Army Corps of Engineers Bonneville Power Administration Lincoln County, Montana	
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Abstract: The Montanore Project Joint Final Environmental Impact Statement describes the land, people, and resources potentially affected by Montanore Minerals Corporation's proposed copper and silver mine (Montanore Project). As proposed, the project would consist of eight primary components: the use of an existing evaluation adit, an underground mine, a mill, three additional adits and portals, a tailings impoundment, access roads, a transmission line, and a rail loadout. Three mine alternatives and a No Action Alternative (No Mine) and four transmission line alternatives, plus a No Action Alternative (No Transmission Line), are analyzed in detail.

The Kootenai National Forest will use the analysis to determine whether to issue approvals necessary for construction and operation of the Montanore Project. The mine is currently covered by an existing state operating permit and Montanore Minerals Corporation requested an amendment of the permit. The Department of Environmental Quality will use the analysis to determine whether to approve an amendment to the existing state operating permit for the mine and whether to issue a certificate for the construction of the transmission line. The preferred mine alternative is Alternative 3, Agency Mitigated Poorman Impoundment Alternative and the preferred transmission line alternative is Alternative D-R, North Miller Transmission Line Alternative. The U.S. Army Corps of Engineers will use the analysis to assist in making a decision to allow construction of certain project facilities in waters of the U.S. The Bonneville Power Administration will use the analysis to decide whether to build a new electrical substation and transmission loop line, and to provide power to its customer, Flathead Electric Cooperative. Flathead Electric Cooperative would provide power to the mine.

The Kootenai National Forest completed an administrative review of the draft Record of Decision in accordance with the requirements of 36 Code of Federal Regulations 218. The Kootenai National Forest will issue a Record of Decision on the project no sooner than 30 days after a Notice of Availability of the Final Environmental Impact Statement is published in the Federal Register. The Department of Environmental Quality will issue a Record of Decision on the project no sooner than 15 days after the Final Environmental Impact Statement is transmitted to the public, the office of the Governor, and the Environmental Quality Council.

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Summary

Purpose and Need for Action

Background

This document presents a summary of the Final Environmental Impact Statement (Final EIS) for the proposed Montanore Project. As a summary, it cannot provide all of the detailed information contained in the Final EIS. If more detailed information is desired, please refer to the Final EIS and the referenced reports. For any remaining questions or concerns, contact the individuals listed in the last section of this summary, *Where to Obtain More Information.*

The U.S. Department of Agriculture (USDA), Kootenai National Forest (KNF), and the Montana Department of Environmental Quality (DEQ) have prepared the Final EIS in compliance with the National Environmental Policy Act (NEPA) and the Montana Environmental Policy Act (MEPA). These laws require that if any action taken by the DEQ or the KNF may "significantly affect the quality of the human environment," an environmental impact statement must be prepared. The Final EIS also has been prepared in compliance with the USDA NEPA regulations (7 Code of Federal Regulations (CFR) 1b), the Forest Service's NEPA compliance regulations (36 CFR 220), the Forest Service's Environmental Policy and Procedures Handbook (Forest Service Handbook 1909.15), DEQ's MEPA regulations (Administrative Rules of Montana (ARM) 17.4.601 *et seq.*), and the U.S. Army Corps of Engineers' (Corps) NEPA implementation procedures for its regulatory program (Appendix B of 33 CFR 325). The Final EIS serves as a report required by the Major Facility Siting Act (MFSA) (75-20-216, Montana Code Annotated (MCA)). Two "lead" agencies are responsible for the analysis of the project: the KNF and the DEQ. Cooperating agencies are the Bonneville Power Administration (BPA), Corps, and Lincoln County, Montana. A single EIS for the Montanore Project is being prepared to provide a coordinated and comprehensive analysis of potential environmental impacts. Before construction and operation of the proposed project could begin, various other permits, licenses, or approvals from the two lead agencies and other agencies would be required.

Mines Management, Inc. (MMI) proposes to construct a copper and silver underground mine and associated facilities, including a new transmission line. Montanore Minerals Corp. (MMC), a wholly-owned subsidiary of MMI, would be the project operator. The proposed project is called the Montanore Project. MMI has requested the KNF to approve a Plan of Operations for the Montanore Project. From the DEQ's perspective, the mining operation is covered by a DEQ Operating Permit first issued by the Montana Department of State Lands (DSL) to Noranda Minerals Corp. (NMC). MMC applied to the DEQ for an amendment of the existing operating permit to incorporate aspects of the Plan of Operations submitted to the KNF that are different from the DEQ Operating Permit. MMC has also applied to the DEQ for a certificate of compliance to allow for construction of the transmission line.

The KNF and the DEQ issued a Draft EIS for the Montanore Project on February 27, 2009 for public comment. In response to public comment, the agencies revised the agencies' mine alternatives (Alternatives 3 and 4) and transmission line alignments (Alternatives C, D, and E) and issued a Supplemental Draft EIS in 2011. Most of the changes to the mine alternatives in the

Supplemental Draft EIS addressed issues associated with water quality. The agencies' proposed monitoring and mitigation plans (Appendix C) also were revised. The transmission line alignments were modified primarily to avoid effects on private land. To avoid confusion between the transmission line alignments presented in the Draft EIS and those presented in the Supplemental Draft EIS, the agencies designated the revised transmission line alternatives as Alternatives C-R, D-R, and E-R. The alignment of Alternatives C-R, D-R, and E-R was modified between the Supplemental Draft EIS and the Final EIS so a 2-mile segment would cross the Fisher River about 800 feet north of the alignment presented in the Supplemental Draft EIS.

The discovery of mineral deposits for the Montanore Project dates back to the early 1980s. In 1980, Heidelberg Silver Mining Company (Heidelberg) located certain mining claims in Sections 29 and 30 of Township (T) 27 North, Range (R) 31 West, M.M., Sanders County, Montana. Subsequently, in 1983, Pacific Coast Mines, Inc. (Pacific), a subsidiary of U.S. Borax and Chemical Corporation, located other mining claims in Sections 29 and 30 of Township 27N, Range 31 West, M.M., Sanders County, Montana. The mining claims located by Pacific in 1983 included the lode mining claims (HR) Hayes Ridge 133 and HR 134 adjacent to Rock Lake. (These claims are shown on Figure 11 in the EIS.) The outcrop contained stratabound copper-silver mineralization, extending over a 200-foot vertical thickness.

In 1984, Pacific leased Heidelberg's mining claims pursuant to the terms of a 1984 Lease and Option to Purchase Agreement (Lease Agreement). Subsequently, in 1988, Heidelberg was merged into Newhi, Inc. (Newhi), a subsidiary of Mines Management, Inc. (MMI). As a result of that merger, Newhi became the successor in interest to Heidelberg under the Lease Agreement. Also in 1988, Pacific assigned its interest in HR 133 and HR 134 and its interest in the Lease Agreement to Noranda Minerals Corporation, a Delaware based corporation and wholly owned subsidiary of Noranda Finance Inc. (Noranda Finance), part of Noranda, Inc.

In 2002, NMC terminated the Lease Agreement with Newhi. Pursuant to the terms of that agreement, NMC conveyed its interest in HR 133 and HR 134 to Newhi. In 2006, Newhi acquired all of the issued and outstanding shares of NMC. Immediately following the acquisition of NMC, NMC's name was changed to Montanore Minerals Corporation (MMC). MMI has unpatented mining, mill site, and tunnel claims on National Forest System lands that cover the proposed mine development.

The permitting process for the Montanore Project began in 1989 when NMC obtained an exploration license from the Montana Department of State Lands (DSL) and other associated permits for construction of an exploration adit from private land in upper Libby Creek. Soon after obtaining the exploration license, NMC began excavating the Libby Adit. NMC also submitted a "Petition for Change in Quality of Ambient Waters" (Petition) to the Board of Health and Environmental Sciences (BHES) requesting an increase in the concentration of select constituents in surface water and groundwater above ambient water quality, as required by Montana's 1971 nondegradation statute. After constructing about 14,000 feet of the Libby Adit, NMC ceased construction in 1991 in response to elevated nitrate concentration in surface water and low metal prices.

Although exploration adit construction ceased in 1991, the permitting process continued. Specifically, the KNF, the Montana Department of Health and Environmental Sciences (DHES), the Montana Department of Natural Resources and Conservation (DNRC), and the DSL, DEQ's predecessor agency, prepared a Draft, Supplemental Draft, and Final EIS on the proposed project.

The environmental review process culminated in 1992 with BHES's issuance of an Order approving NMC's Petition (BHES 1992) and the DSL's issuance of a Record of Decision (ROD) and Hard Rock Operating Permit #00150 (DSL 1992) to NMC. In 1993, the KNF issued its ROD (KNF 1993a), the DNRC issued a Certificate of Environmental Compatibility and Public Need under MFSA (DNRC 1993), and the U.S. Army Corps of Engineers issued a 404 permit (Corps 1993). These decisions approved mine and transmission line alternatives that allowed for the construction, operation, and reclamation of the project.

The BHES Order, issued to NMC in 1992, authorized degradation and established limits in surface water and groundwater in the Libby, Poorman, and Ramsey Creek watersheds adjacent to the Montanore Project for discharges from the project (BHES 1992). The Order established numeric limits for total dissolved solids, chromium, copper, iron, manganese, and zinc (both surface water and groundwater), as well as nitrate (groundwater only), and total inorganic nitrogen (surface water only). Pursuant to BHES's Order, these limits remain in effect during the operational life of the mine and for so long thereafter as necessary (BHES 1992). The Order also adopted the modification developed in Alternative 3, Option C, of the Final EIS, addressing surface water and groundwater monitoring, fish tissue analysis, and in-stream biological monitoring. The Order is presented in Appendix A in the EIS.

In 1997, the DEQ issued a Montana Pollutant Discharge Elimination System (MPDES) permit to NMC (MT0030279) to allow discharges of water flowing from the Libby Adit to Libby Creek. Three outfalls were included in the permit: Outfall 001 – percolation pond discharging to groundwater; Outfall 002 – drainfield with three infiltration zones discharging to groundwater; and Outfall 003 – pipeline outlet to Libby Creek. Surface discharge from the exploration adit ceased in 1998 and water in the adit flowed to the underlying groundwater. The DEQ renewed the MPDES permit in 2006. A minor modification of the MPDES permit in 2008 reflected an owner/operator name change from NMC to MMC. In 2010, MMC applied to the DEQ to renew the existing MPDES permit and requested the inclusion of five new stormwater outfalls under the permit. MMC submitted supplemental information in 2011. In 2011, the DEQ determined the renewal application was complete and administratively extended the permit (ARM 17.30.1313(1)) until MMC receives the renewed permit. The DEQ issued a draft renewal MPDES permit in July 2015 and held a public hearing on the draft renewal permit in August 2015. The DEQ will issue a final MPDES permit with its ROD. MMC also held MPDES permit MTR104874 for stormwater discharges from the Libby Adit Site. These discharges were incorporated into the draft renewal MPDES permit.

Apart from the permitting process, NMC filed an application for patent with the Bureau of Land Management (BLM) in 1991 for lode claims HR 133 and HR 134 (Patent Application MTM 80435). In 1993, the BLM issued a Mining Claim Validity Report recommending that a patent be issued to NMC for HR 133 and HR 134. In 2001, the BLM issued a patent to NMC for the portion of HR 134 that lies outside the Cabinet Mountains Wilderness (CMW) (Patent Number 25-2001-0140). The BLM issued a separate patent to NMC for the mineral deposits for HR 133 and the portion of HR 134 that lies inside the CMW (Patent Number 25-2001-0141).

As discussed above, NMC conveyed its interests in lode claims HR 133 and HR 134 to Newhi in 2002. By that time, many of NMC's permits for the Montanore Project were relinquished, terminated or expired, such as DEQ's air quality permit, the Corps' 404 permit, KNF's approval, and the State's certification of the transmission line. In 2002, NMC notified the KNF it was relinquishing the approval to operate and construct the Montanore Project. NMC's DEQ

Operating Permit #00150 and MPDES permit remain in effect because reclamation of the Libby Adit was not completed.

Proposed Action

In 2004, MMI submitted an application for a hard rock operating permit to the DEQ and a proposed Plan of Operations for the Montanore Project to the KNF. In 2005, MMI also submitted to the DEQ an application for a 230-kV transmission line certificate of compliance, an application for an air quality permit, and an application for a renewed MPDES permit that covered additional discharges not currently permitted under the existing MPDES permit.

In 2006, Newhi acquired all of the issued and outstanding shares of NMC pursuant to the terms of a Stock Transfer Agreement between Noranda Finance, Newhi, and MMI. The name of NMC was changed to MMC immediately following Newhi's acquisition of NMC's shares, and MMC (formerly NMC) remains the holder of DEQ Operating Permit #00150 and the MPDES permit for the Montanore Project.

MMI and MMC advised the agencies that MMC will be the owner and operator of the Montanore Project. Consistent with that indication, Newhi has re-conveyed HR 133 and HR 134 to MMC, and MMI and MMC have requested that the DEQ consider MMI's application for a hard rock operating permit as an application by MMC for modification to DEQ Operating Permit #00150. MMC submitted an updated Plan of Operations to the agencies in 2008 that clarified differences between the 2005 Plan of Operations and DEQ Operating Permit #00150. It also incorporated plans required by DEQ Operating Permit #00150 and additional environmental data collected since 2005. With minor exceptions, MMC proposes to construct, operate, and reclaim a new mine in accordance with the terms and conditions of DEQ Operating Permit #00150 and in accordance with the terms and conditions of the other agencies' permits and approvals issued to NMC in 1992 and 1993. MMC's requested changes to DEQ Operating Permit #00150 are:

- Construction of an additional underground ventilation infrastructure that would disturb about 1 acre of private land near Rock Lake
- Relocation of the concentrate loadout facility to the Kootenai Business Park located in Libby (private land) resulting in less than 1 acre of disturbance
- Other minor amendments that may be required to conform Operating Permit No. 00150 to the anticipated record of decision of the KNF concerning the Montanore Project

In order for DEQ to consider the latter category of amendments, MMC indicated its desire that the DEQ participate in the KNF's preparation of an EIS under NEPA.

MMC requested a revision to its operating permit that involved the relocation of fuel and oil storage areas at the Libby Adit and the addition of more fuel storage capacity. The DEQ approved the revision in 2009 (MR 08-001).

MMC's Plan of Operations is considered as a new proposed Plan of Operations by the KNF because NMC relinquished the federal approval to construct and operate the Montanore Project in 2002. Both the KNF and the DEQ consider MMC's proposed 230-kV North Miller Creek transmission line, Sedlak Park Substation (adjacent to BPA's Noxon-Libby transmission line), and a loop line to the Noxon-Libby transmission line to be part of the Proposed Action as the 1993

Certificate of Environmental Compatibility and Public Need for the 230-kV transmission line expired.

Libby Adit Evaluation Program

Following the acquisition of NMC and DEQ Operating Permit #00150, MMC submitted, and the DEQ approved in 2006, two requests for revisions to DEQ Operating Permit #00150 (MR 06-001 and MR 06-002). The revisions involved reopening the Libby Adit and re-initiating the evaluation drilling program that NMC began in 1989. The key elements of the revisions include: excavation of the Libby Adit portal; initiation of water treatability analyses; installation of ancillary facilities; dewatering of the Libby Adit decline; extension of the current drift; and underground drilling and sample collection.

The KNF determined the activities associated with the Libby Adit evaluation drilling were a new proposed Plan of Operations under its Locatable Minerals Regulations (36 CFR 228 Subpart A), and that MMC needed KNF approval before dewatering and continuing excavation, drilling, and development work at the Libby Adit. Under the authority of revision 06-002 of the DEQ operating permit, MMC installed a Water Treatment Plant and is treating water from the adit.

In 2006, the KNF initiated an analysis that included public scoping for the proposed road use and evaluation drilling at the Libby Adit Site. In 2008, the KNF decided the best approach for disclosing the environmental effects of the Libby Adit evaluation program was to consider the activity as the initial phase of the overall Montanore Project in this EIS. The Libby Adit evaluation program would be the first phase of the Montanore Project in Alternatives 3 and 4.

Purpose and Need

The Forest Service's and DEQ's overall purpose and need is to process MMC's Plan of Operations, permit applications and application for amendment of DEQ Operating Permit #00150, and follow all applicable laws, regulations, and policies pertaining to each pending application. The need, from the perspective of the Forest Service, is to:

- Respond to MMC's proposed Plan of Operations to develop the Montanore copper and silver deposit
- Ensure the selected alternative would comply with other applicable federal and state laws and regulations
- Ensure the selected alternative, where feasible, would minimize adverse environmental impacts on National Forest System surface resources
- Ensure measures would be included, where practicable, that provide for reclamation of the surface disturbance

The Corps is required to consider and express the activity's underlying purpose and need from the applicant's and public's perspectives. From the Corps' perspective, the underlying project purpose is to provide copper and silver from deposits contained in northwestern Montana to meet a portion of current and future public demands.

The MEPA and its implementing rules ARM 17.4.601 *et seq.*, require that EISs prepared by state agencies include a description of the purpose and benefits of the proposed project. MMC's project purpose is described below. Benefits of the proposed project include increased employment in the project area, increased tax payments, and the production of copper and silver to help meet public demand for these metals. The MFSA (75-20-101 *et seq.*, MCA) and an implementing rule, ARM 17.20.920, require that the DEQ determine the basis of the need for a facility and that an application for an electric transmission line contain an explanation of the need for the facility. No electrical distribution system is near the project area. The nearest electrical distribution line parallels US 2 and it is not adequate to carry the required electrical power. A new transmission line is needed to supply electrical power to construct, operate, and reclaim the proposed mine facilities.

BPA's transmission system in northwestern Montana provides reliable power to BPA's customers, including Flathead Electric Cooperative. BPA has a need therefore to improve its transmission system to ensure continued reliable electrical power for all of its customers. BPA's purposes are goals to be achieved while meeting the need for the project; the goals are used to evaluate the alternatives proposed to meet the need.

MMC's project purpose is to develop the Montanore copper and silver deposit by underground mining methods with the expectation of making a profit. MMC's need is to receive all necessary governmental approvals and authorizations to construct, operate, and reclaim the proposed Montanore Mine and the associated transmission line, and all other incidental facilities. MMC proposes to construct, operate, and reclaim the Montanore Project in an environmentally sound manner, subject to reasonable mitigation measures designed to avoid or minimize environmental impacts on the extent practicable.

Decisions

The KNF Supervisor will issue a decision on MMC's proposal in a ROD. The decision objective is to select an action that meets the legal rights of MMC, while protecting the environment in compliance with applicable laws, regulations, and policy. The KNF Supervisor will use the EIS process to develop the necessary information to make an informed decision as required by 36 CFR 228, Subpart A. The Corps will decide whether to issue a 404 permit based on MMC's 404 permit application and information in this EIS. MMC submitted a Section 404 permit application to the Corps for the alternatives preferred by the lead agencies (Mine Alternative 3 and Transmission Line Alternative D-R). The Corps will issue a ROD or a Statement of Findings on its permit decision. The BPA will prepare a decision document stating its intent to construct or not construct the new Sedlak Park Substation and loop line from its Noxon-Libby 230-kilovolt (kV) transmission line. The DEQ will issue a ROD or certificate containing its decisions pursuant to each of the project-related permit applications including MMC's MFSA certificate of compliance application, MPDES, air quality, and other permit or renewal applications, and a decision on MMC's application for amendment of DEQ Operating Permit #00150.

The KNF submitted two Biological Assessments to the U.S. Fish and Wildlife Service (USFWS) that describes the potential effect on threatened and endangered species that may be present in the area. After review of the Biological Assessments and consultation, the USFWS issued biological opinions for the proposed project. In 2014, the USFWS determined the KNF's proposed action (implementing Mine Alternative 3 and Transmission Line Alternative D-R):

- Is not likely to jeopardize the continued existence of the grizzly bear
- Is not likely to jeopardize the continued existence of the lynx
- Is not likely to jeopardize the continued existence of the bull trout

- Is not likely to destroy or adversely modify bull trout critical habitat

Public Involvement

A Notice of Intent was published in the Federal Register on July 15, 2005. The Notice described KNF and DEQ's intent to prepare an EIS for the proposed Montanore Project, set the dates for public scoping meetings, and solicited public comments. In addition, as part of the public involvement process, the lead agencies issued press releases, mailed scoping announcements, and held three public meetings. Based on the comments received during public scoping, the KNF and the DEQ identified seven key issues that drove alternative development. The key issues that led the lead agencies to develop alternatives to the Proposed Action were:

- Issue 1: Potential for acid rock drainage and metal leaching
- Issue 2: Effects on quality and quantity of surface water and groundwater resources
- Issue 3: Effects on fish and other aquatic life and their habitats
- Issue 4: Changes in the project area's scenic quality
- Issue 5: Effects on threatened and endangered wildlife species
- Issue 6: Effects on wildlife and their habitats
- Issue 7: Effects on wetlands and streams

The KNF and the DEQ issued a Draft EIS for the Montanore Project on February 27, 2009, for public comment. In response to public comment, the agencies revised the agencies' mine alternatives (Alternatives 3 and 4) and transmission line alignments (Alternatives C-R, D-R, and E-R) and issued a Supplemental Draft EIS on October 7, 2011.

Alternatives

Alternatives were developed based on requirements for alternatives under regulations implementing NEPA, MEPA, MFSA, and Section 404 of the Clean Water Act. To develop a reasonable range of alternatives, the agencies separated the proposed Montanore Project into components. Components are discrete activities or facilities (*e.g.,* plant site or tailings impoundment) that, when combined with other components, form an alternative. Options were identified for each component. An option is an alternative way of completing an activity, or an alternative geographic location for a facility (component), such as alternative geographic locations for a tailings impoundment or transmission line, or an alternative method of tailings disposal, such as paste tailings. Options generate the differences among alternatives. An alternative is a complete project that has all the components necessary to fulfill the project purpose and need. The agencies considered options for the following project components:

- Underground mine
- Plant site and adits
- Tailings disposal, including both backfilling and surface disposal
- Land application disposal areas
- Access road
- Transmission line

Besides a No Action and a Proposed Action for both the mine facilities and transmission line, the lead agencies analyzed in detail two mine alternatives and three transmission line alternatives.

Mine Alternatives

Alternative 1—No Action, No Mine

In this alternative, MMC would not develop the Montanore Project, although it is approved under DEQ Operating Permit #00150. The Montanore Project, as proposed, cannot be implemented without a corresponding Forest Service approval of a Plan of Operations. The environmental, social, and economic conditions described in Chapter 3 would continue, unaffected by the construction and operation of the mine or a transmission line. The DEQ's Operating Permit #00150 and revised in revisions 06-001, 06-002, and 08-001 would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that did not affect National Forest System surface resources. The conditions under which the Forest Service could select the No Action Alternative or the DEQ deny MMC's applications for MPDES and air quality permits, transmission line certificate, and MMC's operating permit modifications are described in section 1.6, *Agencies Roles, Responsibilities, and Decisions* of Chapter 1 of the Final EIS.

Alternative 2—MMC's Proposed Mine

As proposed by MMC, the Montanore Project would consist initially of a 12,500-tons-per-day underground mining operation that would expand to a 20,000-tons-per-day rate. The surface mill (the Ramsey Plant Site) would be on National Forest System lands outside of the CMW in the Ramsey Creek drainage. The proposed project also would require constructing about 16 miles of high-voltage electric transmission line from a new substation adjacent to BPA's Noxon-Libby transmission line to the project site. The 230-kilovolt (kV) transmission line alignment would be from the Sedlak Park Substation in Pleasant Valley along US 2, and then up the Miller Creek drainage to the Ramsey Plant Site. The proposed transmission line is considered as a separate alternative (see Alternative B). The location of the proposed project facilities is shown on Figure S-1.

The ore body would be accessed from two adits adjacent to the mill. Two other adits, an evaluation/ventilation adit and a ventilation adit, both with entrances located on private land, also would be used during the project. The evaluation/ventilation adit would be located in the upper Libby Creek drainage; the ventilation adit would be located on MMC's private land (patented claim HR 134) in the upper East Fork Rock Creek drainage near Rock Lake. The additional 1-acre disturbance for the ventilation adit is part of MMC's requested DEQ Operating Permit #00150 modifications.

The mineralized resource associated with the Montanore subdeposit is about 135 million tons. MMC anticipates mining up to 120 million tons. Ore would be crushed underground and conveyed to the surface plant located near the Ramsey Adits. Copper and silver minerals would be removed from the ore by a flotation process. Tailings from the milling process would be transported through a pipeline to a tailings impoundment located in the Little Cherry Creek drainage, about 4 miles from the Ramsey Plant Site.

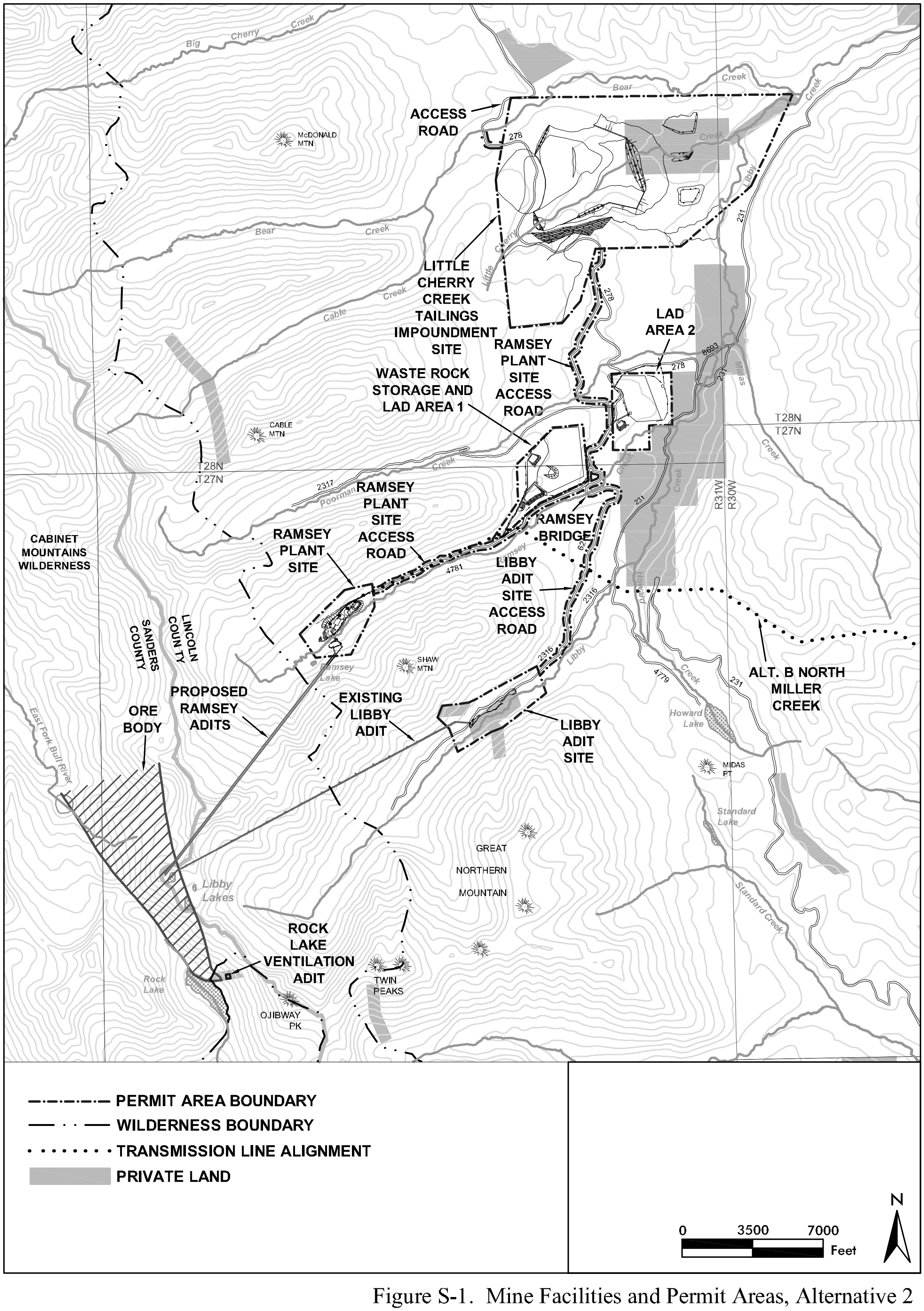


Figure S-1. Mine Facilities and Permit Areas, Alternative 2

Access to the mine and all surface facilities would be via US 2 and the existing National Forest System road #278, the Bear Creek Road. (Road names and numbers are used interchangeably in this EIS; a complete list of all road names and numbers is in Appendix B.) With the exception of the Bear Creek Road, all open roads in the proposed operating permit areas would be gated and restricted to mine traffic only. MMC would upgrade 11 miles of the Bear Creek Road and build 1.7 miles of new road between the Little Cherry Creek Tailings Impoundment Site and the Ramsey Plant Site. Silver/copper concentrate from the plant would be transported by truck to a rail siding in Libby, Montana. The rail siding and Libby Loadout facility are near one of the facilities considered in the 1992 Final EIS. The concentrate would then be shipped by rail to an out-of-state smelting facility.

In Alternative 2, MMC's proposed tailings impoundment would be in Little Cherry Creek, a perennial stream, and the impoundment would require the permanent diversion of the upper watershed of Little Cherry Creek. Numerous wetlands and springs are in the Little Cherry Creek Impoundment Site.

MMC would discharge excess mine and adit wastewater at one of two LAD Areas. Additional water treatment would be added as necessary before discharge at the LAD Areas. Water treatment also would continue at the Libby Adit Site, if necessary. MMC would not discharge mine and adit inflows during operations, and would use them in the mill for ore processing.

Mining operations would continue for an estimated 16 to 19 years once facility development was completed and actual mining operations started. Three additional years may be needed to mine 120 million tons. The mill would operate on a three-shifts-per-day, seven-days-per-week, year-long schedule. At full production, an estimated 7 million tons of ore would be produced annually during a 350-day production year. Employment numbers are estimated to be 450 people at full production. An annual payroll of $12 million is projected for full production periods.

The operating permit area would be 3,628 acres and the disturbance area would be 2,582 acres (Table S-1). The operating permit area would encompass 425 acres of private land owned by MMC at the Little Cherry Creek Tailings Impoundment Site, the Libby Adit Site, and the Rock Lake Ventilation Adit Site. All surface disturbances would be outside the CMW. MMC developed a reclamation plan to reclaim disturbed areas.

Alternative 3—Agency Mitigated Poorman Impoundment Alternative

Alternative 3 would incorporate modifications and mitigating measures proposed by the agencies to reduce or eliminate adverse environmental impacts. These measures are in addition to or instead of the mitigations proposed by MMC. The Libby Adit evaluation program would be the initial phase of the project and would be completed before construction of any other project facility. All other aspects of MMC's mine proposal would remain as described in Alternative 2.

In Alternative 3, three major mine facilities would be located in alternative locations (Figure S-2). MMC would develop a Poorman Tailings Impoundment Site north of Poorman Creek for tailings disposal, use the Libby Plant Site between Libby and Ramsey creeks, and construct two additional adits in upper Libby Creek. The Poorman Tailings Impoundment Site was retained for detailed analysis because it would avoid the diversion of a perennial stream (Issue 2) and minimize wetland effects (Issue 7).

Table S-1. Mine Surface Area Disturbance and Operating Permit Areas, Alternatives 2-4.

Facility	Alternative 2		Alternative 3		Alternative 4	
	Disturbance Area† (acres)	Permit Area (acres)	Disturbance Area† (acres)	Permit Area (acres)	Disturbance Area† (acres)	Permit Area (acres)
Existing Libby Adit Site	18	219	18	219	18	219
Upper Libby Adit	0	0	1	1	1	1
Rock Lake Ventilation Adit	1	1	1	1	1	1
Plant Site and Adits	52	185	76	172	76	172
Tailings Impoundment Site and Surrounding Area	1,928	2,458	1,272	1,506	1,619	2,215
LAD Area 1 and Waste Rock Storage Area§	247	261	0	0	0	0
LAD Area 2	183	226	0	0	0	0
Access Roads†	153	278	197	258	208	370
Total	2,582	3,628	1,565	2,157	1,924	2,979

†Disturbance area shown for roads excludes 33 feet of existing disturbance along roads.

§Waste rock would be stored within the disturbance area of the tailings impoundment in Alternatives 3 and 4, and not at LAD Area 1.

MMC's proposed plant site in the upper Ramsey Creek drainage would affect Riparian Habitat Conservation Areas (RHCAs) (Issue 3), core grizzly bear habitat (Issue 5), and Inventoried Roadless Areas (IRAs) (Figure S-3). An alternative site on a ridge separating Libby and Ramsey creeks was retained for detailed analysis to address these issues. Preliminary evaluation indicates the Libby Plant Site could be built of fill material from the large cut on the west side of the plant site. The cut and fill materials would be balanced, and waste rock would not be used in plant site construction. Avoiding the use of waste rock in plant site construction would address water quality (Issue 6). To avoid disturbance in the upper Ramsey Creek drainage, the adits in Alternative 3 would be in the upper Libby Creek drainage. The modification would address the same issues as the alternate Libby Plant Site (Issues 3 and 5).

In Alternatives 3 and 4, the lead agencies modified the proposed water management plan to address the uncertainties about quality of the mine and adit inflows, the effectiveness of LAD for primary treatment, quantity of water that the LAD Areas would be capable of receiving and the effect on surface water and groundwater quality. In Alternatives 3 and 4, the LAD Areas would not be used and all excess water would be treated at the Water Treatment Plant before discharge. MMC would treat and discharge all mine and adit inflows during all phases in Alternatives 3 and 4. During mill operations, MMC would divert water from Libby Creek near the impoundment site during high flows (April through July) to provide adequate water for mill operations. MMC would cease diversions from Libby Creek and discharge treated water to Libby Creek from the Water Treatment Plant during low flows to avoid adversely affecting senior water rights. Discharges to Ramsey Creek from the Water Treatment Plant at low flows also may be needed for the same reason. Maximum estimated discharge would exceed the current design capacity of the Water Treatment Plant, estimated to be 500 gpm. During final design, MMC would estimate the

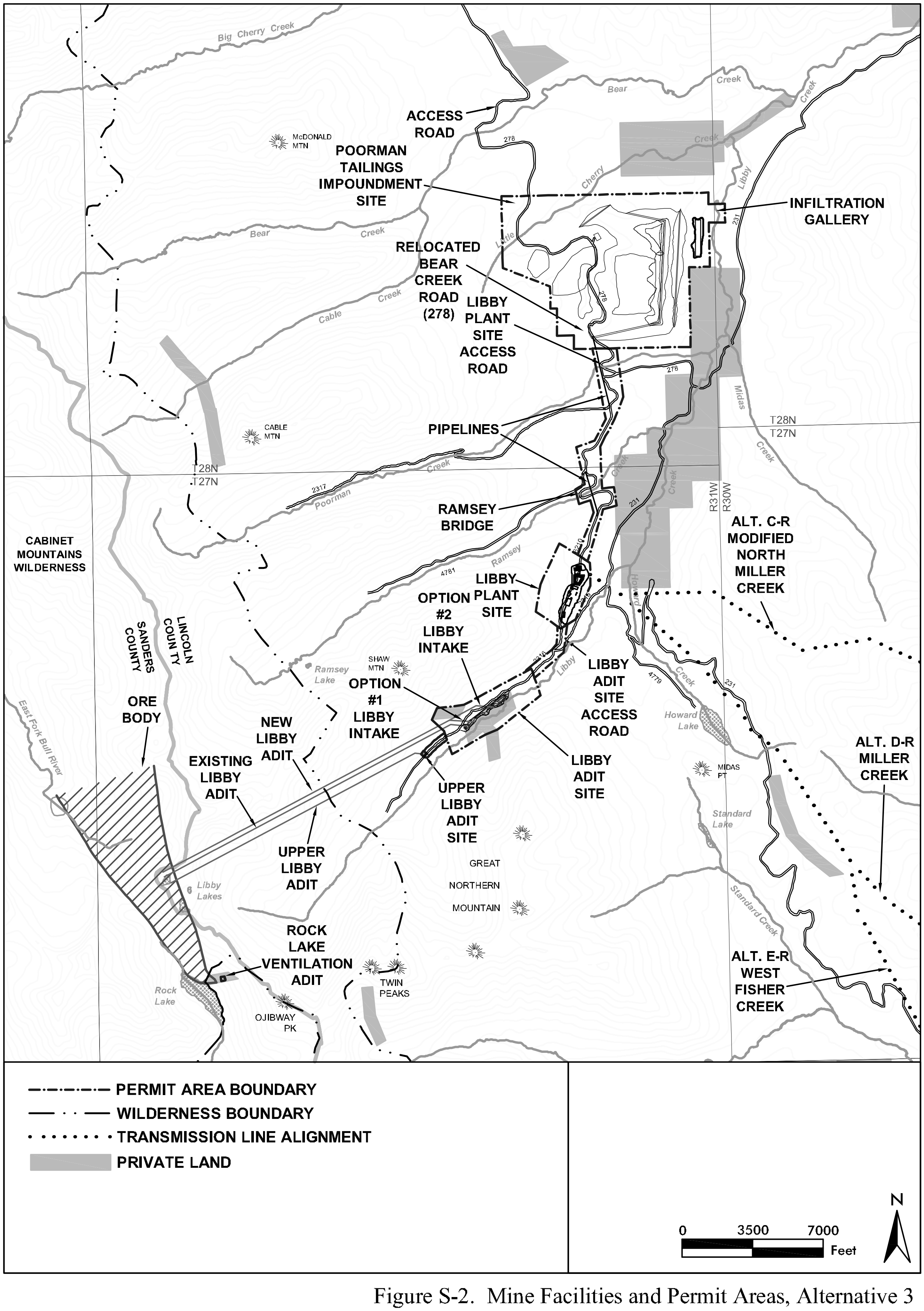


Figure S-2. Mine Facilities and Permit Areas, Alternative 3

maximum discharge rate during the estimated wettest year over a 20-year period using best available precipitation data and modify the Water Treatment Plant such that it would have adequate capacity to treat discharges during a 20-year wet year. MMC also would evaluate the size of the percolation pond at the Libby Adit, and enlarged it, if necessary, to accommodate higher flow rates. The plant would be modified as necessary to treat parameters such as nutrients or metals to meet MPDES permitted effluent limits. The increased capacity and treatment modifications would be in place at mill startup. These modifications would address Issue 2, water quality and quantity.

A comparison of primary mine development and operation features that vary between each mine alternative is shown in Table S-2. The operating permit area would be 2,157 acres and the disturbance area would be 1,565 acres (Table S-1). The operating permit areas would encompass 75 acres of private land owned by MMC at the Libby Adit Site and the Rock Lake Ventilation Adit Site.

MMC would continue to plow the Libby Creek Road (NFS road #231) and the Upper Libby Creek Road (NFS road #2316) year-round during the 2-year Evaluation Phase and the 1-year period during reconstruction of the Bear Creek Road. MMC installed a gate on the Libby Creek Road. MMC would continue to maintain the gate and the KNF would continue to seasonally restrict access on the two roads as long as MMC used and snowplowed the two roads.

In Alternative 3, MMC would use the same roads as Alternative 2 for main access during operations. About 14 miles of Bear Creek Road (National Forest System road #278), from US 2 to the Poorman Tailings Impoundment Site, would be paved and upgraded to a roadway width of 26 feet. South of Little Cherry Creek, MMC would build 0.7 miles of new road west of and parallel to the Bear Creek Road that would connect Bear Creek Road with Ramsey Creek Road (NFS road #4781). The road would have a chip-seal surface and be constructed to a width to accommodate haul traffic. Mine traffic would use the Libby Plant Access Road and the public would use the existing Bear Creek Road.

The agencies extensively revised MMC's proposed mitigation plans in Alternatives 3 and 4, particularly for grizzly bear, lynx, bull trout and other fisheries, and wetlands and streams and completely replaced MMC's plans. The agencies' monitoring plans in Appendix C replace MMC's monitoring plans.

Alternative 4—Agency Mitigated Little Cherry Creek Impoundment Alternative

Alternative 4 would be similar to Alternative 3, but would have modifications to MMC's proposed Little Cherry Creek Tailings Impoundment as part of the alternative. All other modifications and mitigations described in Alternative 3, other than those associated with the Poorman Tailings Impoundment Site, would be part of Alternative 4. As in Alternative 3, the Libby Adit evaluation program would be the initial phase of the project and would be completed before construction of any other project facility.

In Alternative 4, MMC would use the Libby Plant Site between Libby and Ramsey creeks, construct two additional adits in upper Libby Creek, and modify the proposed Little Cherry Creek Tailings Impoundment Site operating permit and disturbance areas to avoid RHCAs (Issue 3) and old growth (Issue 6) in the Little Cherry Creek drainage (Figure S-4). Borrow areas would be reconfigured to maximize disturbance within the impoundment footprint, and to reduce disturbance of RHCAs (Issue 3), core grizzly bear habitat (Issue 5), and old growth (Issue 6) (Figure S-3). Waste rock would be stored temporarily within the impoundment footprint to address water quality and quantity (Issue 2). The proposed permanent Little Cherry Creek Diversion Channel below the engineered upper section would be modified to convey anticipated flows adequately. At closure, surface water runoff would be directed toward the Little Cherry Creek Diversion Channel, and not Bear Creek, an important bull trout stream. The operating permit area would be 2,979 acres and the disturbance area would be 1,924 acres (Table S-1). The operating permit area would encompass 276 acres of private land owned by MMC at the Little Cherry Creek Tailings Impoundment Site, the Libby Adit Site, and the Rock Lake Ventilation Adit Site. All other aspects of MMC's mine proposal would remain as described in Alternative 2, as modified by Alternative 3.

Table S-2. Mine Alternative Comparison.

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Operating Permit Areas	3,628 acres	2,157 acres	2,979 acres
Disturbance Areas	2,582 acres	1,565 acres	1,924 acres
Primary Facilities			
Mill site	Ramsey Plant Site in valley bottom in Upper Ramsey Creek	Libby Plant Site between Libby and Ramsey Creek drainages	Same as Alternative 3
Adits and portals	Existing Libby Adit; two Ramsey Adits; Rock Lake Ventilation Adit	Existing Libby Adit; two additional Libby Adits; Rock Lake Ventilation Adit	Same as Alternative 3
Above-ground conveyor	1,200 feet long between Ramsey Adit portal and mill	6,000 and 7,500 feet long (depending on the option) between Libby Adit Site and Libby Plant Site mill	Same as Alternative 3
Tailings impound-ment and seepage collection pond	628 acres in Little Cherry Creek	608 acres between Poorman and Little Cherry creeks	Same as Alternative 2
Perennial stream diversion	Diversion of Little Cherry Creek 10,800 feet long around impoundment to Libby Creek	None	Same as Alternative 2

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Land application disposal areas	Two; one along Ramsey Creek and one between Ramsey and Poorman creeks	None; any wastewater treated at Water Treatment Plant	Same as Alternative 3
Water treatment	Land application, Libby Adit Water Treatment Plant, or additional Water Treatment Plant at plant site, as necessary	Libby Adit Water Treatment Plant expanded to accommodate discharges during a 20-year wet year; Modified as necessary to treat parameters such as nutrients or metals to meet MPDES permitted effluent limits	Same as Alternative 3
Primary access road	NFS road #278 (Bear Creek Road) plus new access road; 20 to 29 feet wide	NFS road #278 (Bear Creek Road) plus new access road; 26 feet wide; up to 56 feet wide to accommodate haul traffic and public traffic	Same as Alternative 3
Concentrate loadout location	Kootenai Business Park in Libby	Same as Alternative 2	Same as Alternative 2
Facility Details			
New adits: length, grade, and portal elevation	Ramsey Adits: 16,000 feet long, 8% decline; Elevation: 4,400 feet Rock Lake Ventilation Adit: Elevation: 5,560 feet	Upper Libby Adit: 13,700 feet long, 7% decline; Elevation: 4,100 feet New Libby Adit: 17,000 to 18,500 feet long, depending on option; 5% decline; Elevation: 3,960 feet	Same as Alternative 3
New access roads† To Plant Site:	1.7 miles connecting NFS roads #278 and #4781	0.7 miles of new road parallel to NFS roads #278, connecting existing NFS roads #278 and #2317	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Realigned NFS road #278 at impoundment	1.8 miles	0.2 miles	Same as Alternative 2
To Adit Portal:	0.3 mile to portal	None	Same as Alternative 3
To LAD Area 1	1.0 mile	None	Same as Alternative 3
To LAD Area 2	0.2 mile	None	Same as Alternative 3
Pipelines Tailings	Double-walled, high-density polyethylene adjacent to access road; 6.4 miles to impoundment	Double-walled buried adjacent to access road; 4.2 miles to impoundment	Same as Alternative 3; 6.4 miles to impoundment
Reclaim water	High-density polyethylene adjacent to access road	High-density polyethylene buried adjacent to access road	Same as Alternative 3
Tailings pump stations	At Poorman Creek crossing	At each crossing of Ramsey and Poorman creeks	Same as Alternative 3
Borrow areas	Four; 143 acres within and 419 acres outside of impoundment footprint	Three; 124 acres within and 92 acres outside of impoundment footprint	Five; 185 acres within and 252 acres outside of impoundment footprint
Post-mining impoundment runoff	Riprapped channel to Bear Creek	Natural channel to Little Cherry Creek	Riprapped channel to Little Cherry Creek Diversion Channel

†Temporary roads within the disturbance area of each facility not listed.

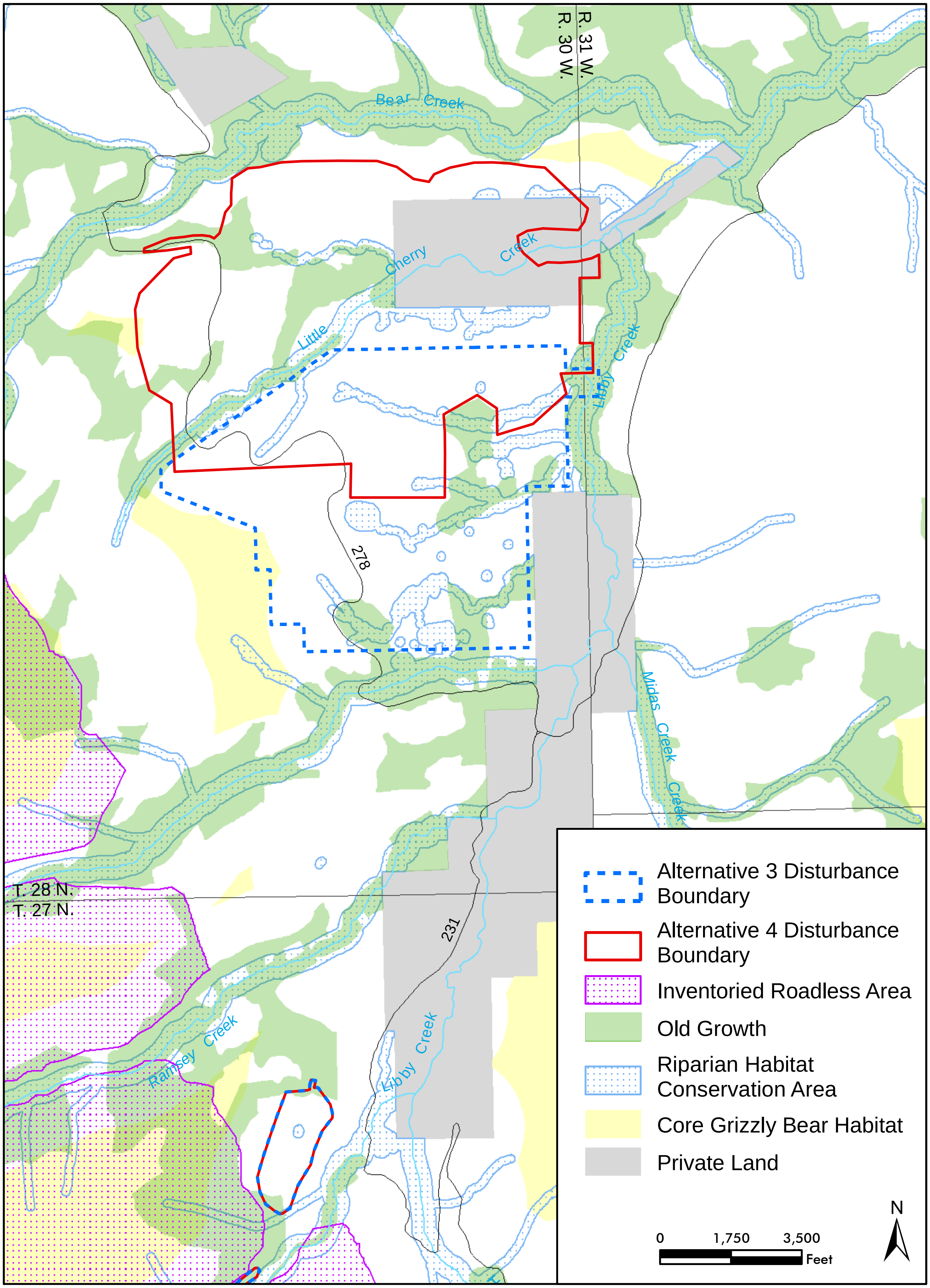


Figure S-3. Key Resources Avoided by Alternatives 3 and 4

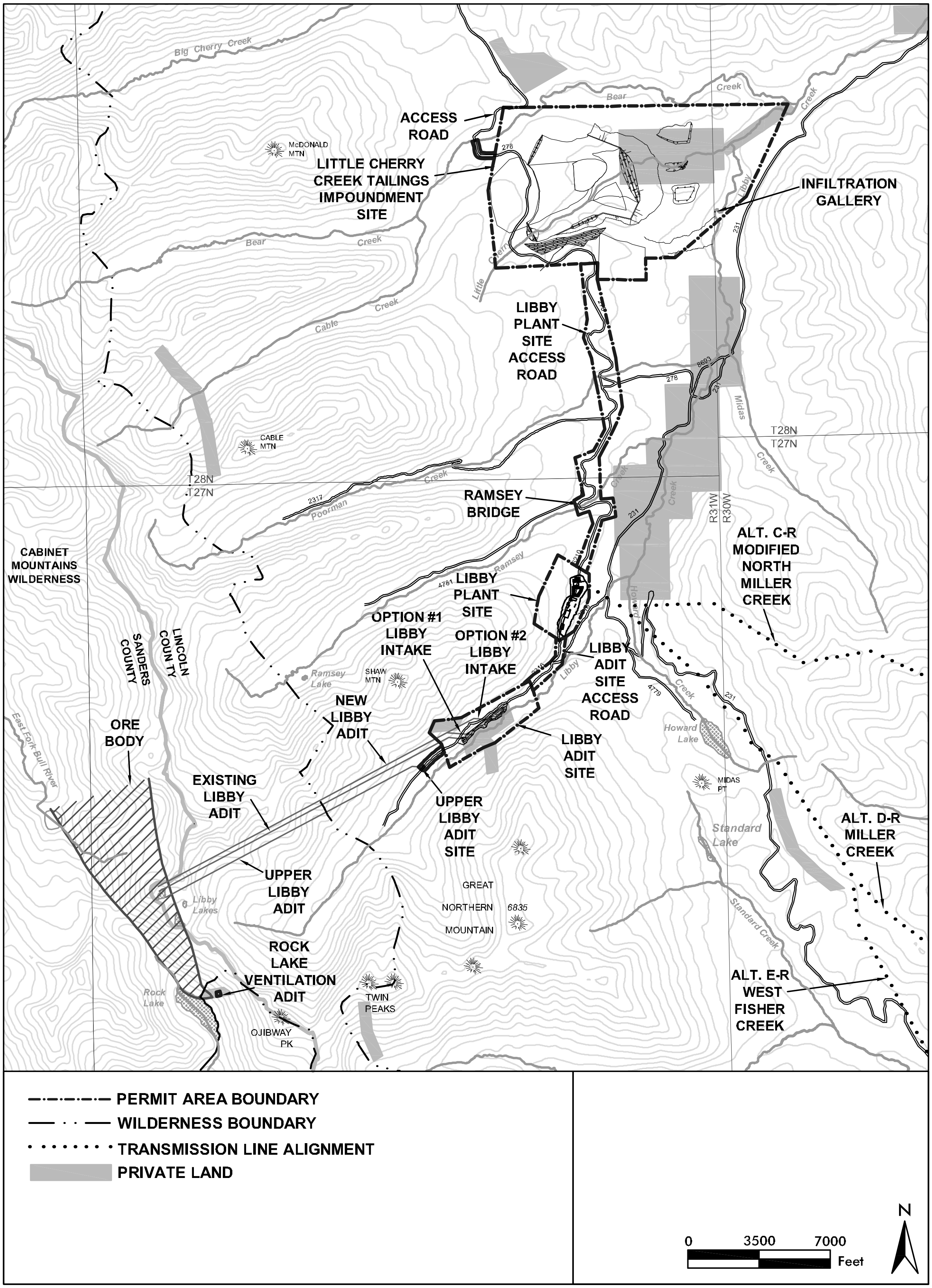


Figure S-4. Mine Facilities and Permit Areas, Alternative 4

Transmission Line Alternatives

Alternative A—No Transmission Line, No Mine

In this alternative, MMC would not build a 230-kV transmission line to provide power to the mine from the Sedlak Park Substation. The BPA would not construct the loop line to the Noxon-Libby 230-kV transmission line nor would it build the Sedlak Park Substation. The environmental, social, and economic conditions described in Chapter 3 would continue, unaffected by the construction and operation of the transmission line. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150, would remain in effect. The DEQ's approval of revisions to DEQ Operating Permit #00150 (revisions 06-001, 06-002, and 08-001) also would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that did not affect National Forest System lands.

Alternative B—MMC's Proposed Transmission Line (North Miller Creek Alternative)

The Ramsey Plant Site's electrical service would be 230-kV, 3-phase, and 60-cycle, provided by a new, overhead transmission line. BPA's proposed Sedlak Park Substation Site at the BPA's Noxon-Libby 230-kV transmission line is in an area known locally as Sedlak Park, 30 miles southeast of Libby on US 2 (Table S-3). The proposed Sedlak Park Substation and loop line is the same in all alternatives. MMC would be responsible for funding construction of the transmission line, substation, and loop line that would connect the substation to the Noxon-Libby 230-kV transmission line.

MMC's proposed transmission line alignment would be in the watersheds of the Fisher River, Miller Creek, a tributary to Miller Creek, Midas Creek, Howard Creek, Libby Creek, and Ramsey Creek (Table S-3). The proposed alignment would head northwest from the substation for about 1 mile east and uphill of US 2 and private homes and cabins, and then follow the Fisher River and US 2 north 3.3 miles. The alignment would then turn west and generally follow the Miller Creek drainage for 2.5 miles, and then turn northwest and traverse up a tributary to Miller Creek. The alignment would then cross into the upper Midas Creek drainage, and then down to Howard and Libby Creek drainages. The alignment would cross the low ridge between Libby Creek and Ramsey Creek, and then would generally follow Ramsey Creek to the Ramsey Plant Site. The maximum annual energy consumed by the project is estimated at 406,000 megawatts, using a peak demand of 50 megawatts. Access roads on National Forest System lands would be closed and reseeded after the transmission line was built, and reclaimed after the transmission line was removed at the end of operations.

Characteristics of MMC's proposed North Miller Creek Alternative (Alternative B) and the agencies' three other transmission line alternatives (Alternatives C-R, D-R, and E-R) are summarized in Table S-3. MMC's proposed alignment would end at a substation at the Ramsey Plant Site; the lead agencies' alternatives would end at a substation at the Libby Plant Site, making the lead agencies' alternatives shorter.

Table S-3. Transmission Line Alternative Comparison.

Characteristic	Alternative B – North Miller Creek	Alternative C-R – Modified North Miller Creek	Alternative D-R – Miller Creek	Alternative E-R – West Fisher Creek
Length (miles)[†]				
Steel monopole	16.4	0.0	0.0	0.0
Wooden monopole	0.0	0.0	0.0	0.5
Wooden H-frame	0.0	13.1	13.7	14.6
Total	16.4	13.1	13.7	15.1
Number of structures[‡]	108	80	91	104
New access roads (miles)	10.2	3.1	5.1	3.9
Average span length (ft.)	799	862	793	767
Helicopter use				
Structure placement	Contractor's discretion	26 structures, primarily in Miller Creek and Midas Creek drainages	16 structures, primarily in Miller Creek and Howard Creek drainages	31 structures, primarily in West Fisher Creek and Howard Creek drainages
Vegetation clearing	Contractor's discretion	4.8 miles at selected locations; see Figure S-6	2.5 miles at selected locations; see Figure S-6	4.3 miles at selected locations; see Figure S-6
Line stringing	Contractor's discretion	Yes, entire line	Yes, entire line	Yes, entire line
Annual inspection	Yes	Yes	Yes	Yes
Estimated cost in millions $[§]				
Construction	$7.3	$5.4	$5.4	$6.6
Mitigation	$3.9	$10.8	$10.8	$10.8

[†]Length is based on line termination at the Ramsey Plant Site in Alternative B and the Libby Plant Site in the other three alternatives.

[‡]Number and location of structures based on preliminary design, and may change during final design. The lead agencies' analysis of MMC's preliminary design and structure locations indicates additional structures and access may be needed to avoid long spans.

[§]Estimated cost used reasonable assumptions regarding costs of construction materials, clearing, land acquisition, and engineering. Final cost could vary from those shown. Estimated construction cost by HDR Engineering, Inc. 2012; estimated mitigation cost by KNF (2015).

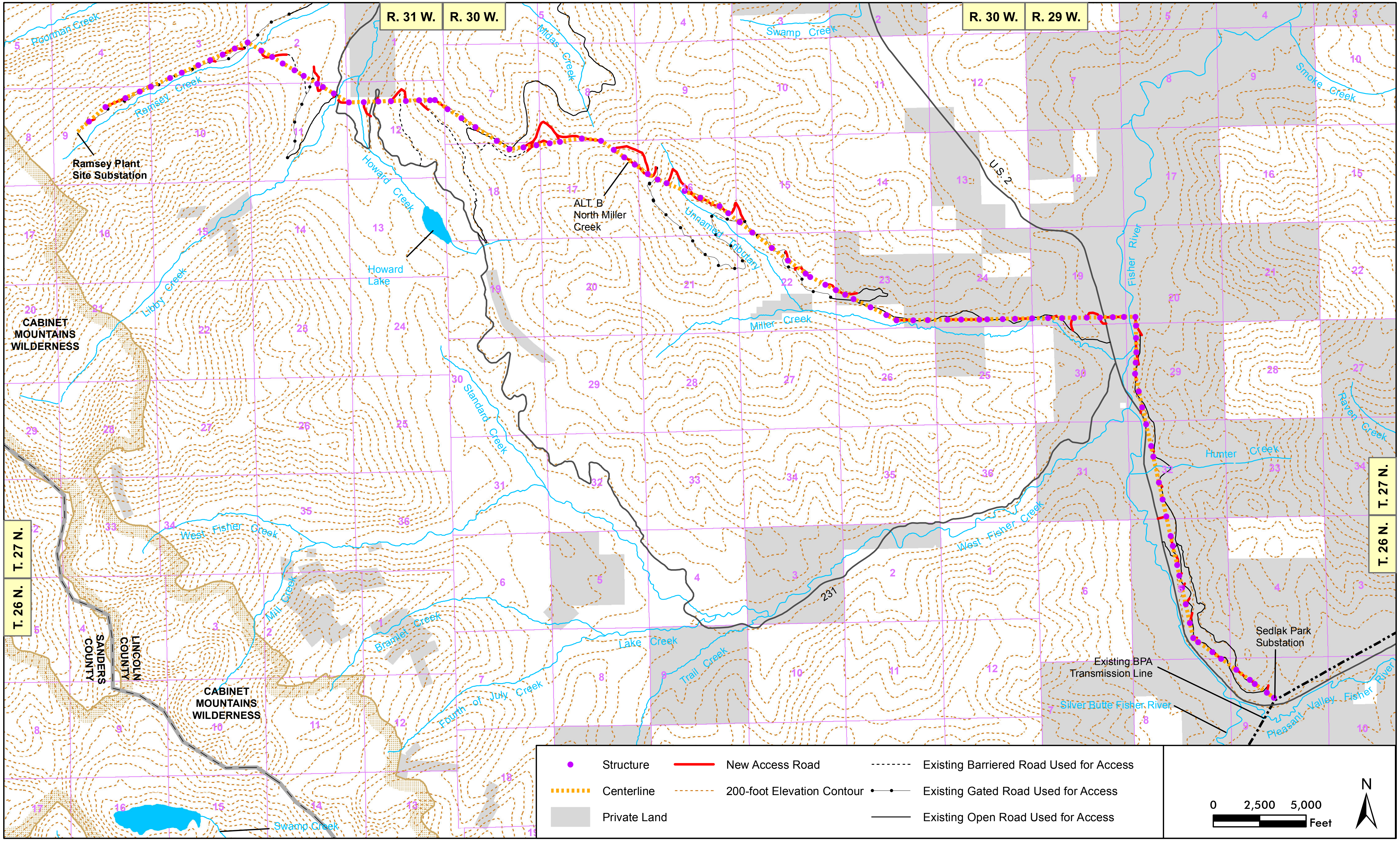


Figure S-5. North Miller Creek Alignment, Structures, and Access Roads, Alternative B

Alternative C-R—Modified North Miller Creek Transmission Line Alternative

This alternative includes modifications to MMC's transmission line proposal described under Alternative B. This alternative could be selected with any of the mine alternatives. For analysis purposes, this alternative would terminate at the Libby Plant Site.

The agencies developed two primary alignment modifications to MMC's proposed North Miller Creek alignment in Alternative B. One modification described in the Draft EIS would route the line on an east-facing ridge immediately north of the Sedlak Park Substation instead of following the Fisher River. The modification would address issues associated with water quality and aquatic life (Issues 2 and 3) by crossing less area with soils that are highly erosive soils and those with potential for high sediment delivery. The modification also addresses the issue of scenic quality (Issue 4) by reducing the visibility of the line from US 2. Fewer residences would be within 0.5 mile of the line. The other alignment modification was developed following comment on the Draft EIS. The modification, which would use an alignment up and over a ridge between West Fisher Creek and Miller Creek, would increase the use of public land and reduce the length of line on private land. During final design, MMC would submit a final Vegetation Removal and Disposition Plan to minimize vegetation clearing, particularly in riparian areas. The alignment was modified between the Supplemental Draft EIS and the Final EIS so a 2-mile segment would cross the Fisher River about 800 feet north of the alignment presented in the Supplemental Draft EIS.

Wooden H-frame structures, which generally allow for longer spans and require fewer structures and access roads, would be used on Alternative C-R. In some locations, a helicopter would be used for vegetation clearing and structure construction (Figure S-6). The lead agencies selected helicopter use so the need to use or construct roads in or adjacent to core grizzly bear habitat would be minimized. Helicopter use also would reduce effects on lynx habitat. Access roads on National Forest System lands would be placed into intermittent stored service after construction and throughout operations, and decommissioned after the transmission line was removed at the end of operations. Unless otherwise specified by a landowner, new roads on private land would be managed in the same manner as on National Forest System lands. These modifications would address issues associated with water quality, aquatic life, threatened and endangered species, and wildlife (Issues 2, 3, 5, and 6) by reducing clearing and wildlife displacement associated with new access roads. Modifications described under Alternative 3 for the mine, such as seed mixtures, revegetation success, and weed control, would be implemented in Alternative C-R.

The agencies developed mitigation measures that would reduce or minimize the effects of the transmission line in Alternatives C-R, D-R, and E-R. Snags and up to 30 tons per acre of coarse woody debris would be left in the clearing area. No transmission line construction in elk, white-tailed deer, or moose winter range would occur between December 1 and April 30 unless approved by the agencies. Grizzly bear mitigations in the agencies' alternatives include restrictions on the timing of transmission line construction and decommissioning. These restrictions would apply to National Forest System and State trust lands. This grizzly bear mitigation would require that MMC be restricted to June 16 to October 14 for conducting these activities. No waiver of winter range timing restrictions would be approved on National Forest System or State trust lands where the grizzly bear mitigations would apply. To mitigate effects on the grizzly bear, MMC would secure or protect replacement grizzly bear habitat on 26 acres in the Cabinet-Yaak Ecosystem. Transmission line construction and decommissioning on National Forest System and State trust lands would be limited to between June 16 and October 14. The

KNF would restrict access on 2.8 miles of NFS road #4725 in an unnamed tributary of Miller Creek in Alternative C-R and 4.2 miles in Alternatives D-R and E-R.

Alternative D-R—Miller Creek Transmission Line Alternative

This alternative includes modifications to MMC's transmission line proposal regarding H-frame structures, helicopter use, vegetation clearing, and other modifications described under Alternative C-R. This alternative could be selected with any of the mine alternatives. For analysis purposes, this alternative would terminate at the Libby Plant Site.

As in the Modified North Miller Creek Alternative (Alternative C-R), this alternative modifies MMC's proposed North Miller Creek alignment by routing the line on an east-facing ridge immediately north of the Sedlak Park Substation (Figure S-6). The development of a final Vegetation Removal and Disposition Plan would be the same as Alternative C-R. The modifications would address issues associated with water quality and aquatic life (Issues 2 and 3) by crossing less area with soils that are highly erosive soils and those with potential for high sediment delivery. The issue of scenic quality (Issue 4) was addressed by this modification by reducing the visibility of the line from US 2. Fewer residences would be within 0.5 mile of the line. Another modification, developed following comment on the Draft EIS, was to use the same alignment as Alternative C-R into the Miller Creek drainage, and then along NFS road #4724 on the south side of Miller Creek. The modification would increase the use of public land and reduce the use of private land. The issue of effects on threatened or endangered wildlife species (Issue 5) was addressed by routing the alignment along Miller Creek and avoiding core grizzly bear and lynx habitat in Miller Creek and the unnamed tributary of Miller Creek. Other alignment modifications, which would use an alignment up and over a ridge between West Fisher Creek and Miller Creek and move the alignment from private land near Howard Lake, would increase the use of public land and reduce the use of private lands. The alignment was modified between the Supplemental Draft EIS and the Final EIS so a 2-mile segment would cross the Fisher River about 800 feet north of the alignment presented in the Supplemental Draft EIS.

This alternative would use an alignment about 0.5 mile east of Howard Lake, a popular recreation facility in the project area. In the 1992 Final EIS, a similar alignment was considered, but was eliminated in part because of visual concerns from Howard Lake. The issue of scenic quality from Howard Lake was addressed by using H-frame structures, which would be shorter than steel monopoles. More detailed engineering was completed and H-frame structures would be used to minimize the visibility of the line from Howard Lake (Issue 4).

As in Alternative C-R, a helicopter would be used for timber clearing and structure construction in some locations (Figure S-6). New access roads would be managed in the same manner as Alternative C-R. These modifications would address issues associated with water quality, aquatic life, threatened and endangered species, and wildlife (Issues 2, 3, 5, and 6) by reducing clearing and wildlife displacement associated with new access roads. Mitigation described for Alternative C-R would be implemented. MMC would secure or protect replacement grizzly bear habitat on 40 acres in the Cabinet-Yaak Ecosystem.

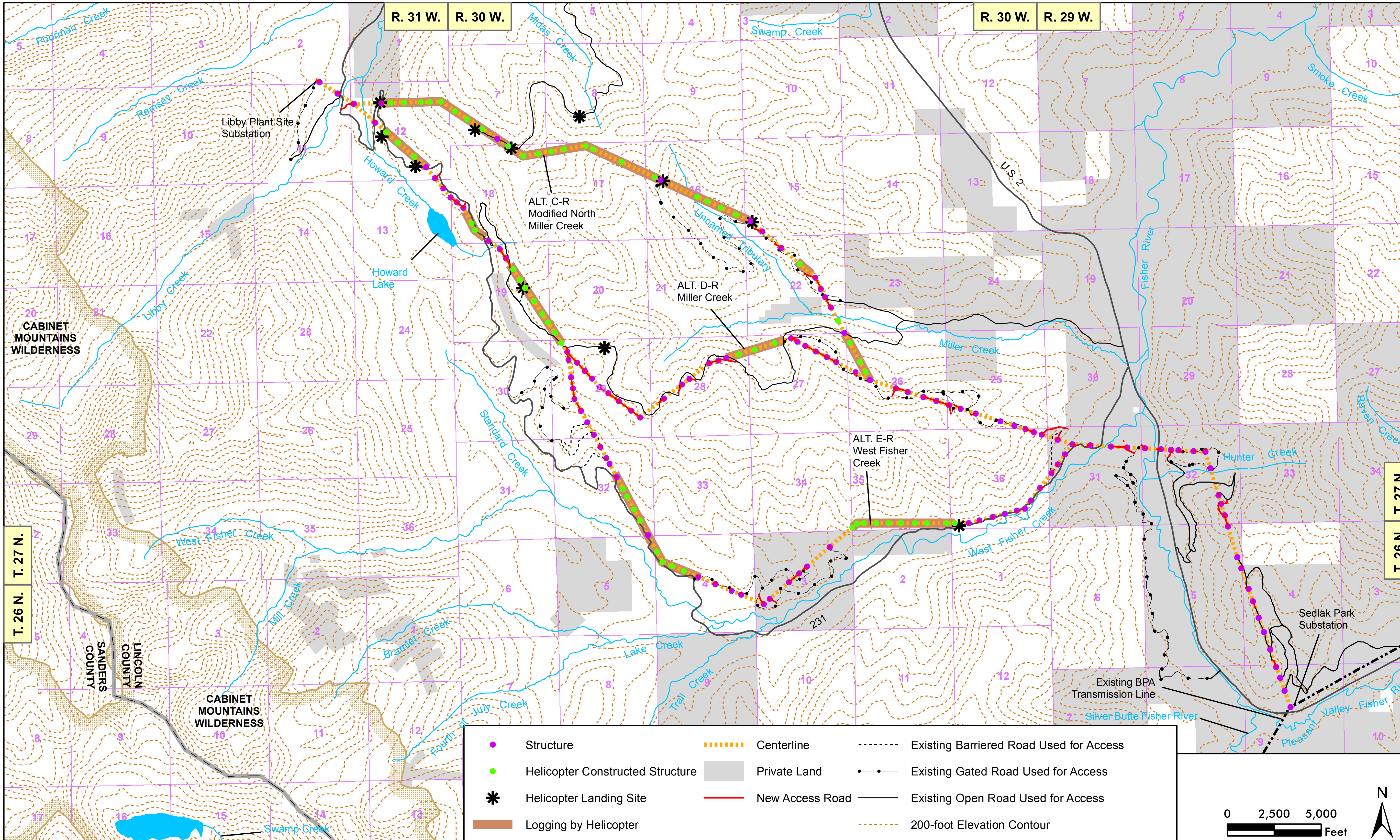


Figure S-6. Transmission Line Alignment, Structures, and Access Roads, Alternatives C-R, D-R, E-R

Alternative E-R—West Fisher Creek Transmission Line Alternative

This alternative includes modifications to MMC's transmission line proposal regarding H-frame structures, helicopter use, vegetation clearing, and other modifications described under Alternative C-R. Some steel monopoles would be used in the steep section 2 miles west of US 2 (Figure S-6). This alternative could be selected with any of the mine alternatives. For analysis purposes, the lead agencies assumed this alternative would terminate at the Libby Plant Site.

As in the Modified North Miller Creek Alternative, this alternative modifies MMC's proposed North Miller Creek Alignment by routing the line on an east-facing ridge immediately north of the Sedlak Park Substation. The modification would address issues associated with water quality (Issue 2) by crossing less area with soils that are highly erosive soils and those with potential for high sediment delivery. The issue of scenic quality (Issue 4) was addressed by this modification by reducing the visibility of the line from US 2. Fewer residences would be within 0.5 mile of the line. The alignment was modified between the Supplemental Draft EIS and the Final EIS so a 2-mile segment would cross the Fisher River about 800 feet north of the alignment presented in the Supplemental Draft EIS.

The primary difference between the West Fisher Creek Alternative (Alternative E-R) and the North Miller Creek Alternative (Alternative B) is routing the line on the north side of West Fisher Creek drainage to Miller Creek to minimize effects on core grizzly bear habitat. As in the Miller Creek Alternative (Alternative D-R), this alternative would use an alignment about 0.5 mile east of Howard Lake, a popular recreation facility in the project area. Wooden H-frame structures, which generally allow for longer spans and require fewer structures and access roads, would be used on this alternative in most locations to minimize the visibility of the line from Howard Lake (Issue 4). In some locations, a helicopter would be used for timber clearing and structure construction (Figure S-6). New access roads on National Forest System lands would be managed in the same manner as Alternative C-R. These modifications would address issues associated with water quality, aquatic life, threatened and endangered species, and wildlife (Issues 2, 3, 5, and 6) by reducing clearing and wildlife displacement associated with new access roads. Mitigation described for Alternative C-R would be implemented. MMC would secure or protect replacement grizzly bear habitat on 30 acres in the Cabinet-Yaak Ecosystem.

Forest Plan Amendments

The 2015 KFP became effective on February 17, 2015. The KNF identified the need to amend the 2015 KFP to provide project-specific variances for the following direction in the agencies' preferred alternatives (Mine Alternative 3 and Transmission Line Alternative D-R).

FW-GDL-WL-08 Big Game: Management activities should avoid or minimize disturbance to native ungulates on winter range between December 1 and April 30, with exception of routes identified on MVUM as open to motor vehicle use. Management activities that occur on winter range during the winter period should concentrate activities to reduce impacts to native ungulates (2015 KFP, page 31-32).

FW-GDL-WL-09 Big Game: Management activities should be avoided on native ungulate winter range areas during the critical mid-winter period (January and February) when snow depths most likely influence movement and availability of forage (2015 KFP, page 32).

FW-GDL-AR-01: Management activities should be consistent with the mapped scenic integrity objective, see Plan set of documents. The scenic integrity objective is High to Very High for scenic travel routes, including Pacific Northwest National Scenic Trail, designated Scenic Byways, and National Recreation Trails (2015 KFP, page 35).

FW-STD-RIP-01: When RHCAs are intact and functioning at desired condition, then management activities shall maintain or improve that condition. Short-term effects from activities in the RHCAs may be acceptable when those activities support long-term benefits to the RHCAs and aquatic resources (2015 KFP, page 25)

FW-STD-RIP-02: When RHCAs are not intact and not functioning at desired condition, management activities shall include restoration components that compensate for project effects to promote a trend toward desired conditions. Large-scale restoration plans or projects that address other cumulative effects within the same watershed may be considered as compensatory components and shall be described during site-specific project analyses (2015 KFP, page 25).

FW-GDL-VEG-02: Road construction (permanent or temporary) or other developments should generally be avoided in old growth stands unless access is needed to implement vegetation management activities for the purpose of increasing the resistance and resilience of the stands to disturbances (2015 KFP, page 19).

These amendments to the 2015 KFP would be required if any of the action alternatives are selected. Additional amendments to the 2015 KFP would be required if MMC's proposed alternatives were selected in the ROD. Should MMC's proposed alternatives be selected in the ROD, additional amendments will be discussed in the ROD. A detailed analysis of the amendments is available in the ROD and project record.

Affected Environment

The project is in the KNF, 18 miles south of Libby, Montana. Elevation of the project area ranges from 2,600 feet along US 2 to nearly 8,000 feet in the Cabinet Mountains. Most of the area is forested. Annual precipitation varies over the area, and is influenced by elevation and topography. Precipitation is between 30 and 50 inches annually where most project facilities would be located. The ore body is beneath the CMW and all access and surface facilities would be located outside of the CMW boundary. The analysis area is drained by East Fork Rock Creek, a tributary of the Clark Fork River, the East Fork Bull River, Libby Creek and its tributaries, and tributaries to the Fisher River. Two tributaries of the Kootenai River, Libby Creek and the Fisher River, provide surface water drainage for most of the area where project facilities are located. Most of the area is National Forest System lands managed in accordance with the 2015 KFP. Private land, most of which is owned Plum Creek Timberlands LP, Libby Placer Mining Company, or MMC, is found in the project area. Residential areas are found along US 2, the Libby Creek Road (NFS road #231), and Miller Creek. Recreation, wildlife habitat, and timber harvesting are the predominant land uses. Important grizzly bear and lynx habitat is found in the area. Segments of Fisher River, West Fisher Creek, Libby Creek, Rock Creek, East Fork Rock Creek, and East Fork Bull River are designated bull trout critical habitat. Chapter 3 provides more information about the affected environment.

Environmental Consequences

The following two sections summarize the environmental consequences of the four mine and five transmission line alternatives. The effects of the mine alternatives are summarized for the seven key issues discussed in the previous *Public Involvement* section. For the transmission line, the DEQ requires a certificate of compliance for development of electric transmission lines. The DEQ must find that the selected transmission line alternative meets the set of criteria listed under 75-20-301, MCA to be eligible for transmission line certification. Findings for all criteria under each alternative are summarized in the following *Draft Findings for Transmission Line Certification Approval* section.

Mine Alternatives

Issue 1: Potential for Acid Rock Drainage and Near Neutral pH Metal Leaching

The mineral deposit proposed for mining is part of the Rock Creek-Montanore deposit. The Rock Creek-Montanore deposit has two sub-deposits, the Rock Lake sub-deposit and the Montanore sub-deposit. The Troy Mine, developed within the upper quartzites of the Revett Formation, is a depositional and mineralogical analog for the zone of quartzite to be mined within the upper-most part of the lower Revett Formation at the Montanore sub-deposit. Geological analogs are valuable techniques for predicting acid generation potential and water quality from a proposed mine site. This type of comparison is based on the assumption that mineralization formed under comparable conditions within the same geological formation, and that has undergone similar geological alteration and deformation, will have similar mineralogy and texture and, thus, similar potential for oxidation and leaching under comparable weathering conditions.

The risk of acid generation for rock exposed in underground workings or for tailings would be low, with some potential for release of select metals at a near-neutral pH (around pH 7) and a high potential for release of nitrogen compounds due to blasting. Low acid generation potential exists for a fraction of the total waste rock volume in portions of the Prichard Formation and moderate potential exists within the altered waste zones of the Revett Formation, which MMC proposes to mitigate through selective handling (particularly of the barren lead zone) and additional evaluation by sampling and characterization during mine development and operations. Portions of the waste rock at Montanore have the potential to release trace elements at a near-neutral pH.

Some additional sampling would be conducted during the Evaluation, Construction, and Operations Phases, when a more representative section of waste rock would be available for sampling. Characterization of metal release potential for tailings and waste rock would be expanded in Alternatives 3 and 4. Descriptions of mineralogy in rocks exposed in the evaluation adit ore zone (for the Revett Formation) and production adits (for the Burke and Prichard Formations) would be used to waste rock characteristics and tonnage to be mined, to guide sampling density. If the Wallace Formation were intercepted, samples of this lithology would be collected and characterized. This information would be used to redefine geochemical units for characterization and evaluate potential selective handling and encapsulation requirements.

Waste rock would be stockpiled for a short period of time near LAD Area 1 in Alternative 2, and in the impoundment area in Alternatives 3 and 4. Waste rock would be used to construct the Plant

Site in Alternative 2, and the Tailings Impoundment dam in all alternatives. Because selective handling criteria would be developed using data from the Evaluation Phase, as specified in the geochemistry Sampling and Analysis Plan (Appendix C), it is not known what fraction of the Revett Formation waste rock would be brought to the surface. MMC currently plans to keep the waste rock from the barren lead zone underground, and would consider selective handling and backfill of waste rock when the characterization required in the Sampling and Analysis Plan was complete. Once more detailed information about the Revett and Prichard Formations waste rock was available, along with updated predictions of metal loading for tailings, they would be incorporated into updated water quality mass balance calculations.

Issue 2: Quality and Quantity of Surface Water and Groundwater Resources

Groundwater Level and Baseflow-Mine Area. The No Mine alternative would not change groundwater levels or stream baseflow. Disturbances at the Libby Adit Site would remain until reclaimed in accordance with existing permits and approvals.

A conceptual model and two numerical models of the mine area hydrogeology were developed to understand the characteristics of the groundwater flow system and evaluate potential impacts of the proposed project on groundwater resources. The results of the agencies' 2D model were provided in the Draft EIS. Subsequently, MMC prepared a more complex and comprehensive 3-dimensional (3D) model of the same analysis area. The results of both models were used to evaluate the site hydrogeology and analyze potential impacts due to mining. Although the results of the two models were similar, the 3D groundwater model provides a more detailed analysis by incorporating the influence of known or suspected faults and recent underground hydraulic testing results from the Libby Adit. The 3D groundwater model also uses a more comprehensive calibration process and better simulates vertical hydraulic characteristics of the geologic formations that will be encountered during the mining process. The models required a number of simplifying assumptions described in section 3.10, *Groundwater Hydrology* section of Chapter 3. The 3D model was also used to evaluate the effectiveness of possible mitigation measures, such as grouting during mining, and low permeability barriers post-mining. A different 3D groundwater model was used to assess effects in the Poorman Tailings Impoundment Site (see next section). For the purpose of analyzing the effects of possible mitigations, MMC simulated two options in the modeling: 1) grouting, during Operations Phase, of the sides of the three uppermost mine blocks and corresponding access ramps that would be adjacent to the Rock Lake Fault, and 2) installing two bulkheads in the mine at Closure.

With the data currently available, the model results provide a potential range of dewatering rates and streamflow impacts. They are the best currently available estimates of impacts and associated uncertainty that can be obtained using currently available data in the groundwater models. Both 3D groundwater flow models would be refined and rerun after data from the Evaluation Phase were incorporated into the models (see Section C.10.4, *Evaluation Phase* in Appendix C). Following additional data collection and modeling, the predicted impacts on surface water resources in the project area, including simulation of mitigation measures, may change and the model uncertainty would decrease. See section 3.10.4.3.5, *Groundwater Model Uncertainty*, for more discussion of uncertainty.

The effects of Alternatives 2, 3, and 4 due to the inflow of groundwater into the adits and mine void would be the lowering of the regional potentiometric surface and changes in stream baseflow in drainages adjacent to the mine and adits. Baseflow is the contribution of near-channel alluvial groundwater and deeper bedrock groundwater to a stream channel. Baseflow does not include any direct runoff from rainfall or snowmelt into the stream. In general, the effects on the groundwater table and related changes in stream baseflow would gradually increase through the mining phases of Evaluation, Construction, and Operations, as mine inflows increased due to an increasing mine void volume. Because of the low overall permeability of the bedrock, the groundwater system would be somewhat slow to respond to dewatering. Impacts on hydrology, as indicated by groundwater drawdown and related changes in stream baseflow, are predicted to reach a maximum soon after the adits were plugged (in the Closure Phase) in watersheds on the east side of the Cabinet Mountains and reach a maximum in 16 to 30 years after the adits were plugged (in the Post-Closure Phase) in watersheds on the west side of the Cabinet Mountains. Groundwater drawdown is predicted to extend north of St. Paul Lake, south of Rock Lake, and along the trend of the proposed adits. At the end of mining, the largest drawdown is expected to be between 100 and 500 feet north and east of Rock Lake and between 10 and greater than 500 feet along the adits. Alternative 2 would likely result in more drawdown in the Ramsey Creek watershed and less drawdown in the Libby Creek watershed upstream of Ramsey Creek compared to Alternatives 3 and 4.

The effects of groundwater drawdown due to dewatering of the mine are best expressed by estimating changes to baseflow. Streams in the area may reach baseflow for about 1 to 2 months between mid-July to early October; periods of baseflow may also occur during November through March. The 3D model predicted that baseflow would be reduced in East Fork Rock Creek, Rock Creek, East Fork Bull River, Libby Creek, Ramsey Creek, and Poorman Creek in all mine alternatives. In addition to baseflow effects, the model predicted the volume of groundwater flowing into Rock Lake would be reduced. Without mitigation, the model predicted water would flow out of the lake toward the mine void, resulting in a reduction in lake storage. The model predicted the reduction would occur for about 130 years after mining ceased. With mitigation, the model predicted that 16 years after mining ceased and the adits were plugged, the volume of the lake would be reduced by an estimated 2 percent, the surface area would be reduced by an estimated 1 percent, and the lake level would decline by 0.5 foot during the 2-month summer/fall period.

As groundwater levels began to recover during the Post-Closure Phase, the model predicted the changes in baseflow would decrease, reaching steady state conditions about 1,200 to 1,300 years after mining ended. The 3D model predicted that the mine void and adits would require about 490 years to fill. Much of the mine void would be substantially filled in less time, but as the mine void filled, the inflow rate would decrease, requiring a total of about 490 years to completely fill the mine void and adits. The 3D model predicted that groundwater levels would not recover to pre-mining levels, and the baseflow in upper East Fork Rock Creek (above Rock Lake) would be permanently reduced. Without mitigation, baseflow in East Fork Rock Creek below the lake, in Rock Creek, and in East Fork Bull River also would be permanently reduced. Leaving barrier pillars with constructed concrete bulkheads at limited access opening in the mine would minimize post-mining effects on the East Fork Bull River and East Fork Rock Creek streamflow. With mitigation, baseflow in East Fork Rock Creek and Rock Creek below the lake would return to pre-mine conditions or increase slightly, and in the East Fork Bull River would be slightly reduced.

The volume of groundwater stored in the flooded mine void and adits would be substantially greater than groundwater stored in fractures in the same area before mining. Assuming 120 million tons of ore and 3.2 million tons of waste rock were mined, the estimated increase in groundwater storage would be about 11.3 billion gallons or 34,600 acre feet of water.

Groundwater Levels-Tailings Impoundment and LAD Areas. The Little Cherry Creek Tailings Impoundment in Alternatives 2 and 4 would be designed with an underdrain system to collect seepage from the tailings impoundment and divert intercepted water to a Seepage Collection Pond below the impoundment. A pumpback well system also would be used, if necessary, in Alternative 2 to collect tailings seepage that reached underlying groundwater. Similar underdrain and pumpback well systems would be required at the impoundment site in Alternatives 3 and 4. The tailings are expected to be placed in the impoundment with a high water content and as they consolidate, water would pool in low areas at the surface and percolate downward. Most of the percolating water would be captured by the underdrain system, but some would seep into the underlying aquifer. Tailings seepage not collected by the underdrains would flow to groundwater at a maximum estimated rate of 25 gpm, slowly decreasing to an estimated 5 gpm after operations ceased. Groundwater drawdown resulting from a pumpback well system would reduce flows in adjacent streams. In Alternative 3, groundwater levels from north of Ramsey Creek to north of Little Cherry Creek are predicted to be reduced. Streamflow in Poorman, Little Cherry, and Libby creeks is predicted to be reduced collectively by 0.55 cubic feet per second. The reduction in streamflow would begin in the Operations Phase and continue into the Post-Closure Phase.

A subsurface bedrock ridge occurs between the Little Cherry Creek and Poorman Creek watersheds, which may separate groundwater flow between the watershed of Little Cherry Creek from those of unnamed tributaries in the Poorman Impoundment Site. If a ridge and hydrologic divide separates the two areas, it is likely that groundwater drawdown from pumping in the Poorman Impoundment area would have limited effect on surface resources in the Little Cherry Creek drainage. The pumping rate required to capture all seepage would potentially be lower without recharge from the Little Cherry Creek watershed. Additional subsurface data from this area would be collected during the final design process of the Poorman Impoundment to confirm the geophysical results and the 3D model would be rerun to evaluate the site conditions with the new data.

After flow from the impoundment met BHES Order limits or applicable nonsignificance criteria of all receiving waters, operation of the seepage collection system and the pumpback wells would be terminated and the wells plugged and abandoned. Assuming pumpback wells operated at 250 gpm until all pumping ceased, groundwater levels would mostly recover in 13 years after pumping ceased with an estimated residual flow depletion to Libby Creek of 0.1 cfs (50 gpm) and fully recover in about 25 years. Groundwater levels may recover sooner if pumping rates were reduced during the Closure Phase in response to tailings consolidation and impoundment reclamation. As groundwater levels recovered, springs that were buried by the impoundment may again flow, but into the impoundment's gravel underdrain system. Springs outside of the impoundment footprint that were affected by the pumpback wells would likely return to pre-mine conditions and may contribute to baseflow to channels outside of the impoundment.

Seven known springs and seeps in Little Cherry Creek area would be covered by the impoundment or disturbed by other facilities in Alternative 2 and six springs would be similarly affected by Alternative 4. Thirteen springs identified in the vicinity of the Poorman Impoundment Site would be affected by Alternative 3. A pumpback well system in alternatives may potentially affect springs: 10 in Alternative 2, 5 in Alternative 3, and 11 and in Alternative 4. Some of the springs potentially affected by the pumpback well system may be separated by a bedrock ridge that may limit drawdown effects.

In Alternative 2, mine and adit inflows greater than that needed in the mill or that could be stored in the tailings impoundment would be discharged at two LAD Areas between Ramsey and Poorman creeks or treated at the Water Treatment Plant. Groundwater levels in the LAD Areas would rise, and the flow rate from any springs near the two LAD Areas may increase. The increase in groundwater levels would be a function of the application rate used at the LAD Areas. The agencies' analysis indicates the rates proposed by MMC in Alternative 2 would likely cause surface water runoff or increased spring and seep flow on the downhill flanks of the LAD Areas. The maximum application rate would be determined on a performance basis by monitoring both groundwater quality and changes in groundwater levels. It is possible that monitoring would determine that the maximum application rate is higher or lower than estimated by the agencies' analysis. The application rate would be selected to ensure that groundwater did not discharge to the surface as springs between the LAD Areas and downgradient streams. Any water that could not be treated at the LAD Areas would be sent to the Water Treatment Plant.

The LAD Areas would not be used in Alternatives 3 and 4. All mine and adit inflows and any other wastewater in Alternatives 3 and 4 would be sent to the Water Treatment Plant and discharged after treatment to one of three outfalls near Libby Creek. Discharge to locations other than the percolation pond has not been reported since the MPDES permit was first issued in 1997.

Streamflow. The analysis area is drained on the east by Libby Creek and its tributaries: Ramsey Creek, Poorman Creek, Little Cherry Creek, and Bear Creek. Libby Creek flows north from the analysis area to its confluence with the Kootenai River near Libby. The analysis area is drained on the west by the East Fork Rock Creek and East Fork Bull River. The East Fork Rock Creek flows southwest into Rock Creek and then into the Clark Fork River downstream of Noxon Reservoir. The East Fork Bull River flows northwest into the Bull River. The transmission line corridor area is drained by the Fisher River and its tributaries: Sedlak Creek, Hunter Creek, Miller and North Fork Miller creeks, Standard Creek, and West Fisher Creek; and by Libby Creek and its tributaries: Howard Creek, Midas Creek, and Ramsey Creek, all perennial streams. Numerous unnamed ephemeral streams also drain the area. Snowmelt, rainfall, and groundwater discharge are the sources of supply to streams, lakes, and ponds in the analysis area. High surface water flows occur during snowmelt runoff, typically between April and July, and as a result of runoff-producing storm events, such as during late fall. Low flows typically occur during August and September, as well as sometimes during the winter months. Flow in drainages above an elevation of about 5,000 to 5,600 feet are not perennial because the drainages are above the regional potentiometric surface and receive water only from surface water runoff and from limited perched shallow groundwater in unconsolidated deposits.

Streamflow changes may occur due to mine and adit dewatering, pumpback well system operation around the impoundment, evaporative losses from a tailings impoundment or LAD Areas (in Alternative 2), diversion from Libby Creek during high flows, discharges from a Water Treatment Plant or to the LAD Areas (in Alternative 2), and potable water use. Changes due to mine and adit dewatering and pumpback well system operation around the impoundment were predicted by groundwater models. With the data currently available, the model results provide a potential range of dewatering rates and streamflow impacts. They are the best currently available estimates of impacts and associated uncertainty that can be obtained using currently available data in the groundwater models. Both 3D groundwater flow models would be refined and rerun after data from the Evaluation Phase were incorporated into the models (see Section C.10.4, *Evaluation Phase* in Appendix C). Following additional data collection and modeling, the predicted impacts on surface water resources in the project area, including simulation of mitigation measures, may change and the model uncertainty would decrease. Section 3.10.3.4.3, *Groundwater Model Uncertainty* discusses uncertainty of the model results.

In Alternative 1, reduction of streamflow in Libby Creek above the Libby Adit at LB-300 from the partial dewatering of the Libby Adit would continue until the Libby Adit was plugged and groundwater levels recovered. Streamflow below the Libby Adit at LB-300 would not be affected.

Alternatives 2, 3, and 4 would reduce the flow in some area streams due to diversions, mine inflows, and use of the pumpback wells. Discharges of treated water to Libby Creek from the Water Treatment Plant would increase streamflow in Libby Creek below the Libby Adit when discharges occurred. Discharges to Libby Creek would occur in all phases in Alternatives 3 and 4, and in all phases except operations in Alternative 2. In general, the model predicted all mine alternatives would reduce streamflow in East Fork Rock Creek and East Fork Bull River during the Evaluation through early Post-Closure Phases. Predicted effects of Alternative 3 on estimated low flow ($7Q_2$ flow) are shown on Figure S-7. Similarly, predicted effects of Alternative 3 on estimated very low flow ($7Q_{10}$ flow) are shown on Figure S-8. The $7Q_{10}$ flow is defined as the lowest streamflow averaged over 7 consecutive days that occurs, on average, once every 10 years. The $7Q_2$ flow is the lowest streamflow averaged over 7 consecutive days that occurs, on average, once every 2 years. When groundwater levels reached steady state conditions in an estimated 1,200 to 1,300 years, low flows in upper East Fork Rock Creek (above Rock Lake) would be permanently reduced. Without mitigation, the model predicted low flow in East Fork Rock Creek and Rock Creek and in East Fork Bull River would be permanently reduced.

MMC's modeled mitigation would reduce post-mining effects on the East Fork Rock Creek Rock Creek, and slightly reduce flow in the East Fork Bull River. Streamflow in East Fork Rock Creek and Rock Creek below the lake would return to pre-mine conditions or increase slightly (Figure S-7, Figure S-8).

The model predicted flow in upper Libby Creek above the Libby Adit would decrease during the Evaluation through Closure Phases and would return to pre-mine conditions when groundwater levels reached steady state conditions. Flow in Libby Creek below the Libby Adit would increase during all phases in Alternatives 3 and 4 and during all phases except the Operations Phase in Alternative 2 because of the discharge of treated water from a Water Treatment Plant at the Libby Adit. Flow in Libby Creek below the Libby Adit would return to pre-mine conditions after groundwater levels reached steady state conditions and Water Treatment Plant discharges ceased.

To mitigate effects on senior water rights on Libby Creek and Ramsey Creek, MMC would install plugs near the mine void of each adit soon after mining operations ceased in Alternatives 3 and 4. Streamflow reductions would continue and would cease within an estimated one to two decades after all initial adit plugs were in place. The effect would be reduced to a few years if MMC used water diverted from Libby Creek during high flows to fill the adits during the Closure Phase. The model predicted flow in Ramsey Creek would be slightly reduced during the Construction through early Post-Closure Phases and would return to existing rates after groundwater levels reached steady state conditions. The flow in Libby Creek would also be reduced when the pumpback wells were operating.

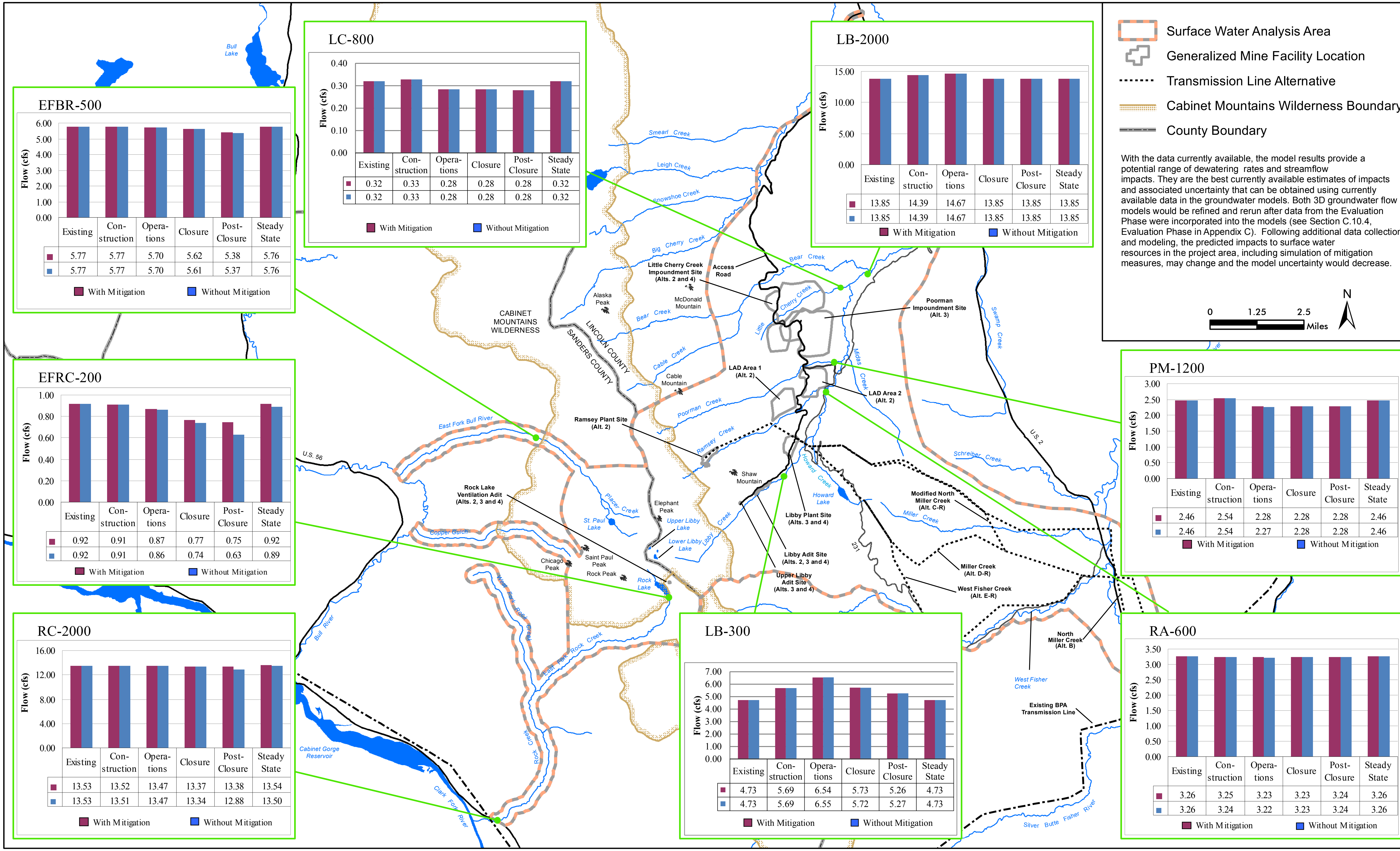


Figure S-7. Estimated Changes in Seven-Day, Two-Year Low Flow, Alternative 3

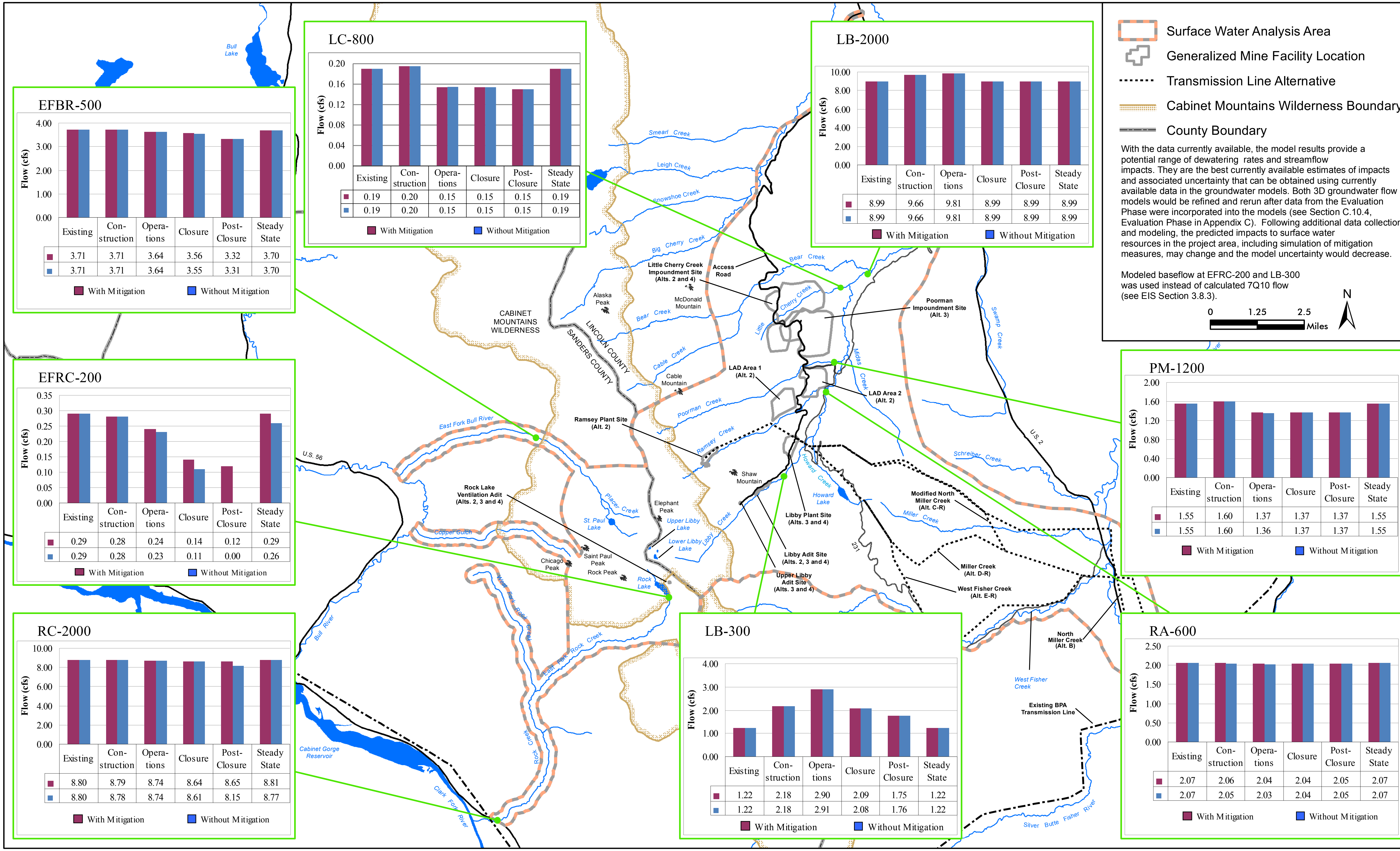


Figure S-8. Estimated Changes in Seven-Day, Ten-Year Low Flow, Alternative 3

The model predicted flow in Poorman Creek would decrease slightly during the Operations through the early Post-Closure Phases in all mine alternatives due to mine inflows. In Alternative 3, flow in Poorman Creek would increase slightly during the Construction Phase from surface water diverted around the impoundment. Flow in lower Poorman Creek in Alternative 3 would be reduced during the Operations through the Post-Closure Phases from a pumpback well system around the Poorman Impoundment. Flow in Poorman Creek would return to existing rates after groundwater levels reached steady state conditions and the pumpback well system ceased operations.

Little Cherry Creek would not be diverted in Alternative 3. Flow in Little Cherry Creek would not be affected during the Evaluation Phase. In Alternative 3, flow in Little Cherry Creek would increase slightly during the Construction Phase from surface water diverted around the impoundment. Flow in lower Little Cherry Creek would be reduced during the Operations through the Post-Closure Phases from a pumpback well system around the Poorman Impoundment. The A low permeability bedrock ridge separates groundwater flow between the watershed of Little Cherry Creek and those of Drainages 5 and 10 in the Poorman Impoundment Site. The bedrock ridge would limit drawdown in the Little Cherry Creek watershed, but drawdown could still extend between watersheds unless the bedrock ridge provided a complete barrier to cross-boundary groundwater flow. Additional subsurface data from this area would be collected during the final design process of the Poorman Impoundment to assess the separation of groundwater flow between the Little Cherry Creek and Poorman Impoundment Site watersheds and the 3D model would be rerun with the new data to evaluate the site conditions.

Post-Closure, the watershed area of Little Cherry Creek would increase by 644 acres, an increase of 44 percent. The Hortness method overestimates low flows in watersheds containing a reclaimed impoundment. The reclaimed impoundment would be in a watershed adjacent to the original watershed, and some of the precipitation that would infiltrate into the reclaimed impoundment would be intercepted by the impoundment's underdrain system and routed toward the original watershed. Both $7Q_2$ and $7Q_{10}$ flow likely occur during late summer or early fall during periods of little or no precipitation. The amount of baseflow that would flow during these periods toward Little Cherry Creek would be negligible. The agencies anticipate little or no increase in $7Q_2$ and $7Q_{10}$ flow in Little Cherry Creek. Any increased flow would be partially offset by flow reduction due to the pumpback well system as long as it operated. As part of the final closure plan, MMC would complete a hydraulic and hydrologic analysis of the impoundment channel during final design, and submit it to the lead agencies and the Corps for approval. The analysis would include a channel stability analysis and a sediment transport assessment. Based on the analysis, modifications to the final channel design would be made and minor modifications to the upper reaches of the tributary of Little Cherry Creek may be needed to minimize effects on channel stability in the tributary of Little Cherry Creek.

After closure in Alternative 4, runoff from the reclaimed tailings impoundment surface would be routed via the permanent Diversion Channel and Drainage 10 to Libby Creek. (Drainage 10 is one of four unnamed drainages in the Poorman Impoundment Site.) After the Seepage Collection Dam was removed, runoff from the South Saddle Dam and the south Main Dam abutment also would flow to the Diversion Channel. Consequently, the watershed of Drainage 10 would increase by about 500 acres post-closure, compared to operational conditions. Average annual flow in the diverted Little Cherry Creek would be about five times the existing flow in Drainage 10, but about 10 percent less than the current flow of Little Cherry Creek. The larger watershed would increase average annual flow and would not affect low flows.

Runoff from the Main Dam would flow to the former Little Cherry Creek channel. Post-closure, the watershed area contributing water to the former Little Cherry Creek channel would decrease by 85 percent directly below the tailings impoundment and by 74 percent at the confluence of Little Cherry and Libby creeks.

Flow in Bear Creek would not be affected by Alternative 3. In Alternatives 2 and 4, flow in Bear Creek would be reduced during the Operations through the Post-Closure Phases from a pumpback well system around the Little Cherry Impoundment. After the pumpback well system ceased operations in the Post-Closure Phase, runoff from the reclaimed tailings impoundment surface would be routed toward Bear Creek and flow would increase. Post-Closure, the watershed area of Bear Creek would increase by 560 acres, an increase of 8 percent.

Groundwater Quality-Mine Area. The No Mine alternative would not change groundwater quality in the mine area. During the Evaluation through Operations Phases, groundwater quality in the mine area would not be affected in Alternatives 2, 3, and 4 because groundwater would move toward the mine void and adits and then be pumped to the surface for use in the ore processing. Any water affected by the mining process would be removed from the mine void, used in mill processing, or treated and discharged. Groundwater would continue to flow toward the mine void and adits in the Closure and early Post-Closure Phases, and groundwater quality in the mine area would not be affected.

The agencies anticipate the quality of the post-closure mine water would be similar to the Troy Mine water quality when it was not operating. The groundwater table would begin to recover, and water would continue to flow toward the mine void for hundreds of years. Eventually, water may begin to flow out of the underground mine workings and may mix with groundwater in saturated fractures, react with iron oxide and clay minerals along an estimated 0.5-mile flow path, undergo changes in chemistry due to sorption of trace elements and mineral precipitation, and, without mitigation, discharge at a low rate (0.07 cfs) as baseflow to the East Fork Bull River. The discharge is unlikely to adversely affect water quality. Using all available hydrologic data collected during mining, low permeability barriers would be designed to minimize post-mining changes in East Fork Bull River and East Fork Rock Creek streamflow.

Water Quality Standards and Limits. The DEQ developed and the Montana Board of Environmental Review adopted numeric and narrative water quality standards for the protection of beneficial uses of analysis area water bodies. In response to a petition from NMC (MMC's predecessor), the BHES issued an 1992 Order to that authorized degradation and established numeric limits for total dissolved solids, chromium, copper, iron, manganese, and zinc (both surface water and groundwater), as well as nitrate (groundwater only), and total inorganic nitrogen (surface water only). For these parameters, the limits contained in the authorization to degrade apply. For the parameters not covered by the authorization to degrade, the applicable nonsignificance criteria established by the 1994 nondegradation rules apply, unless MMC obtained an authorization to degrade under current statute. The limits apply to all surface water and groundwater in the Libby Creek, Poorman Creek, and Ramsey Creek watersheds adjacent to the Montanore Project and remain in effect during the operational life of the mine and for as long thereafter as necessary.

Groundwater Quality-Tailings Impoundment, LAD Areas, and Libby Adit Area. Groundwater in the tailings impoundment, LAD Areas, and Libby Adit Area is a calcium-bicarbonate or calcium-magnesium bicarbonate type with low total dissolved solids concentrations, low nutrient concentrations, and dissolved metal concentrations that are typically below detection limits. No groundwater users have been identified in the analysis area. Private land immediately downgradient of the Little Cherry Creek Tailings Impoundment Site in Alternatives 2 and 4 is owned by MMC. Private land immediately downgradient of LAD Area 2 in Alternative 2 and downgradient of the Poorman Impoundment Site in Alternative 3 is not owned by MMC.

In all alternatives, seepage not captured by the seepage collection system at the tailings impoundment would mix with the underlying groundwater. The existing groundwater quality would be altered because the seepage water quality would have higher concentrations of nitrate, several metals, and total dissolved solids than existing water quality. Manganese and antimony concentrations in all alternatives are predicted to be higher than nondegradation or BHES Order limits. Concentrations of other metals, after mixing, are predicted to be below nondegradation and BHES Order limits. MMC requested a groundwater mixing zone beneath and downgradient of the Poorman Impoundment for changes in water quality. Requested boundaries of the groundwater mixing zone beneath and downgradient of the Poorman Impoundment are 5,000 feet in length (east-west) downgradient of the west upper edge of the tailings impoundment; and 7,000 feet in width extending north-south (coinciding with tailings impoundment width plus an additional 1,000 feet for spread of mixing zone). The DEQ would determine if a mixing zone beneath and downgradient of the impoundment would be authorized in accordance with ARM 17.30.518 and, if so, would determine its size, configuration, and location. If DEQ authorized a mixing zone, water quality changes might occur, but BHES Order limits could not be exceeded outside the mixing zone, and for other water quality parameters, exceedance of nonsignificance criteria could not occur outside the mixing zone unless authorized by DEQ. A mixing zone is a limited area of a surface water body or a portion of an aquifer, where initial dilution of a discharge takes place and water quality changes may occur, and where certain water quality standards may be exceeded (ARM 17.30.502(6)).

Seepage not captured by the seepage collection system at the tailings impoundment would be intercepted by the pumpback well system and pumped to the mill for reuse during operations. Pumpback wells would be installed if required to comply with applicable standards in Alternative 2. In Alternatives 3 and 4, a pumpback well system would be required and a system design would be finalized after site investigations gathered sufficient information to refine a 3D groundwater model. The goal of a pumpback system would be to establish and maintain complete hydraulic capture of all groundwater moving downgradient from the impoundment, as confirmed by measuring water levels at adjacent monitoring wells. At closure, intercepted seepage would be sent to the LAD Areas or Water Treatment Plant in Alternative 2, the Water Treatment Plant in Alternatives 3 and 4, or pumped back to the impoundment in all alternatives. MMC would continue to operate the seepage collection and pumpback well systems, and the Water Treatment Plant until water quality standards, BHES Order limits, and MPDES permitted effluent limits were met without treatment.

In Alternative 2, concentrations of total dissolved solids, nitrate, antimony, arsenic, cadmium, mercury, and manganese beneath the LAD Areas are predicted to exceed groundwater quality standards, BHES Order limits or nonsignificance criteria in one or more phases of mining. MMC requested a source-specific groundwater mixing zone for the LAD Areas. During the MPDES permitting process, the DEQ would determine if a mixing zone beneath and downgradient of the LAD Areas should be authorized in accordance with ARM 17.30.518 and, if so, would determine its size, configuration, and location. If DEQ authorized a mixing zone, water quality changes might occur and certain water quality standards could be exceeded within the mixing zone. The

DEQ typically does not authorize mixing zones for LAD Areas. The DEQ also would determine where compliance with applicable standards would be measured.

In all mine alternatives, mine and adit water treated at the Water Treatment Plant at the Libby Adit Site may be discharged to groundwater via a percolation pond or drainfield located in the alluvial adjacent to Libby Creek. The expected quality of the treated water would be below BHES Order limits for groundwater or nonsignificance criteria. In the draft renewal MPDES permit, the DEQ preliminarily determined the size, configuration, and location of the mixing zones in Libby Creek for Outfalls 001, 002, and 003. The chronic groundwater mixing zone for Outfalls 001 and 002 authorized in the 1997-issued MPDES permit and continued in the 2006-issued MPDES permit was retained in the draft renewal MPDES permit. The final MPDES permit will contain DEQ's final determination regarding mixing zones.

Surface Water Quality. Surface waters in the analysis area are a calcium bicarbonate-type water. Total suspended solids, total dissolved solids, turbidity, major ions, and nutrient concentrations are low, frequently at or below analytical detection limits. Metal concentrations are generally low with a high percentage of below detection limit values. Some elevated metal concentrations may be attributable to local mineralization. Analysis area streams are poorly buffered due to low alkalinities, and consequently tend to be slightly acidic. Water hardness is typically less than 35 mg/L. Lakes in and near the CMW have high water quality. The water quality of streams, springs, and lakes varies based on the relative contribution of surface water runoff, shallow groundwater, and deeper bedrock groundwater.

In the analysis area, five streams are listed on Montana's list of impaired streams. Libby Creek is separated into two segments. The upper segment is from 1 mile above Howard Creek to the US 2 bridge. This segment is listed as not supporting drinking water and partially supporting its fishery and aquatic life. Probable causes of impairment listed are alteration in stream-side vegetative covers and physical substrate habitat alterations. Probable sources of impairment are impacts from abandoned mine lands and historic placer mining. The lower segment, which is downstream of the analysis area, begins at the US 2 bridge and is impaired for physical substrate habitat alterations and sediment/siltation. A short segment of Big Cherry Creek where it parallels the Bear Creek Road is in the analysis area. Big Cherry Creek from Snowshoe Creek to the mouth is impaired due to alteration in stream-side vegetative cover, cadmium, lead, zinc, and physical substrate habitat alterations. Probable sources of impairment are forest road construction and use, mine tailings, impacts from abandoned mine lands, and habitat modification. A Total Maximum Daily Load for cadmium, lead, and zinc was established in Big Cherry Creek; alteration in stream-side vegetative cover and physical substrate habitat alterations are not pollutants and did not require a Total Maximum Daily Load. A short segment of the Fisher River where it parallels US 2 is in the transmission line analysis area. The Fisher River from the confluence of the Silver Butte Fisher River and the Pleasant Valley Fisher River to the confluence with the Kootenai River also is impaired, with aquatic life support and cold-water fishery uses only partially supported. Probable causes for the Fisher River impairment are a high flow regime, with probable sources of these impairments listed as channelization and streambank modification and destabilization. Rock Creek from the headwaters (including Rock Lake and East Fork Rock Creek) to the mouth below Noxon Dam is impaired, with aquatic life support and cold-water fishery uses only partially supported. The DEQ did not separate East Fork Rock Creek and Rock Creek, which begins at the confluence of the East and West forks. Probable causes for the Rock Creek impairment are other anthropogenic substrate alterations, with probable sources of these impairments listed as silvicultural activities. A Total Maximum Daily Load is not required on the upper Libby Creek segment, the Fisher River, East Fork Rock Creek, or Rock Creek because no pollutant-related use impairment was identified.

Alternative 1 would not affect surface water quality. Alternatives 2, 3, and 4 would affect stream quality by increasing dissolved solids, nitrogen, and metal concentrations. In Alternative 2, wastewater discharges at the LAD Areas are predicted to exceed BHES Order limits or nonsignificance criteria for one or more parameters in Libby, Ramsey, and Poorman creeks. If land application of excess water resulted in water quality exceedances, MMC would treat the water at the Water Treatment Plant before land application. If needed, an additional water treatment facility may be required. Water discharged from the Water Treatment Plant in all alternatives would not cause an exceedance in a BHES Order limits or water quality standards for any parameter downstream of the mixing zone.

In Alternatives 3 and 4, all wastewater would be treated at the Water Treatment Plant. The treatment plant would be expanded to accommodate discharges during the estimated wettest year in a 20-year period and modified as necessary to treat parameters such as nutrients or metals to meet MPDES permitted effluent limits. To monitor protection of beneficial uses, MMC would implement the water quality and aquatic biology monitoring described in Appendix C, such as monitoring for periphyton and chlorophyll-a monthly between July and September. Changes also would occur in part due to reductions in streamflow contributions from deeper groundwater, which contributes more dissolved solids to streams than shallower sources of water.

The DEQ preliminarily established a mixing zone in the draft renewal MPDES permit. The mixing zone for Outfalls 001 and 002 extended from their point of discharge to Libby Creek downgradient to monitoring station LB-300 for these parameters: nitrate + nitrite, total inorganic nitrogen, chromium, copper, iron, lead, manganese, and zinc. For Outfalls 001, 002, and 003, the DEQ preliminarily authorized a chronic mixing zone, at 25 percent of the $7Q_{10}$, from the point of discharge two stream widths for the following parameters: nitrate + nitrite, total inorganic nitrogen, chromium, copper, iron, lead, manganese, and zinc. For Outfalls 001, 002, and 003, the DEQ also preliminarily authorized a nutrient mixing zone, at 100 percent of the 14-day, 5-year low flow ($14Q_5$), from the point of discharge two stream widths for the following parameters: total nitrogen, and total phosphorus. MMC did not request a mixing zone for any discharges from Outfalls 004 through 008; any applicable effluent limitations must be met at the end-of-pipe discharge. The DEQ did not authorize a mixing zone for any parameters discharged from Outfalls 004 through 008 in the draft renewal permit. The final MPDES permit will contain DEQ’s final determination regarding mixing zones.

Stream temperature is an important criterion for aquatic life and Montana has surface water aquatic life standards for temperature changes. The project may affect stream temperatures by discharge of treated water from the Water Treatment Plant, vegetation clearing, decreased streamflow due to direct diversions, or changes in groundwater discharge to area streams. Water discharged from the Water Treatment Plant, if discharged to the percolation pond or drainfield next to Libby Creek, would cool as it flowed from the percolation pond via the subsurface to the creek. Heat is not added as part of the facility’s wastewater treatment process. Discharges to groundwater (Outfalls 001 and 002) are expected to attenuate any thermal effects. Synoptic temperature data collected in 2014 and 2015 generally indicate less than 1 degree change between monitoring locations LB-200 and LB-300. Conditions where a direct discharge to Libby Creek would be necessary are expected to be limited in duration and frequency during the project; a direct discharge to Libby Creek has not been reported since the MPDES permit was first issued in

1997. Temperatures upstream and downstream of the Water Treatment Plant outfalls would be monitored during water resources and aquatic biology monitoring (see Appendix C). Clearing would increase direct solar radiation to streams and may increase stream temperature slightly at and for a short distance below the stream crossings along new roads on warm to hot days. The pumpback wells and any other diversions (such as make-up wells) would reduce streamflow. For example, at PM-1200 in Poorman Creek, the estimated $7Q_{10}$ flow is predicted to be reduced by up to 12 percent. It is possible that this might increase the stream temperature during low flows, but forest shading and flow in the gravel streambed substrate, as well as groundwater supply to the stream, may prevent or minimize such a temperature change.

The reduction in bedrock groundwater inflows to analysis area streams due to mine inflows may increase stream temperatures where and when bedrock groundwater is the major component of baseflow, such as in the upper streams in the mine area where alluvial and colluvial deposits are thin or absent. Bedrock groundwater flow to streams is fracture controlled and does not occur uniformly along any stream reach. It is difficult to predict how, when and where reduced bedrock inflows may affect stream temperatures, or if such changes would be measureable.

Due to the numerous factors affecting stream temperatures and the constantly changing stream temperature regime that occurs, it is difficult to predict how activities other than water treatment plant discharges may indirectly affect stream temperature, or to what extent stream temperatures may change. It may not be possible to separate indirect effects of the mine alternatives on stream temperature from other natural effects. The agencies' water resources and aquatic biology monitoring includes temperature monitoring (Appendix C).

Surface Water Quality-Sediment. In Alternatives 2, the Ramsey Plant Site would be built within a Riparian Habitat Conservation Area. Non-channelized sediment flow rarely travels more than 300 feet and 200- to 300-foot riparian buffers are generally effective at protecting streams from sediment from non-channelized overland flow. The Ramsey Plant Site would increase the potential for non-channelized sediment flow to reach Ramsey Creek.

Stormwater runoff from all mine facilities and roads within the mine permit area boundary in Alternatives 2, 3 and 4 would be collected in ditches and directed to one or more sediment ponds. In Alternative 2, ponds would be designed to contain runoff from a 10-year/24-hour storm. Ditches and sediment ponds containing process water or mine drainage in Alternatives 3 and 4 would be designed for the 100-year/24-hour storm to minimize potential overflow to nearby streams, which would be more effective in minimizing erosion and sedimentation.

Within the mine permit area boundary, all stormwater runoff from roads would be captured by ditches and sediment ponds sized to contain the 10-year/24 hour storm. Any discharges from the ponds would be routed toward MPDES permitted outfalls.

For access roads located outside of the mine permit area boundary, the sediment runoff model showed that reducing the road length contributing to the nearest RHCA by adding drain dips, surface water deflectors or open top box culverts that would route the water off the road away from drainages or wetlands would reduce the average annual sediment leaving the road buffer and entering RHCAs by about one-third. Reducing the contributing road length to less than 150 feet would reduce sediment delivery further. The sediment runoff from roads outside of the permit area boundary would be minimized through the use of Best Management Practices in all alternatives. Various studies have shown that Best Management Practices implemented to reduce sediment movement from roads, cutslopes and fillslopes to drainages are effective in reducing sediment by 70 to 100 percent. Appropriate Best Management Practices would be determined on a site-specific basis and would be monitored to determine their effectiveness.

In Alternative 2, a Diversion Dam in Little Cherry Creek would be constructed to divert flow above the dam around the tailings impoundment. The Diversion Channel would consist of an upper channel, and two existing natural drainage channels tributary to Libby Creek. Two natural drainages would be used to convey water from the upper channel to Libby Creek. The drainages are not large enough to handle the expected flow volumes and downcutting and increased sediment delivery to Libby Creek would occur as the channels stabilized. In the event of heavy precipitation during construction of the channel, substantial erosion and short-term increases in sedimentation to the lower channel and Libby Creek would occur. Where possible, MMC would construct bioengineered and structural features in the two tributary channels to reduce flow velocities, stabilize the channels, and create fish habitat.

Alternative 4 would have similar effects as Alternative 2. The Diversion Channel in Alternative 4 would flow into a constructed channel that would be designed to be geomorphologically stable and to handle the 2-year flow event. A floodplain would be constructed along the channel to allow passage of the 100-year flow. Following reclamation of the impoundment, the constructed channel would undergo an additional period of channel adjustment when runoff from the impoundment surface was directed to the Diversion Channel. The increase in flow would be about 50 percent higher than during operations, and would lead to new channel adjustments. This would likely cause short-term increases in sedimentation in the lower channel and Libby Creek. Alternative 3 would not require the diversion of a perennial stream.

Issue 3: Fish and Other Aquatic Life and Their Habitats

Aquatic habitat in most analysis area streams is good to excellent. The riparian habitat condition in Libby Creek between Poorman Creek and Little Cherry Creek is fair, reflecting the physical effects of abandoned placer mining operations. Overall, the analysis area streams score high on measures such as bank cover and stability, while measures of pool quality and quantity are typically lower, resulting in an overall reduction in stream reach scores for habitat condition. Most streams have a moderate susceptibility to habitat degradation.

Analysis area streams provide habitat for the federally listed bull trout, and Forest Service sensitive species westslope cutthroat trout and interior redband trout. Mixed redband rainbow, coastal rainbow, and westslope cutthroat/rainbow hybrids, Yellowstone cutthroat, brook trout, torrent and slimy sculpin, mountain whitefish, longnose dace, and largescale suckers are also in the drainages. In the mine analysis area, designated critical bull trout habitat is found in segments of Libby Creek, Bear Creek, Rock Creek, East Fork Rock Creek, and East Fork Bull River. Bull trout are found in most streams, except where barriers have prevented their passage, such as Little Cherry Creek and Miller Creek. No pure westslope cutthroat trout populations have been found to inhabit stream reaches within the Libby Creek watershed. The hybrid trout populations in Ramsey Creek, Bear Creek, Little Cherry Creek, and segments of Libby Creek downstream of the mine area include coastal rainbow/westslope cutthroat and redband/westslope cutthroat trout hybrids. The East Fork Bull River has a pure westslope cutthroat trout population, and both pure and hybrid populations are found in East Fork Rock Creek. Miller Creek has a pure westslope cutthroat trout population. Pure populations of interior redband trout are found in Libby, Bear, Little Cherry Creek, Poorman, and Ramsey creeks and in the Fisher River.

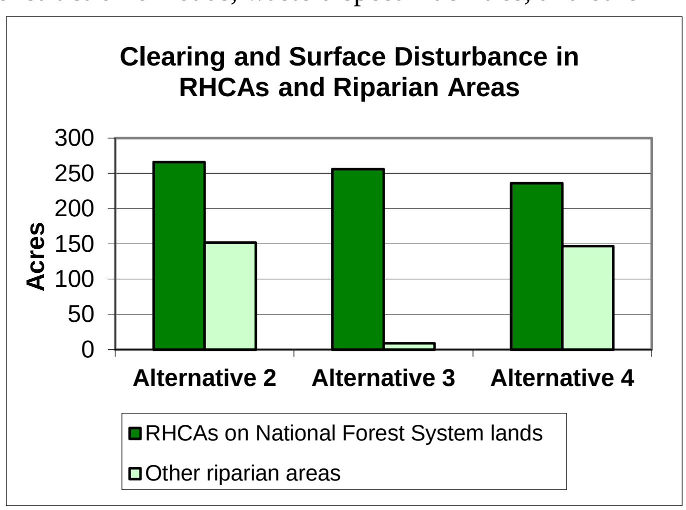
In Alternative 1, No Mine, the Montanore Project would not be developed and existing disturbances would continue to affect aquatic habitats. Past activities, particularly timber harvest and road construction, and ongoing current activities have occurred in RHCAs, and would continue to decrease the quality of aquatic habitats. Productivity of fish and other aquatic life in analysis area streams would continue to be limited by past natural and human-caused adverse habitat changes, by naturally low nutrient concentrations, and by natural habitat limitations from periodic floods and other climate and geology influences.

Bull trout populations would continue to be marginal and their habitat would continue to be in need of restoration work. Bull trout populations would be susceptible to decline or disappearance due to hybridization with the introduced brook trout, competition with brook trout and other trout present in the analysis area, or from other land use disturbances. Redband trout and westslope cutthroat trout also would continue to be subject to population declines, mainly due to the threat of hybridization from past introductions of non-native salmonids.

Sediment. Any increased sediment loads to streams would most likely occur during the Construction Phase of the mine, when trees, vegetation, or soils were removed from many locations for mine facilities, and roads. Road construction and reconstruction is often considered the largest source of sediment in mining and timber harvest areas due to the removal of vegetation and construction of cut and fill slopes that expose large areas subject to erosion. Any increased sediment in streams would alter stream habitat by decreasing pool depth, alter substrate composition by filling in interstitial spaces used by juvenile fish and invertebrates, and increase substrate embeddedness, or the degree in which fine substrates surround coarse substrates. Best Management Practices in all action alternatives and road closures in Alternatives 3 and 4 would minimize any sedimentation to streams, substantially decrease sediment delivery from roads to streams, and benefit aquatic life.

Riparian Habitat Conservation Areas. RHCAs are protection zones adjacent to streams, wetlands, and landslide-prone areas. The 2015 KFP has standards and guidelines for managing activities that potentially affect conditions within the RHCAs, and for activities in areas outside RHCAs that potentially degrade RHCAs. These standards and guidelines apply only to riparian areas on National Forest System lands. Similar riparian areas are found on private land. All riparian areas are covered by Montana's Streamside Management Zone law.

Alternatives 2, 3, and 4 would require construction of roads, waste disposal facilities, and other facilities in RHCAs. Protection of RHCAs was a key criterion in the alternatives analysis and development of alternatives. The lead agencies did not identify an alternative that would avoid locating all mine facilities in RHCAs. Alternative 2 would affect 266 acres of RHCAs and 152 acres of other riparian areas on private lands, primarily in the Little Cherry Creek Impoundment Site and the Ramsey Plant Site. Little Cherry Creek and Ramsey Creek are both fish-bearing streams, which affects the width of



RHCAs. Effects of Alternatives 3 and 4 would be less than Alternative 2. Alternative 3 would affect 256 acres of RHCAs and 9 acres of other riparian areas on private lands. The RHCAs in the Poorman Tailings Impoundment Site in Alternative 3 are not adjacent to fish-bearing streams. The Libby Plant Site in Alternatives 3 and 4 would not affect RHCAs. The disturbance area at the Little Cherry Creek Impoundment Site would be changed in Alternative 4 to avoid RHCAs. Alternative 4 would affect 236 acres of RHCAs and 147 acres of other riparian areas on private lands, primarily in the Little Cherry Creek Impoundment Site. In Alternatives 3 and 4, MMC would develop and implement a final Road Management Plan to reduce effects on RHCAs. The plan would describe for all new and reconstructed roads criteria that govern road operation, maintenance, and management; requirements of pre-, during-, and post-storm inspection and maintenance; regulation of traffic during wet periods to minimize erosion and sediment delivery and accomplish other objectives; implementation and effectiveness monitoring plans for road stability, drainage, and erosion control; and mitigation plans for road failures.

Water Quantity. Alternatives 2, 3, and 4 would alter flow in Libby Creek and its tributaries through appropriations and discharges. Changes in flow would not affect aquatic habitat during high flow periods between April and July. In all alternatives, reduced streamflow would reduce habitat availability at low flow in Ramsey, Poorman, Libby Creek above the Libby Adit, East Fork Rock Creek, Rock Creek, and East Fork Bull River, particularly during Closure and Post-Closure Phases. Reduction in habitat availability would range up to 20 percent. The agencies' bull trout mitigation plan would mitigate for the reduction in habitat availability in Alternatives 3 and 4. Reduced streamflow and habitat availability below the Libby Adit also would occur in Alternative 2. In Alternatives 3 and 4, higher low flow from discharges to Libby Creek would improve habitat in Libby Creek below the Libby Adit during all mine phases. Streamflow changes when groundwater levels reached steady state conditions would not affect aquatic habitat in any analysis area stream.

In Alternatives 2 and 4, Little Cherry Creek would be diverted permanently around the tailings impoundment, resulting in a loss of 15,600 feet of fish habitat in the existing Little Cherry Creek. The agencies' analysis assumed the engineered diversion channel would not provide any fish habitat, while the two channels would eventually provide marginal fish habitat. Reductions in flow in the Diversion Channel during Operations, Closure, and early Post-Closure phases would not support the current redband trout population in Little Cherry Creek. The effect of Alternative 3 on Little Cherry Creek would be minimal.

Water Quality. Alternative 2 would increase concentrations of nutrients, such as nitrate and some metals in Ramsey, Poorman, and Libby creeks. Similar increases would occur in Libby Creek in Alternatives 3 and 4. Low nutrient concentrations currently contribute to low aquatic productivity. A total nitrogen concentration greater than 0.275 mg/L may cause an increase in algal growth in Libby Creek, but algal growth may be constrained by factors other than nitrogen, such as phosphorus, temperature, or streambed scouring. Increased algal growth could stimulate productivity rates for aquatic insects and, consequently, stimulate populations of trout and other fish populations. Whether total inorganic nitrogen concentrations greater than 0.275 mg/L and less than 1 mg/L would actually increase algal growth to the extent that it would be considered "nuisance" algae is unknown. To address the uncertainty regarding the response of area streams to increased total inorganic nitrogen concentrations, MMC would implement water quality and aquatic biology monitoring, including monitoring for periphyton and chlorophyll-a monthly between July and September.

The low concentrations of dissolved minerals in surface waters of the Libby Creek drainage cause these waters to tend toward acidic pH levels, and to have extreme sensitivities to fluctuations in acidity. For most heavy metals, the percentage of the metal occurring in the dissolved form increases with increasing acidity. Generally, dissolved metals are the most bioavailable fraction and have the greatest potential toxicities and effects on fish and other aquatic organisms. Any increase in metal concentrations could increase the potential risk for future impacts on fish and other aquatic life in some reaches. Metal concentrations near the aquatic life could result in physiological stress, such as respiratory and ion-regulatory stress, and mortality.

Issue 4: Scenic Quality

The existing scenery would not change in the No Mine Alternative. The existing Libby Adit Site would remain, and would be visible only from one KOP in a montane forest at a National Forest System road #231 pullout. Disturbances on private land at the Libby Adit Site would remain until reclaimed in accordance with existing permits and approvals.

Mine facilities in all mine action alternatives would have very low scenic integrity during the Operations Phase and would not meet the 2015 KFP mapped scenic integrity objectives. Following mine closure, reclamation of most mine facilities would return disturbed areas to a condition similar to a timber harvested area, which would be consistent with scenic integrity objectives. The landscape at the impoundment sites would always appear altered and portions of the impoundment would not be consistent with a scenic integrity objective of moderate. None of the mine action alternatives would entirely meet the 2015 KFP guideline (FW-GDL-AR-01) for scenic resources and amendments to the 2015 KFP would be required.

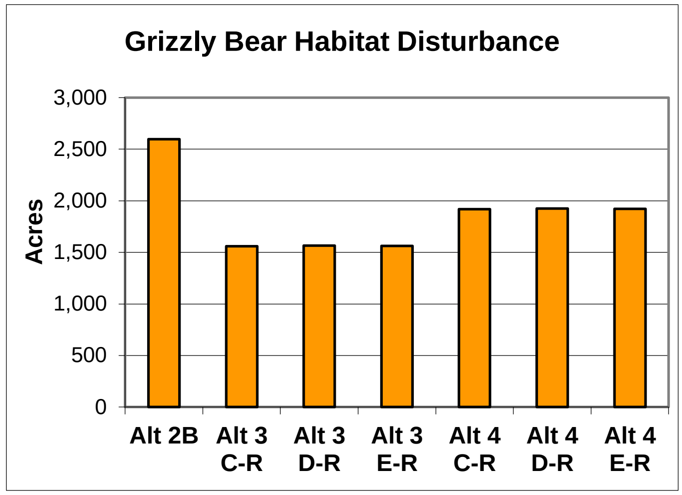
Issue 5: Threatened and Endangered Wildlife Species

The mine area provides habitat for two threatened and endangered wildlife species: the grizzly bear and the Canada lynx. Bull trout, which is also a threatened and endangered species, was discussed previously under Issue 3, *Effects on Fish and Other Aquatic Life and Their Habitats*.

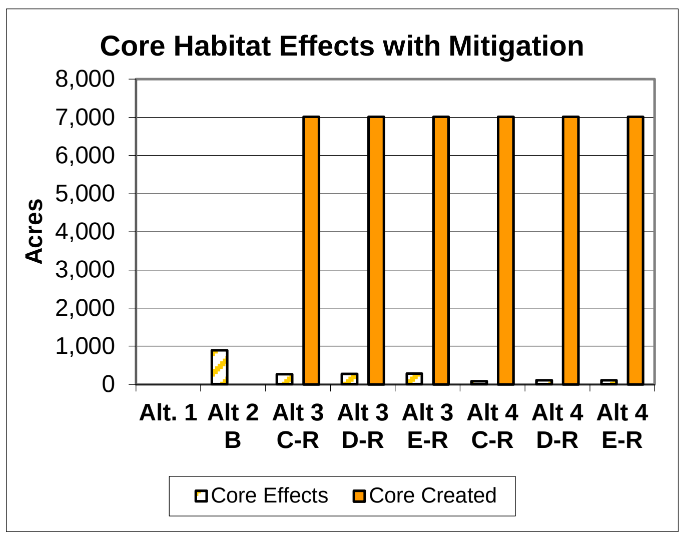
Grizzly Bear. All alternatives may affect, and are likely to adversely affect the grizzly bear. In its Biological Opinion, the USFWS indicated that it was the USFWS' biological opinion that the Montanore Project as proposed in the KNF's preferred Mine Alternative 3 and the agencies' preferred Transmission Line Alternative D-R is not likely to jeopardize the continued existence of the grizzly bear. No critical habitat has been designated for this species, and therefore none would be affected.

The agencies used five measurable criteria to assess effects on the grizzly bear: physical habitat disturbance, percent core habitat, percent open motorized route density, percent total motorized route density, and displacement effects. These criteria are evaluated within a planning area called a Bear Management Unit, or BMU. A BMU is an area of land containing sufficient quantity and quality of all seasonal habitat components to support a female grizzly. The project would affect habitat in three BMUs: BMU 2, Snowshoe, BMU 5, St. Paul, and BMU 6, Wanless.

Because of the complexity of the analysis, the agencies did not complete separate analyses for criteria dependent on open roads for the mine alternatives and transmission line alternatives. Instead, the agencies analyzed combinations of mine and transmission line alternatives, which would compose a complete project. Alternative 2B is MMC's proposed mine (Alternative 2) and its proposed North Miller Creek transmission line alternative (Alternative B). Six other mine and transmission line alternative combinations were analyzed: mine Alternative 3 with the three agencies' transmission line alternatives (Alternatives C-R, D-R, and E-R); and mine Alternative 4 with the three agencies' transmission line alternatives (Alternatives C-R, D-R, and E-R). These combinations are discussed in the following sections on effects on grizzly bear.



Physical Habitat Disturbance. All action alternatives would remove grizzly bear habitat due to the construction of mine facilities and new or upgraded roads. Alternative 2B would remove the most grizzly bear habitat (2,598 acres), while Alternatives 3C-R, 3D-R, and 3E-R would remove the least (1,560 to 1,567 acres). For all combined action alternatives, construction and improvement of access roads during transmission line construction would temporarily remove habitat. The impacts of physical habitat loss would be reduced through MMC and agencies' land acquisition requirements. In Alternative 2B, MMC would acquire 2,826 acres (an approximate 1:1 ratio of habitat lost to replacement) and transfer the lands or a conservation easement to the KNF. In the agencies' alternatives, MMC would acquire 2 acres of habitat for every acre of grizzly bear habitat physically lost (between 3,120 and 3,852 acres, depending on the alternative). Acquired parcels that might otherwise be developed in a manner inconsistent with bear needs would be managed for grizzly bear use in perpetuity.

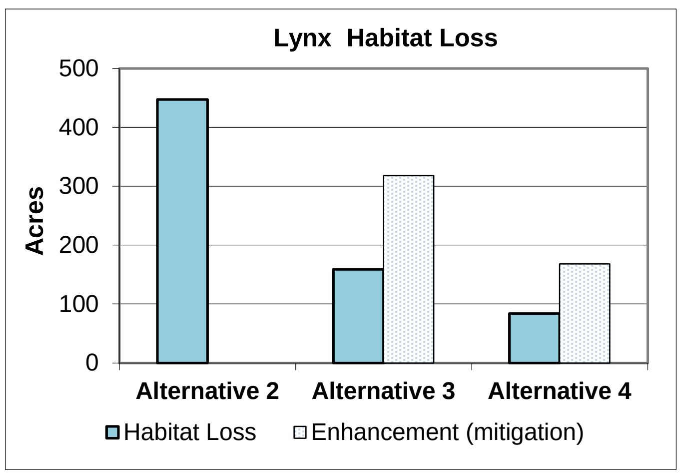


Percent Core Habitat. A core area or core habitat is an area of high quality grizzly bear habitat within a BMU that is greater than or equal to 0.31 mile from any road (open or gated), motorized trail, or high use non-motorized trail open during the active bear season. Core habitat may contain restricted roads, but such roads must be effectively closed with devices such as earthen barriers or vegetation growth.

Alternative 2B would reduce core habitat by 566 acres in BMU 5 and 314 acres in BMU 6, for a total reduction of 880 acres. Access changes proposed in MMC's mitigation plan would have no effect on core. Alternatives 3C-R, D-R, and E-R would have similar effects, reducing core by 253 to 271 acres. Alternative 4C-R would have the least effect on core habitat, reducing 73 acres in BMU 5. Access changes proposed by the KNF would create core habitat in the agencies' alternatives, and core habitat in BMU 5 in the other six alternative combinations would increase by 6,732 acres. The agencies' proposed land acquisition requirement for wildlife mitigation would have the potential to increase core habitat through access changes on acquired land.

Total and Open Motorized Route Density. These criteria measure of the density of roads or trails in a BMU that exist or are open for motorized access. In Alternative 2B, road density would increase in one or more phases of the project in BMU 5 and 6. In Alternatives 3C-R, 3D-R, 4C-R, and 4D-R with mitigation, only total motorized route density during the Construction Phase would increase above standards. Route density would be better than the standards during the other phases and would be better than the standards in all phases in Alternatives 3E-R and 4E-R.

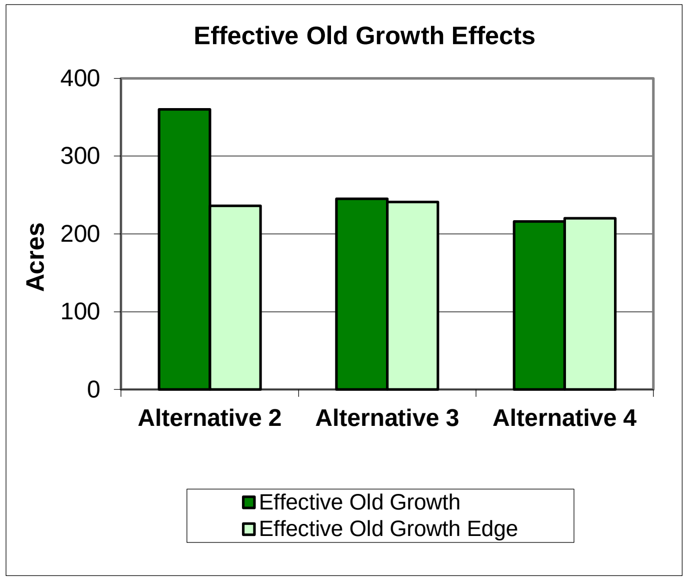
Displacement Effects. Disturbance from human activities may displace grizzly bears from suitable habitat to other areas with fewer disturbances, changing normal behavior or disrupting normal movement patterns. The analysis of habitat displacement estimates the extent of the displacement, or zone of influence, and the degree to which suitable grizzly bear habitat is used. Long-term displacement effects in the Cabinet-Yaak Recovery Zone from activities associated with mine construction and operations would occur on a total of 6,901 acres in Alternative 2, 5,087 acres in Alternative 3, and 5,362 acres in Alternative 4. Displacement in Alternatives 3 and 4 would be primarily during the grizzly bear summer season of April 16 to October 31. Long-term displacement effects would be mitigated by the agencies' proposed land acquisition requirements and other measures. The land acquisition requirement for mitigation of long-term displacement would be 2,293 acres in Alternative 3 and 2,339 acres in Alternative 4.



Canada Lynx. Alternative 2 would not meet all Northern Rockies Lynx Management Direction objectives, standards, or guidelines and would remove 2 percent of lynx habitat in either the Crazy or West Fisher Lynx Analysis Units for the life of the mine (about 30 plus years) from the Crazy Lynx Analysis Unit. The agencies combined action alternatives would remove less than 1 percent of lynx habitat in either the Crazy or West Fisher Lynx Analysis Units and would meet all applicable Northern Rockies Lynx Management Direction objectives, standards, and guidelines. The USFWS concurred with the Forest Service's determination that the KNF's preferred Mine Alternative 3 and the agencies' preferred Transmission Line Alternative D-R may affect, but is not likely to adversely affect the Canada lynx. The USFWS does not review or provide concurrence on no effect determinations but acknowledged the Forest Service's analysis that the project would have no effect on lynx critical habitat.

Effects on lynx habitat would range from 447 acres in Alternative 2 to 84 acres in Alternative 4. In the agencies' alternatives, impacts on currently suitable lynx habitat would be offset through enhancement of between 168 and 308 acres of lynx stem exclusion habitat.

Issue 6: Other Wildlife and Key Habitats



Old Growth. Alternative 1 would have no direct effect on effective old growth or associated plant and wildlife. All old growth areas would maintain their existing conditions and continue to provide habitat for those species that use the area over a long term. Alternatives 2, 3, and 4 would reduce the amount of effective old growth. Effective old growth removed for mine facilities would range from 216 acres in Alternative 4 to 360 acres in Alternative 2. Alternatives 2, 3, and 4 would reduce the quality of effective old growth by creating openings in old growth, or creating an "edge effect." Edge effects would range from 220 acres in Alternative 4 to 241 acres in Alternative 3. Losses and degradation of old growth may be offset by land acquisition associated with grizzly bear habitat mitigation if old growth characteristics were present on the acquired parcels. Sufficient old growth would be present in all alternatives to be consistent with the 2015 KFP direction regarding old growth.

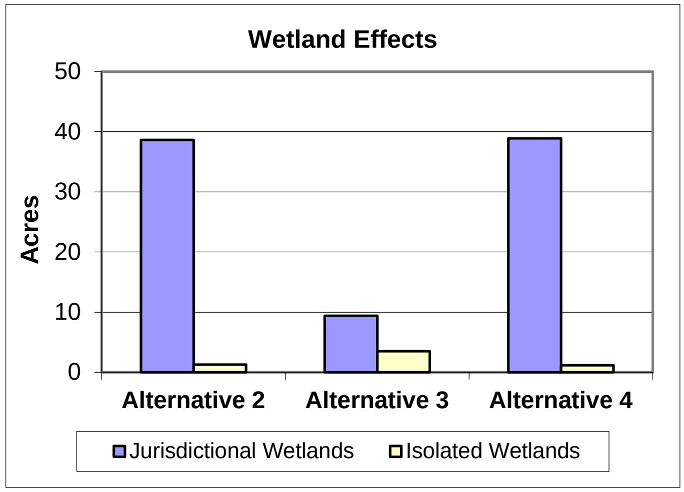
Pileated Woodpecker. In Alternative 1, natural successional processes would continue to occur throughout old growth stands and habitat would continue to be provided for pileated woodpecker nesting pairs where feeding and breeding conditions are suitable. Alternative 1 would not have direct or indirect impacts on pileated woodpecker habitat and would not change potential population index. The effects on old growth in Alternatives 2, 3, and 4 would reduce nesting and foraging habitat and habitat quality for the pileated woodpecker. Alternatives 2, 3, and 4 would result in the loss of snags and downed logs greater than 10 inches diameter at breast height that provide potential nesting and foraging habitat for pileated woodpeckers. Snag densities and quantities of down wood would continue to be sufficient to sustain viable populations of cavity-dependent species in the KNF.

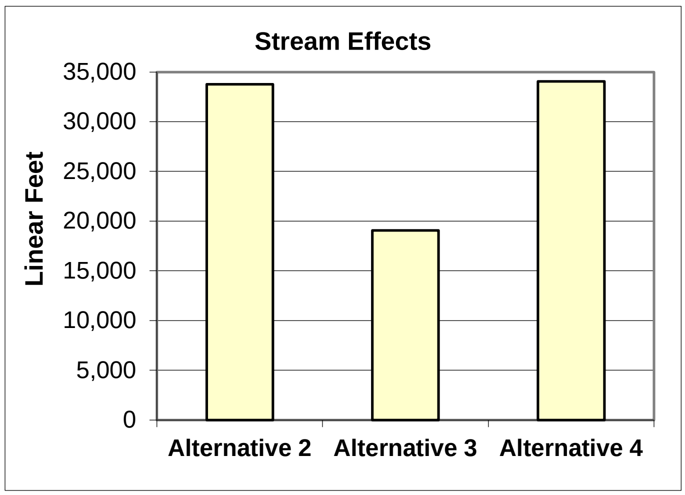
Issue 7: Wetlands and Streams

The No Mine Alternative would not disturb or affect any wetlands or streams. Any existing wetland disturbances would be mitigated in accordance with existing permits and approvals.

Alternatives 2, 3, and 4 would require the unavoidable filling of jurisdictional wetlands, isolated wetlands, and streams. Wetlands that are isolated from other waters of the U.S., and whose only connection to interstate commerce is use by migratory birds, do not fall under Corps of Engineers' jurisdiction. The terms "isolated" and "non-jurisdictional" wetlands are used synonymously. The jurisdictional status of the wetlands and other waters of the U.S. is preliminary and impacts may change during the 404 permitting process.

Effects of Alternatives 2 and 4 would be similar, with Alternative 2 directly or indirectly affecting 38.6 acres and Alternative 4 affecting 38.9 acres of jurisdictional wetlands; both alternatives would affect about 1 acre of isolated wetlands. Both alternatives would have similar effects on streams, directly and indirectly affecting about 34,000 linear feet. Alternative 3 would have less effect than Alternatives 2 and 4. Alternative 3 would directly or indirectly affect 9.4 acres of jurisdictional wetlands, 3.5 acres of isolated wetlands, and about 19,000 linear feet of streams.





The effect on wetland, spring, and seep habitat overlying the mine would be the same in Alternatives 2, 3, and 4. The effects on springs and seeps at the tailings impoundment site in each alternative was discussed previously under groundwater (see p. S-32). The indirect effect on wetlands, springs, and seeps overlying the mine and downstream of the tailings impoundment is difficult to predict. The effect on plant species, functions, and values associated with the affected wetlands, springs, or seeps by a change in water level would be best determined by relating plant species with water abundance and quality for monitoring and evaluation. Alternative 2 does not include a survey and monitoring of groundwater-dependent ecosystems overlying the mine. Without this type of monitoring, mining-induced changes in water level or quality may result in a loss of species, functions, and values associated with the affected wetlands, springs, or seeps. Monitoring of wetlands, springs, and seeps overlying the mine area and tailings impoundment sites would be conducted in Alternatives 3 and 4.

In Alternative 2, MMC proposes to replace forested and herbaceous wetlands at a 2:1 ratio and herbaceous/shrub wetlands at a 1:1 ratio. The feasibility of MMC's proposed Wetland Mitigation Plan to replace the lost functions of all potentially affected wetlands is uncertain. MMC's plan is conceptual and would be refined during the 404 permitting process. MMC did not update its mitigation plan for Alternative 2 to reflect new wetland and stream mitigation regulations and procedures.

In Alternatives 3 and 4, the proposed Swamp Creek off-site wetland mitigation area has about 15 acres of a degraded wetland that would be rehabilitated for mitigation of effects on jurisdictional wetlands. Mitigation for streams would consist of constructing about 6,500 linear feet of new meandering channels and other improvements at the Swamp Creek property; removing a bridge and replacing culverts, stabilizing 400 feet of eroding roadcut, and removing 21 culverts and restoring adjacent riparian habitat on lands acquired for grizzly bear mitigation. MMC would follow the Corps' compensatory wetland mitigation regulations (33 CFR 332) regarding compensatory mitigation requirements for losses of aquatic resources and Montana Stream Mitigation Procedure in finalizing the mitigation plan. The mitigation would replace the functions of the channels that would be directly or indirectly affected by the tailings impoundment. The Corps would be responsible for developing final mitigation requirements for jurisdictional wetlands and waters of the U.S. during 404 permitting process.

Federal agencies have responsibilities to avoid, minimize, and mitigate unavoidable impacts on wetlands under Executive Order 11990. Federal agencies must find that there is no practicable alternative to new construction located in wetlands, and that the proposed action includes all practicable measures to minimize harm to wetlands. During final design, the agencies would require MMC to avoid or minimize, to the extent practicable, filling wetlands and other streams, such as described in Glasgow Engineering Group, Inc. (2010). This mitigation would ensure adverse effects would be minimized before considering compensatory mitigation. The Corps' wetland mitigation requirements would fulfill the Executive Order's requirements to minimize harm to jurisdictional wetlands. To minimize harm to isolated wetlands, the KNF would require MMC to create 4.5 acres of wetlands and 2.5 acres of upland buffers at three sites in Little Cherry Creek and 3 acres of wetlands and 2 acres of upland buffers at an unreclaimed gravel pit. After the 3D model has been rerun, MMC would reevaluate the feasibility of the three Little Cherry Creek sites and the Gravel Pit site as mitigation for isolated wetlands. Should one or more of the sites be determined to infeasible, MMC could develop similar sites north of Little Cherry Creek where groundwater drawdown would not occur. MMC also would convey the title or a perpetual conservation easement to the Forest Service for the following lands: lands contiguous with existing wetlands, the isolated wetland mitigation sites, and National Forest System lands owned by MMC along Little Cherry Creek.

Draft Findings for Transmission Line Certification Approval

This section summarizes the effects of the transmission line and serves as the draft findings for transmission line certification approval. The DEQ will approve a transmission line facility as proposed or as modified, or an alternative to the proposed facility if it finds and determines:

- The need for the facility
- The nature of probable environmental impacts
- That the facility minimizes adverse environmental impact, considering the state of available technology and the nature and economics of the various alternatives
- What part, if any, would be located underground
- That the facility is consistent with regional plans for expansion of the appropriate grid of the utility systems serving the state and interconnected utility systems
- That the facility will serve the interests of utility system economy and reliability
- The location of the facility as proposed conforms to applicable state and local laws and regulations, except that the department may refuse to apply any local law or regulation if it finds that, as applied to the proposed facility, the law or regulation is unreasonably restrictive in view of the existing technology, of factors of cost or economics, or of the needs of consumers, whether located inside or outside the directly affected government subdivisions;
- That the facility will serve the public interest, convenience, and necessity

- That DEQ has issued all necessary decisions, opinions, orders, certifications, and permits
- That the use of public lands for the location of the facility was evaluated, and public lands were selected whenever their use is as economically practicable as the use of private lands (75-20-301(1), MCA)

Need

In order to determine that there is a need for the proposed electric transmission line, the DEQ must make one of the findings enumerated in ARM 17.20.1606. No electrical distribution system is near the project area. The nearest electrical distribution line parallels US 2 and it is not adequate to carry the required electrical power. The lead agencies considered, but eliminated from detailed analysis, alternatives other than a new transmission line. A new transmission line is needed to supply electrical power to construct, operate, and reclaim the proposed mine facilities.

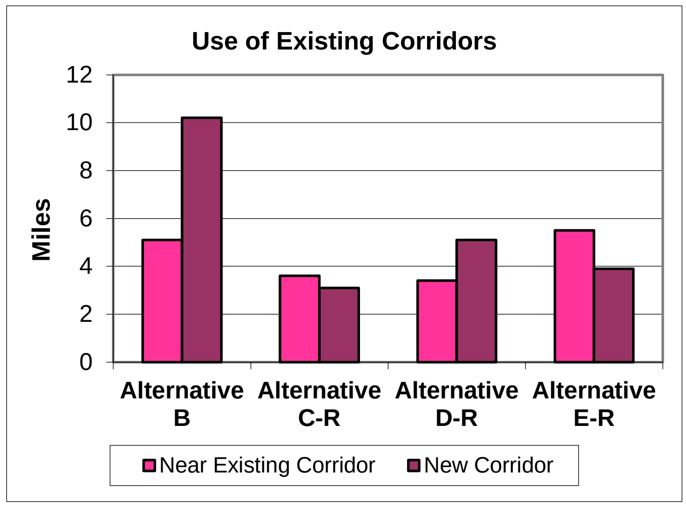
Probable Environmental Impacts

The probable environmental impacts of the construction and maintenance of the proposed transmission line, Sedlak Park Substation, and loop line are described in Chapter 3. The DEQ does not regulate the Sedlak Park Substation or loop line under MFSA, and the probable environmental impacts of the substation and loop line are not discussed in this section. The following sections summarize selected effects of the North Miller Creek Alternative (Alternative B) as proposed by MMC, along with the agencies' alternatives: Modified North Miller Creek Alternative (Alternative C-R), Miller Creek Alternative (Alternative D-R), and West Fisher Creek Alternative (Alternative E-R) using the preferred location criteria listed in DEQ Circular MFSA-2, section 3.1. These criteria are:

- Locations with the greatest potential for general local acceptance of the facility
- Locations that use or parallel existing utility and/or transportation corridors
- Locations in nonresidential areas
- Locations on rangeland rather than cropland and on nonirrigated or flood irrigated land rather than mechanically irrigated land
- Locations in logged areas rather than undisturbed forest
- Locations in geologically stable areas with nonerosive soils in flat or gently rolling terrain
- Locations in roaded areas where existing roads can be used for access to the facility during construction and maintenance
- Locations where structures are not on a floodplain
- Locations where the facility will create the least visual impact
- Locations a safe distance from residences and other areas of human concentration
- Locations that are in accordance with applicable local, state, or federal management plans when public lands are crossed

None of the transmission line alternatives would cross rangeland or cropland. This preferred criterion is not discussed further. Alternative A, No Transmission Line, would not require the construction and operation of a transmission line. Electrical power would be provided by generators. The No Transmission Line Alternative would not provide a safe and reliable source of electrical power for the mine. Alternative A is not discussed in the following sections on the preferred location criteria.

General Local Acceptance. Issues and concerns about the proposed transmission line were identified during the public involvement process, discussed in Chapter 1. A public meeting on the proposed 230-kV transmission line was held in May 2005 to identify resources potentially affected by the proposed transmission line, suggested locations for the proposed line, alternatives to the proposed line, and mitigation measures for the proposed line. At the meeting, MMC presented information on the need for the proposed facility. The agencies issued a Draft EIS for public comment in 2009 and a Supplemental Draft EIS in 2011. Based on public and agency comments, the transmission line alternatives were revised to reduce effects on private lands.

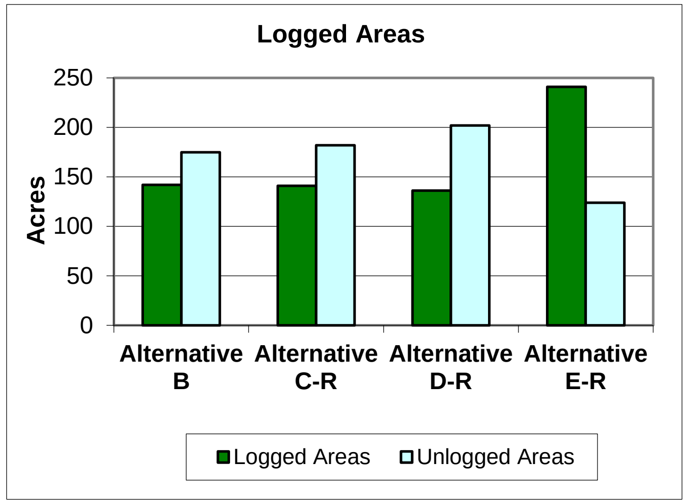


Use of Existing Corridors. No existing transmission line corridors are found in the analysis area. Existing transportation corridors consist of US 2 and roads on National Forest System lands, such as NFS road #231 or #278, and roads on Plum Creek lands. Alternatives B through E-R would use or parallel existing road corridors, including open, gated, barriered, or impassable roads. Alternative B would have 5 miles of centerline within 100 feet of an existing open road. Alternative E-R would make greater use of existing corridors, with 5.5 miles of centerline within 100 feet of these roads. Alternative D-R would make the least use of existing corridors.

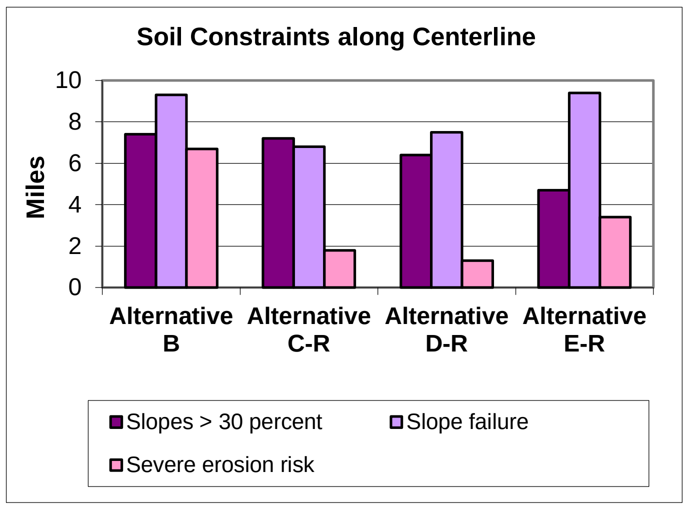
Location in Nonresidential Areas. Most of the transmission line corridors are National Forest System lands or private lands owned by Plum Creek Timberlands LP. Residential areas are not found on either type of land. Twenty residences are within 1 mile of one of the four transmission line alternatives. Most of these properties are within 0.5 mile of US 2. Alternative B would be closer to more residences than the other three alternatives. Fourteen residences are within 0.5 mile of Alternative B, of which 11 are greater than 450 feet from the centerline of the right-of-way, and the remaining three are within 450 feet of the centerline.

All residences in Alternatives C-R, D-R, and E-R would be more than 450 feet from the centerline. Montana regulations allow the final centerline to vary up to 250 feet from the centerline analyzed in this EIS (ARM 17.20.301 (21)), unless there is a compelling reason to increase or decrease this distance. The centerline during the final design of these alternatives would be no closer than 200 feet from the centerline.

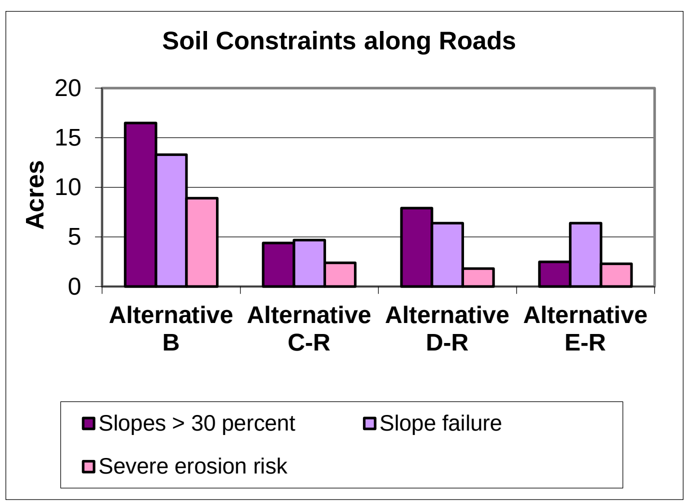
Logged Areas rather than Undisturbed Forest. Alternatives B through E-R would cross both logged areas, and undisturbed forest, riparian, and other areas. Slightly less than half of the area crossed by Alternatives B and C-R has been logged. Alternative E-R would cross the most logged areas (241 acres) and least undisturbed areas (124 acres). Alternative D-R would cross the least logged areas (136 acres) and most undisturbed areas (202 acres).



Geologically Stable Areas with Nonerosive Soils in Flat or Gently Rolling Terrain. The terrain in the transmission line analysis area consists of relatively flat alluvial valleys along major creeks and rivers, such as the Fisher River, Miller Creek, and West Fisher Creek; or steep hillsides with slopes greater than 30 percent. Soils subject to slope failure are found throughout the analysis area, primarily on lower hillslopes. Erosive soils are found along the Fisher River, Miller Creek, and West Fisher Creek.



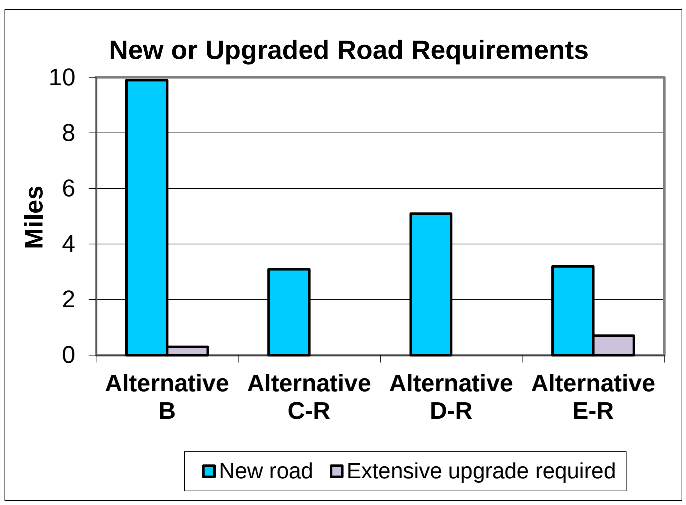
Of the four alternatives, the centerline of the transmission line of Alternative B would cross more steep areas (7.4 miles) and more soils with a severe erosion hazard (6.7 miles) than the other three alternatives. The centerline of Alternative E-R would cross the least amount of steep slopes, (4.7 miles). Alternatives B and E-R would have a similar length of line subject to slope failure. The centerline of Alternative C-R would cross the least amount of soils subject to slope failure.



New or reconstructed access roads also would be needed on all transmission line alternatives. Alternative B would have more access roads than the other alternatives. In Alternatives C-R through E-R, the need for access roads would be reduced by using a helicopter to set structures in areas of poor accessibility. The access roads in Alternative B would disturb 17 acres of slopes greater than 30 percent, 13 acres of soil having potential for slope failure, and 9 acres of soil having severe erosion risk. Because of the fewer roads in the other alternatives, roads would disturb 2 and 8 acres of soils with these constraints in Alternatives C-R, D-R, and E-R.

Within the transmission line analysis area, a segment of Libby Creek and the Fisher River are on Montana's list of impaired streams. Alternative B would have 4.7 miles of line paralleling the Fisher River, where soils with severe erosion risk and high sediment delivery are found. Clearing for the transmission line and new or upgraded roads would disturb 84 acres in the watershed. Alternative B also would disturb 17 acres in the Libby Creek drainage. The soils at the Libby Creek crossing have severe erosion risk and high sediment delivery. Alternatives C-R, D-R, and E-R would have fewer disturbances in the watersheds of impaired streams, disturbing 21 acres in the Fisher River watershed and 13 acres in the Libby Creek watershed. Through the use of Best Management Practices, Environmental Specifications, and other design criteria, these potential sediment sources would have minimal effects on analysis area streams under most conditions. The new transmission line roads would be graveled, and have 40- to 60-foot buffers to eliminate any sediment from entering RHCAs. The sediment runoff analysis results for the existing and proposed transmission line roads for Alternative D-R showed that for both high and low road use, reducing the contributing road lengths and adding a gravel surface to roads that currently do not have a gravel surface would reduce the amount of sediment leaving the roads and buffers. When not in use, the roads would be changed to intermittent stored service roads, and would be treated to minimize erosion and sediment movement from the roads. The roads would be monitored throughout the project to ensure that Best Management Practices implemented to minimize sediment from moving from roads to streams were effective.

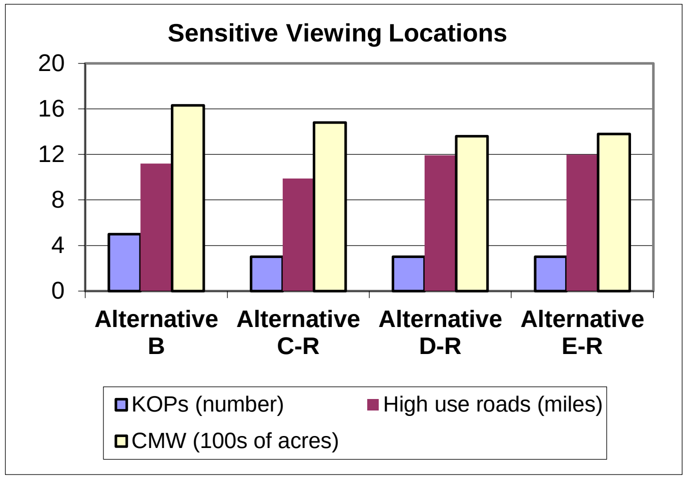
Roaded Areas. Existing roads are found throughout the transmission line analysis area. Most of the roads on the KNF were used for timber harvest and are currently closed. Roads on Plum Creek land would be used for all alignments. Four open roads would be used as primary access by one or more of the transmission line alternatives: US 2, NFS road #231 (Libby Creek Road), NFS road #385 (Miller Creek Road), and NFS road #4724 (South Fork Miller Creek Road).

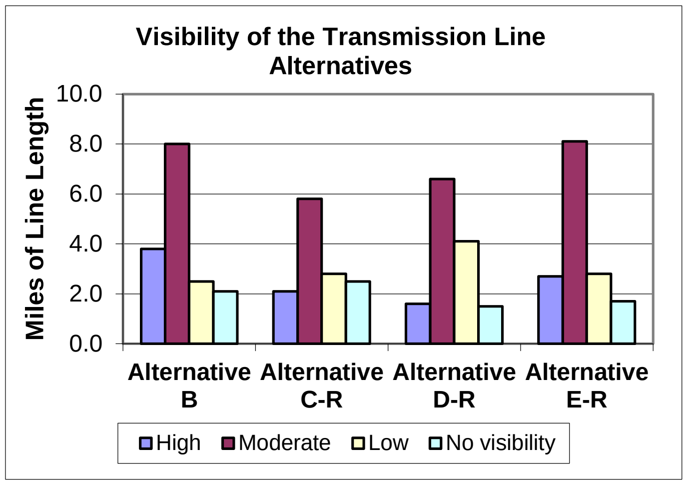


Alternative B would require about 10 miles of new roads or roads with extensive upgrade requirements. In Alternatives C-R through E-R, the need for access roads would be reduced by using a helicopter to set structures in areas of poor accessibility. Alternatives C-R and E-R would require about 3 miles of new or extensively upgraded roads and Alternative D-R would need 5 miles. Alternatives B and E-R would also require extensively upgrading of less than a mile of existing road.

Structures in a Floodplain. One hundred-year floodplains have been designated along the Fisher River, Miller Creek, an unnamed tributary to Miller Creek, Ramsey Creek, and Libby Creek. Eight structures in Alternative B would be located in a designated 100-year floodplain, primarily along the Fisher River. Two structures would be located in a designated 100-year floodplain in the other three alternatives.

Visual Impact. The transmission line analysis area is characterized visually by the summit peaks of the Cabinet Mountains surrounded by the adjacent densely forested mountains and valleys, with some flat, open stream valleys of dense low-growing herbaceous vegetation interspersed with the forest. The four transmission line alternatives would be located in montane forest and valley characteristic landscapes within the KNF. All alternatives would be visible from KOPs, high use roads, and the CMW. Alternative B would be visible from five KOPs, with the other alternatives visible from three KOPs. Alternative C-R would be visible from 10 miles of high use roads, with the other three alternatives visible from 11 miles of high use roads. The effects of views from the CMW would be the greatest in Alternative B, with 1,600 acres in the CMW having views of the corridor, and the least in Alternative E-R. A short segment of Alternatives D-R and E-R would be visible from Howard Lake, a popular recreation area.





About 3.8 miles of Alternative B would have high visibility and 8 miles would be moderately visible. Alternatives C-R, D-R, and E-R would have similar lengths of high visibility (about 2 to 3 miles). Alternatives C-R, D-R, and E-R would have increasing lengths of moderate visibility, with 5.8, 6.6, and 8.1 miles each. Alternative C-R would have the greatest length of transmission line without any visibility at 2.5 miles. Visually sensitive and high visibility areas are considered sensitive areas and under the agencies' Environmental Specifications (see Appendix D), MMC would take all necessary actions to avoid adverse impacts on them.

Safe Distance from Residences and Other Areas of Human Concentration. Fourteen residences are within 0.5 mile of Alternative B, of which 11 are greater than 450 feet from the centerline and the remaining three are within 450 feet of the centerline. Because the final alignment could vary by up to 250 feet from the centerline analyzed in this EIS (ARM 17.20.301 (21)), three residences may be within 200 feet of the centerline, depending on the final transmission line alignment. At lateral distances from the edge of the right-of-way (50 feet from the centerline) to 200 feet away, the electric field strength would range from about 0.75 kV/m (kilovolt/meter) at 50 feet to about 0.05 kV/m (or 50 V/m) at 200 feet. The magnetic field strength would be about 4 milligauss (mG) at 50 feet and less than 1 mG at 200 feet. This maximum electric field strength at 50 feet would be below the level set by Montana regulation for subdivided and residential areas for electric field strength, and both the electric and magnetic field strengths at 50 feet would be below the exposure levels for the public recommended as reference levels or maximum permissible levels.

All four residences in Alternative C-R and all six residences within 0.5 mile of Alternatives D-R and E-R are more than 450 feet from the centerline. As part of these alternatives, the centerline would be no closer than 200 feet from any residence during final design. The electric field strength would be less than 0.05 kV/m (or 50 V/m), and the magnetic field strength would be less than 1.0 mG at 200 foot from the center line. Based on the electric and magnetic field strengths recommended in guidelines as reference levels or maximum permissible levels for the public, and the current state of scientific research on electric and magnetic fields, these alternatives would be a safe distance from residences and other areas of human concentration.

If approved, the DEQ would require that the project meet minimum standards set forth in the National Electrical Safety Code and Federal Aviation Administration requirements for marking the line.

Compliance with Local, State, or Federal Management Plans. The 2015 KFP guides all natural resource management activities and establishes management direction for the KNF in the form of prescriptions (goals, desired conditions, objectives, standards, and guidelines). This direction may be established to apply throughout the forest plan area (forest-wide direction), or it may be established for only a part of the forest plan area, a Management Area or Geographic Area. Unincorporated Lincoln County has no comprehensive or general plan, zoning regulations, or growth policies.

The Montana Fish, Wildlife and Parks (FWP) holds a conservation easement on some lands owned by Plum Creek Timberlands LP where the transmission line may be located. Under the terms of the conservation easement, the FWP has reserved the right to prevent any inconsistent activity on or use of the land by Plum Creek Timberlands LP or other owners, and to require the restoration of any areas or features of the land damaged by such activity or use. Activities and uses prohibited or restricted include installing any natural gas or other pipelines or power transmission lines greater than 25-kV unless prior written approval is given by the FWP. If the selected transmission line were approved by the FWP, it would comply with the FWP-Plum Creek conservation easement. Before the transmission line construction began, MMC would convey title or a conservation easement to FWP to up to 91 acres of private land adjacent to the FWP conservation easement in Alternatives C-R and D-R, and 94 acres in Alternative E-R. MMC would follow any FWP requirements for conveyance. Acquired lands or easements would be added to the existing conservation easement.

Alternative B would not comply with all goals, desired conditions, objectives, standards, and guidelines of the 2015 KFP. For example, a 2015 KFP Inland Native Fish Strategy guideline for minerals management (MM-2) requires all structures, support facilities, and roads to be located outside RHCAs. Where no alternative to siting facilities in RHCAs exists, operators are to locate and construct the facilities in ways that avoid impacts on RHCAs and streams, and adverse effects on inland native fish. MMC’s Alternative B would locate roads and transmission line structures in RHCAs. The lead agencies’ alternatives incorporate modifications and mitigations to MMC’s proposals that are alternatives to siting facilities in RHCAs and would minimize effects on

RHCAs and inland native fish. No alternatives exist that eliminate the need to site facilities in RHCAs. Compliance with the 2015 KFP is discussed in each resource section of Chapter 3.

Minimized Adverse Environmental Impact

The MFSA requires a finding that the facility as proposed or modified, or an alternative to the facility, must minimize adverse environmental impacts, considering the state of available technology and the nature and economics of the various alternatives (75-20-301(1)(c), MCA). ARM 17.20.1607 outlines additional requirements before this finding can be made. In addition, the final location for the facility must achieve the best balance among the preferred site criteria discussed in the previous section.

In addition to the DEQ's preferred location criteria listed in DEQ Circular MFSA-2, section 3.1, transmission line impacts were evaluated based on criteria listed in DEQ Circular MFSA-2, sections 3.2(1)(d)(iii) through (xi) and 3.4(1)(b) through (w) (see Appendix J), and other criteria established to meet Forest Service and NEPA requirements. Alternative A, No Transmission Line, would not have additional effects beyond that described for the mine, and is not discussed further. Impacts of transmission line alternatives are summarized below, based on the criteria listed in Appendix J. Other key issues as required by the Forest Service or NEPA are discussed where they relate to DEQ Circular MFSA-2 criteria. Additional Forest Service or NEPA issues that do not fit in the context of MFSA criteria are discussed at the end of this section. Of the key issues identified by the KNF and the DEQ, the transmission line alternatives would have no effect on acid rock drainage, metal leaching, groundwater quality or quantity, or surface water quantity, and these issues are not discussed further. The proposed transmission line would have no effect for the following resources listed in DEQ Circular MFSA-2 criteria: national primitive areas; national wildlife refuges and ranges; state wildlife management areas and wildlife habitat protection areas; national parks and monuments; state parks; national recreation areas; designated or eligible wild and scenic river systems; specifically managed buffer areas; state or federal waterfowl production areas; designated natural areas; national historic landmarks, districts, or sites; municipal watersheds; sage and sharp-tailed grouse breeding areas and winter range; high waterfowl population areas; areas of unusual scientific, educational, or recreational significance; areas of high probability of including significant paleontological resources; water bodies; potable surface water supplies, or active faults.

National Wilderness Areas. None of the transmission line alternatives would directly affect the wilderness attributes of the CMW. Indirect effects of the transmission line alternatives on the CMW are discussed below under Scenic Integrity.

Roadless Areas over 5,000 acres. Alternative B would physically disturb 2 acres of the Cabinet Face East IRA in the Ramsey Creek drainage. Timber harvest for line clearing would occur in the IRA, and 0.1 mile of new roads would be constructed in the IRA under Alternative B. Alternatives C-R, D-R, and E-R would avoid physical disturbance in the Cabinet Face East IRA. No road construction or timber harvest would occur in the IRA for these alternatives.

Rugged Topography, Soil Erosion, and Sediment Delivery. The centerline of Alternative B would cross more areas with slopes greater than 30 percent (7.4 miles), more soils with a severe erosion hazard (6.7 miles), and more soils with high sediment delivery (5.1 miles) than the other three alternatives. The total disturbance for access roads, which would be either new roads or closed roads requiring upgrades, would be greater in Alternative B (16 acres) than the other alternatives, followed by Alternative D-R and E-R (4 acres). Of the agencies' alternatives, Alternative D-R would cross the most areas with slopes greater than 30 percent (7.9 miles), and Alternative C-R would cross the most soils with a severe erosion hazard (2.4 miles). Alternatives C-R, D-R, and E-R would cross the same amount of soils with high sediment delivery (0.5 miles). Slopes greater than 30 percent, areas with severe erosion hazard, and areas with high sediment delivery are shown for all transmission line alternatives in Appendix J.

Sediment delivery from roads used during transmission line construction would be less than existing sediment delivery in all action alternatives. In Alternatives C-R, D-R, and E-R, MMC would implement Best Management Practices and road closure mitigation, some of which would be completed before the Evaluation Phase and some before the Construction Phase. To minimize erosion risk and sediment delivery, Alternative B would include implementing erosion and sediment control Best Management Practices; interim reclamation (replacing soil where it was removed and reseeding) access roads; immediately stabilizing cut-and-fill slopes; seeding, applying fertilizer, and stabilizing road cut-and-fill slopes and other disturbances along roads as soon as final post-construction grades were achieved; at the end of operations, decommissioning new roads and reclaiming most other currently existing roads to pre-operational conditions; ripping compacted soils before soil placement; and disking and harrowing seedbeds. In addition to measures listed for Alternative B, Alternatives C-R, D-R, and E-R would minimize erosion risk and reduce sediment delivery through: rerouting to avoid highly erosive soils; using H-frame poles, allowing longer spans, and fewer structures and access roads; using helicopter construction in grizzly bear core habitat to decrease the number of access roads; and implementing a Road Management Plan. For all transmission line alternatives, with implementation of mitigation measures there would be no substantial adverse impacts on the soil resources, and the soil losses along access roads would likely be minor until vegetation was re-established in most areas after 3 to 5 years. Vegetation re-establishment on steep areas, particularly on south- and west-facing slopes, could take longer.

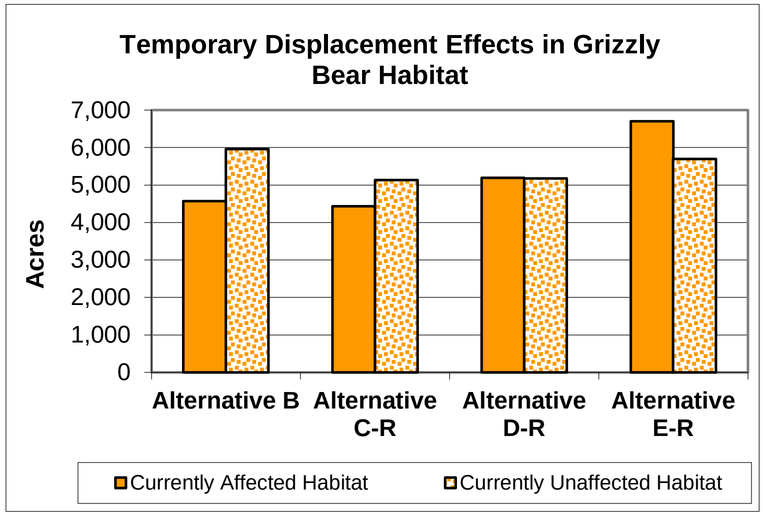
Bull Trout Critical Habitat and Occupied Habitat and Other Fisheries. The Forest Services' effect determination and the USFWS' Biological Opinion on the bull trout and bull trout critical habitat were discussed under the mine alternatives. The Fisher River, West Fisher Creek, Libby Creek, and Ramsey Creek in the transmission line analysis area provide habitat for bull trout, listed as threatened. Because of natural barriers, bull trout are not found in Miller Creek or its tributaries. The USFWS designated bull trout critical habitat in the transmission line analysis area in the Fisher River, West Fisher Creek, and Libby Creek.

Bull trout could be affected by increased sedimentation caused by clearing, road construction, and other disturbance associated with the transmission line. All alternatives may affect bull trout and designated critical habitat. All alternatives would cross critical habitat in Libby Creek. Alternative B also would cross essential excluded habitat in the Fisher River; and Alternatives C-R, D-R, and E-R would cross critical habitat in West Fisher Creek. Alternative E-R would parallel critical habitat and essential excluded habitat in West Fisher Creek. For most of its length adjacent to West Fisher Creek, the existing Libby Creek Road (NFS road #231) would be between the transmission line and any new roads in Alternative E-R, and West Fisher Creek. As shown in Appendix J, Alternative E-R would have the most structures within 1 mile of bull trout critical habitat (67), and Alternative B would disturb the most habitat for road construction and upgrades within 1 mile of bull trout critical habitat (9.6 acres). Alternative D-R would have the fewest structures within 1 mile of bull trout critical habitat (25), and would disturb the least habitat for road construction and upgrades within 1 mile of bull trout critical habitat (4 acres). Alternative B would have the most disturbance from clearing and road construction or upgrades in watersheds of occupied bull trout streams (182 acres), followed by Alternative E-R (177 acres). Alternative D-R would have the least disturbance in watersheds of occupied bull trout streams (70 acres). Bull trout critical habitat is considered a sensitive area and, under the agencies' Environmental Specifications (see Appendix D), MMC would take all necessary actions to avoid adverse impacts on this habitat.

Three Montana fish species of concern are found in the transmission line analysis area streams: interior redband trout, torrent sculpin, and westslope cutthroat trout. Pure populations of interior redband trout are found in the Fisher River, West Fisher Creek, Ramsey Creek, a short segment of Libby Creek below Ramsey Creek, and Midas Creek. Torrent sculpin are found in Libby Creek and Miller Creek. Both torrent and slimy sculpin are found in analysis area streams. Westslope cutthroat trout are found in Howard Creek and Miller Creek. The transmission line alternatives would have only minor disturbance in these watersheds, which is unlikely to affect aquatic life. None of the transmission line alternatives would likely contribute to a trend toward federal listing of interior redband trout or westslope cutthroat trout.

In addition to mitigation measures described above to minimize erosion and sediment delivery, Alternative B would include implementation of a Stormwater Pollution Prevention Plan and structural and nonstructural Best Management Practices, construction of stream crossings per KNF and DEQ requirements, minimization of disturbance on active floodplains, and curtailment of construction activities during heavy rains. Alternatives C-R, D-R, and E-R also would include the following measures: where feasible, location of structures outside of riparian areas, installation of new culverts to allow fish passage, design of stream crossing structures to withstand a 100-year flow event, and the completion of a habitat inventory and development of instream structures in Libby Creek. Based on the use of Best Management Practices, the agencies' transmission line Environmental Specifications, and other design criteria, sediment delivery would not occur to analysis area streams under most conditions. Monitoring throughout the project would be completed to ensure that Best Management Practices implemented to minimize sediment from moving from disturbed areas to streams were effective.

Grizzly Bear. As discussed in the previous summary of the mine alternatives, an analysis of the independent effects of the transmission line alternatives on the grizzly bear was not completed because of the analysis' complexity. The effects of the combined mine and transmission line alternatives have been discussed previously. The following is an estimate of the effects of the transmission line alternatives. The physical loss of grizzly bear habitat would be low, primarily from construction of roads and the Sedlak Park Substation. About 34 acres of grizzly bear habitat would be lost in Alternative B, while the agencies' alternatives would affect between 13 and 20 acres. The impacts of physical habitat loss would be reduced through MMC and agencies' land acquisition requirements. In the agencies' alternatives, 2 acres of habitat would be acquired for every acre of grizzly bear habitat physically lost. Most impacts on grizzly bear habitat in the clearing area would be temporary because disturbed habitat would be reclaimed and revegetated after the transmission line was built. Some of the coniferous forest in the clearing area would be converted to grassland or shrubland in the long term.



In all alternatives, project activities would temporarily increase displacement effects on bears both inside and outside the Recovery Zone. Some areas in the zone of influence of transmission line activities are currently being affected by other activities, such as road use or activities on private land. Total additional displacement effects within and outside of the Grizzly Bear Recovery Zone in currently affected habitat would range from 4,432 acres in Alternative C-R to 6.706 acres for Alternative E-R, while new displacement effects in currently undisturbed habitat would range from 5.136 acres in Alternative C-R to 5,962 acres in Alternative B. In all alternatives, increased displacement would be primarily due to helicopter activity. Displacement effects in the agencies' alternatives would be mitigated by restricting transmission line construction and decommissioning on National Forest System and State trust lands to between June 16 and October 14.

In all alternatives, helicopters would be used for line stringing, which would last about 10 days. In Alternatives C-R, D-R, and E-R, helicopters also would be used in some segments for vegetation clearing and structure construction, prolonging disturbance for up to 2 months. New roads would not be needed where a helicopter was used for vegetation clearing and structure construction. For all alternatives, disturbance also would occur for about 2 months during other transmission line construction activities in areas where helicopters were not used, and would be more extensive for Alternative B than Alternatives C-R, D-R, or E-R. For all transmission line alternatives, except for annual inspection and infrequent maintenance operations, helicopter use and other transmission line construction activity would cease after the transmission line was built until decommissioning. Helicopter use and other transmission line construction activities would cause similar disturbances with similar durations during line decommissioning. The effects on the grizzly bear would be mitigated through habitat acquisition, access changes, and habitat enhancement.

Canada Lynx. Impact evaluation criteria for the Canada lynx have been discussed in the previous summary of the mine alternatives. All transmission line alternatives would comply with Northern Rockies Lynx Management Direction objectives, standards, and guidelines. Overall lynx habitat disturbed in the transmission line clearing area or for road construction or improvement would range from 63 acres for Alternative C-R to 107 acres for Alternative D-R. All transmission line alternatives may affect the Canada lynx. In the agencies' alternatives, impacts on currently suitable lynx habitat would be offset through enhancement of between 126 and 214 acres of lynx stem exclusion habitat. Land acquired for grizzly bear mitigation for the transmission line alternatives would likely improve habitat conditions for lynx and their prey.

Cultural Resources. Five cultural sites eligible or recommended eligible for the National Register of Historic Places are in the Alternative B 500-foot corridor. The corridor for Alternatives C-R, D-R, and E-R would cross three, four, and seven, respectively, eligible or recommended eligible cultural sites. These sites are discussed in Chapter 3. All sites would either be avoided or mitigated in consultation with the Montana State Historic Preservation Office (SHPO). One site is a portion of US 2 that crosses Alternatives B, C-R, D-R, and E-R; it has not been evaluated for the National Register of Historic Places. For all transmission line alternatives, consultation with the SHPO would be conducted to receive consensus determinations and to develop a plan of action for this portion of US 2. Sites identified on State land would be coordinated with the Montana Department of Natural Resources and Conservation. Additional fieldwork in all alternatives would be necessary before SHPO consultation. Cultural resources are considered sensitive areas and under the agencies' Environmental Specifications (see Appendix D), MMC would take all necessary actions to avoid adverse impacts on them.

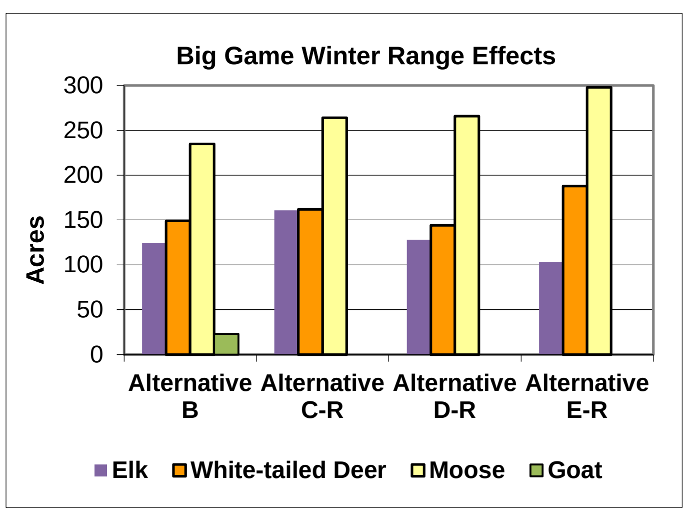
Surface Water Quality. Libby Creek, Ramsey Creek, Poorman Creek, Little Cherry Creek, Bear Creek, Howard Creek, and Midas Creek are rated as outstanding (Class 1) for fisheries habitat by the FWP. No Class II streams are found in the analysis area. Clearing for the transmission line within watersheds of Class I streams would range from 47 acres for Alternatives D-R and E-R to 72 acres for Alternative C-R, to 107 acres for Alternative B. Road construction and improvement would disturb less than 1 acre in watersheds of Class I streams for Alternatives C-R, D-R, and E-R; and 7 acres for Alternative B (see Appendix J).

Stream segments on Montana's list of impaired streams in the analysis area are described in the previous summary of the mine alternatives. Vegetation clearing and road construction within watersheds of impaired streams would be 34 acres for Alternatives C-R, D-R, and E-R to 101 acres for Alternative B (see Appendix J).

Scenery. In all action transmission line alternatives, segments of the 230-kV transmission line corridor (ranging from 131 acres to 189 acres) would have low scenic integrity during construction and would not meet the 2015 KFP mapped scenic integrity objective of moderate or high. The scenic integrity of all disturbances associated with the transmission line would improve to moderate or high after the line was decommissioned and the revegetation became re-established. None of the transmission line alternatives would entirely meet the 2015 KFP guideline (FW-GDL-AR-01) for scenic resources and amendments to the 2015 KFP would be required.

Elk Security Habitat. All transmission line alternatives would maintain elk security and would be consistent with FW-GDL-WL-10 in the 2015 KFP.

Big Game Winter Range. All transmission line alternatives would requirement clearing and road construction in winter range for elk, deer, and moose. Alternative B would affect mountain goat winter range. Habitat loss from road construction would be negligible. Clearing would create and contribute forage habitat for native ungulates. Timing restrictions on tranmission line construction during the winter on winter range would avoid



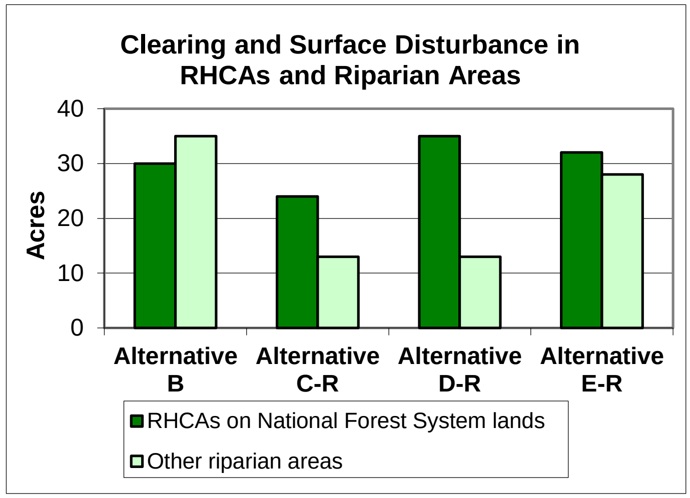
displacement of wintering elk, deer and moose. None of the alternatives would create barriers to connectivity. Big game winter range is considered a sensitive area and, under the agencies' Environmental Specifications (Appendix D) in Alternatives C-R, D-R and E-R, MMC would take all necessary actions to avoid adverse impacts on it. Impacts on mountain goats would be reduced through land acquisition programs proposed by MMC and the agencies, if the acquired land provided big game habitat.

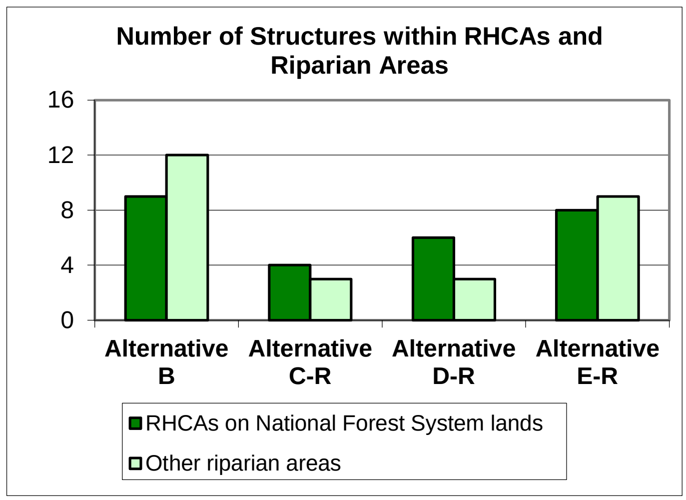
Mountain Goat. Only Alternative B would physically disturb mountain goat habitat, affecting 47 acres. Helicopter use and other transmission line construction activities associated with the transmission line alternatives are described previously for the grizzly bear. Helicopter and other transmission line construction activities could temporarily displace goats from suitable habitat or reduce their ability to effectively use the available habitat in the short term. Individual goats could suffer increased stress levels from helicopter and construction disturbance. During the Construction Phase, additional displacement effects in Alternative B would occur on 3,362 acres of goat summer habitat, primarily due to helicopter line stringing in the Ramsey Creek area. Additional disturbance effects would be less for Alternatives C-R, D-R, and E-R, ranging from 743 acres for Alternative C-R to 766 acres for Alternatives D-R and E-R. Impacts on mountain goats would be reduced through land acquisition programs proposed by MMC and the agencies, if the acquired land provided suitable goat habitat.

Bald Eagle. Alternative B would be within 0.07 mile of an active bald eagle nest along the Fisher River west of US 2, while the Alternatives C-R, D-R, and E-R would be within 0.58 mile. Montana's Bald Eagle Management Plan recommends no additional human activity, including low-intensity activity, during the breeding season (February 1 to August 15) for activities within 0.25 mile of a nest site (Zone 1). The plan also recommends no high intensity activities during the breeding season, construction of permanent developments, or structures that pose a hazard within 0.5 mile (primary use areas or Zone 2) and minimization of disturbance, habitat alteration, and hazards for activities within 2.5 miles (home range or Zone 3).

Alternative B would have direct impacts on about 9 acres of habitat in Zone 1, and 10 acres of habitat in Zone 2. None of the agencies' alternatives would cross Zones 1 or 2. Direct impacts on Zone 3 habitat would be comparable for all alternatives. Compared to other alternatives, Alternative B would create greater risks of bald eagle collisions with the transmission line due to its proximity to nesting bald eagles and their foraging habitat along the Fisher River. For all alternatives, potential collisions of bald eagles with the transmission line would be reduced by constructing the transmission line according to recommendations for minimizing avian collisions with power lines and compliance with the agencies' Environmental Specifications, including restrictions on the location of overhead utility lines. Bald eagle primary use areas are considered sensitive areas and under the agencies' Environmental Specifications (see Appendix D), MMC would take all necessary actions to avoid adverse impacts on them.

Riparian Habitat Conservation Areas. Alternatives B through E-R would require construction of roads and other facilities in RHCAs and other riparian areas. Protection of RHCAs was a key criterion in the alternatives analysis and development of alternatives. The lead agencies did not identify an alternative that would avoid locating transmission line facilities or timber harvest in RHCAs. Effects from clearing and road construction and improvement on RHCAs would range from 24 acres in Alternative C-R to 35 acres in Alternative D-R; effects on other riparian areas on state and private land would range from 13 acres in Alternatives C-R and D-R to 35 acres in Alternative B. In Alternatives C-R, D-R, and E-R, MMC would develop and implement a final





Road Management Plan to reduce the effects on RHCAs. The plan would describe criteria for all new and reconstructed roads that govern road operation, maintenance, and management; requirements of maintenance and inspection before, during, and after storms; and regulation of traffic during wet periods to minimize erosion and sediment delivery, among other traffic-related objectives. The plan would also describe criteria related to implementation and effectiveness of monitoring plans for road stability, drainage, and erosion control and mitigation plans for road failures.

A 2015 KFP Inland Native Fish Strategy guideline is to locate structures and support facilities, such as the transmission line, outside of RHCAs, unless no alternative exists. Based on preliminary design, the agencies did not identify an alternative that would avoid locating structures in RHCAs. Alternative B would have more structures in RHCAs and other riparian areas, with nine structures on RHCAs and 12 structures on riparian areas on state and private land. Structures in RHCAs in the other alternatives would be fewer, ranging from four in Alternative C-R to eight in Alternative E-R. Similarly, fewer structures would be located in other riparian areas in the other alternatives, ranging from three in Alternatives C-R and D-R, to nine in Alternative E-R. RHCAs are considered sensitive areas and under the agencies’ Environmental Specifications (see Appendix D), MMC would take all necessary actions to avoid adverse impacts on them. Effects on RHCAs in Alternatives C-R, D-R, and E-R would be minimized by include developing and implementing a Vegetation Removal and Disposition Plan. Heavy equipment use in RHCAs would be minimized. Shrubs in RHCAs would be left in place unless they had to be removed for safety reasons.

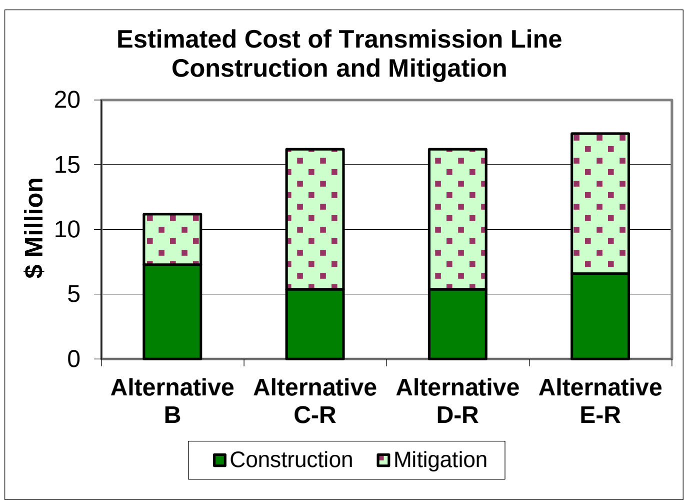
Effective ***Old Growth.*** Effective old growth in the transmission line corridors is found in small blocks along the Fisher River, Miller Creek, West Fisher Creek, and Libby Creek. Alternatives B through E-R would remove effective old growth and reduce the quality of effective old growth adjacent to new disturbances. Loss of old growth on both private and National Forest System lands would be 31 acres in Alternative B, 10 acres in Alternative C-R, 8 acres in Alternative D-R, and 7 acres in Alternative E-R. Edge effects would be 101 acres in Alternative B, 1 acre in Alternative C-R, and 4 acres in Alternative E-R. Edge effects would not change in Alternative D-

R. Increased new road construction would contribute to the greater edge effect of Alternative B. Old growth is considered a sensitive area and under the agencies' Environmental Specifications (see Appendix D), MMC would take all necessary actions to avoid adverse impacts on it. Losses and degradation of old growth may be offset by private land acquisition associated with grizzly bear habitat mitigation, if old growth characteristics were present on the acquired parcels.

Pileated Woodpecker. The effects on old growth in the transmission line alternatives, especially edge effects, would reduce nesting and foraging habitat, and habitat quality for the pileated woodpecker. The potential population index in the transmission line alternatives would not be affected. All transmission line alternatives would eliminate some snags and downed logs greater than 10 inches diameter at breast height that provide potential nesting and foraging habitat for pileated woodpeckers. Snag densities and quantities of down wood would continue to be sufficient to sustain viable populations of cavity-dependent species in the KNF. Loss of snag and old growth providing potential pileated woodpecker habitat may be offset by private land acquisition associated with grizzly bear habitat mitigation, if snag habitat and old growth characteristics were present on the acquired parcels.

Wetlands. Direct effects on wetlands and streams are expected to be avoided by the placement and location of transmission structures outside of wetlands and streams. The BPA would avoid all wetlands at the Sedlak Park Substation Site. Unavoidable wetland direct effects would be determined during final design. Potential indirect effects on wetlands from road construction, such as sediment or pollutant delivery, would be minimized through implementation of Best Management Practices and appropriate stream crossings. In addition, wetlands are considered sensitive areas and under the agencies' Environmental Specifications (see Appendix D), MMC would take all necessary actions to avoid adverse impacts on them.

Transmission Line Construction Costs. Resource-specific impacts and cumulative impacts are described in the previous section and discussed in Chapter 3. The monetary values of these impacts cannot reasonably be quantified. Many potential adverse environmental impacts would be minimized through measures proposed by MMC and the application of the agencies' proposed measures that would be included in Environmental Specifications. Agency-proposed mitigation measures would be included as conditions in the certificate should the DEQ approve the transmission line. The agencies' Environmental Specifications for the transmission line, including environmental protection and monitoring measures, are described in Appendix D and are further detailed in ARM 17.20.1901.



Estimated transmission line construction costs range from $7.3 million for Alternative B to $5.4 million for Alternatives C-R and D-R. Cost estimates are based on preliminary design and material costs in 2012. High steel costs would make the steel monopoles proposed in Alternative B more expensive than the wooden H-frame structures proposed in the other alternatives. The lower cost of wooden H-frame structures in Alternatives C-R, D-R, and E-R would offset the cost of helicopters to set structures and clear timber in these alternatives. The estimated mitigation cost of $10.8 million is the same for the agencies' alternatives. Alternative B mitigation would cost an estimated $3.9 million, but would not adequately mitigate effects. Overall cost is lowest for Alternative B and highest for Alternative E-R.

Locating Transmission Lines Underground

The lead agencies considered locating the transmission line underground. Underground transmission lines typically have less clearing and do not have the visual impact of the transmission lines and structures. Underground transmission lines typically have significantly fewer faults, fewer voltage sags, and fewer short- and long-duration interruptions. Traditional overhead circuits typically fault about 90 times per 100 miles per year; underground circuits fail less than 10 or 20 times per 100 miles per year. Because overhead circuits have more faults, they cause more voltage sags, more momentary interruptions, and more long-duration interruptions.

Locating the line underground would require proximity to an access road for the entire length of the line. Consequently, the option chosen for analysis is generally the route of Alternative E-R, West Fisher Creek. The line would not follow the overhead line route exactly, but would be adjacent to US 2 and NFS road #231. This alignment would allow easy access for construction and maintenance. The line would start at the Sedlak Park Substation. Two voltages would be feasible for an underground line, 230 kV and 115 kV. Both voltages would be solid dielectric, cross-linked polyethylene, insulated cable in duct banks encased in concrete. Multiple underground cable splicing vaults with access manholes would be required along the route. Generally, the vaults would be required every 1,000 feet. Aboveground to overhead line termination points would be necessary at the Sedlak Park Substation and at the Plant Site Substation. The duct bank would have four, 5-inch to 8-inch conduits with a cable in each conduit. One conduit would be a spare conduit and cable for reliability of service in case of a cable failure.

Considerable disturbance would be necessary for construction due to the size of the cable trench and the cable splicing vaults. Trenches are 5 feet deep and vaults are 8 feet high, 10 25 feet, and 20 to 30 feet long. The line length would be about 20 miles.

For the 230-kV option, the proposed BPA Sedlak Substation would stay essentially the same except for the addition of a cable termination system. This could increase the substation cost by 15 percent. The construction cost for the installation would be $3 million per mile or $60 million total. For the 115-kV option, the proposed BPA Sedlak Substation would require a voltage step-down transformer, which would increase the substation construction area and require additional facilities and equipment. It also would require a termination system. The substation costs would increase by about 60 percent for the 115-kV cable option. The construction cost for the cable installation would be $2 million per mile or $40 million total. The agencies eliminated underground installation as an alternative because of the cost.

Consistency with Regional Plans for Expansion

The transmission line would allow the mine to connect to the regional electrical transmission grid. While there is no single formal published plan for expansion of the regional grid, the line would be consistent with plans for expansion of the BPA grid in the area. The line would not significantly add to the ability of the grid as a whole to deliver electricity because the purpose of the line would be to serve only the mine loads. The BPA completed the studies necessary to interconnect the proposed line to BPA's Libby-Noxon 230-kV line. BPA's study indicated the proposed line would not have a significant effect on the interconnected system.

Utility System Economy and Reliability

The BPA completed a study indicating that the proposed interconnection would not adversely affect BPA's system. Operating the proposed line at 230 kV would help ensure low line losses.

Conformance with Applicable State and Local Laws

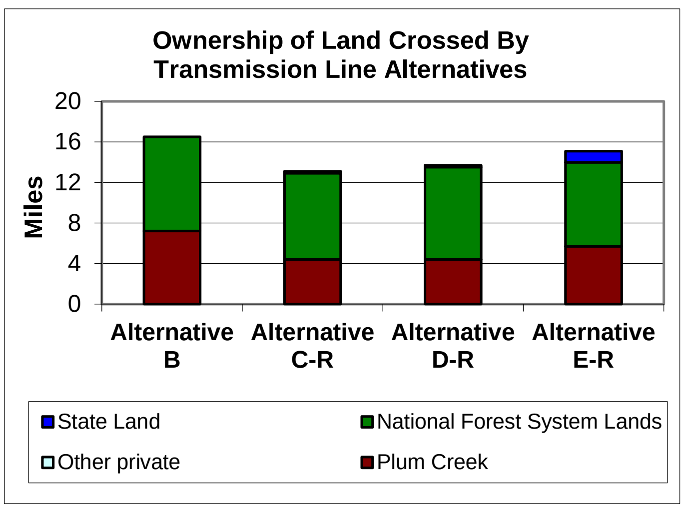
The location of the facility would conform to applicable state and local laws and regulations either as a permitting or certification condition, or in compliance with the agencies' project-specific Environmental Specifications (see Chapter 1).

Public Interest, Convenience, and Necessity

The proposed transmission line would be built to meet the need for additional transfer capacity to the mine. Benefits to MMC would be the monetary profit from operating the mine and transmission line. Benefits to the state include local tax revenues to counties in which the line and mine are located, state tax revenues from the line and mine, a short-term beneficial effect on local economies from construction of the line and mine, and a long-term beneficial effect on local economies from maintenance of the line.

Economic impacts due to the proposed transmission line would be minimal at a state level. Construction benefits due to the line would be short-term. Line maintenance employment benefits and tax benefits would be long-term but small at both a county and state level. The total costs include mine and transmission line construction, and operation costs and other costs due to environmental impacts described in Chapter 3. The costs of these environmental impacts cannot be reasonably quantified in monetary terms.

The proposed transmission line is unlikely to have adverse effects on public health, welfare, and safety because the line would conform to the requirements of the National Electrical Safety Code and DEQ standards for electric field strength in residential or subdivided areas, and at road crossings. Sensitive receptors such as residences would be located at distances sufficient that even the most restrictive suggested standards for magnetic fields would be met under normal operating conditions. Alternatives C-R, D-R, and E-R would be constructed in a manner that minimizes adverse impacts on soil, water, and aquatic resources.



The DEQ will make a final determination on public interest, convenience, and necessity after a Final EIS is issued.

Public and Private Lands

The use of public lands for location of the facility was evaluated, and public lands were incorporated into alternatives whenever their use was as economically practicable as the use of private lands (75-20-301(1)(h), MCA). All of the transmission line alternatives would be primarily on National Forest System lands and private land owned by Plum Creek. Alternative B would cross 7.2 miles of private and Plum Creek land. The other alternatives would cross less land, with Alternatives C-R and D-R crossing 4.4 miles and Alternative E-R crossing 5.7 miles. The agencies did not identify an alternative that would avoid the use of private land.

DEQ Issuance of Necessary Decisions, Opinions, Orders, Certifications, and Permits

As appropriate, the DEQ would issue all necessary environmental permits for the transmission line at the time the decision is made on whether to grant a certificate for the facility.

Where to Obtain More Information

More information on the proposed Montanore Project can be found on the KNF's website: http://www.fs.usda.gov/projects/kootenai/landmanagement/projects, or the DEQ's website: http://www.deq.mt.gov/eis.asp. If you have any additional questions or concerns, please contact the individuals listed below.

Lynn Hagarty	Craig Jones	Tish Eaton KEC-4
Kootenai National Forest	Montana DEQ	Bonneville Power Administration
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Chapter 1. Purpose of and Need for Action

1.1 Document Structure

Mines Management, Inc. (MMI) proposes to construct a copper and silver underground mine and associated facilities, including a new transmission line. Montanore Minerals Corp. (MMC), a wholly owned subsidiary of MMI, would be the project operator. The proposed project is called the Montanore Project. MMI has requested the U.S. Department of Agriculture (USDA), Kootenai National Forest (KNF) to approve a Plan of Operations for the Montanore Project. From the perspective of the Montana Department of Environmental Quality (DEQ), the mining operation is covered by a DEQ Operating Permit first issued by the Montana Department of State Lands (DSL) to Noranda Minerals Corp. (NMC). MMC applied to the DEQ for an amendment of the existing Operating Permit to incorporate aspects of the Plan of Operations submitted to the KNF that are different from the DEQ Operating Permit. MMC has also applied to the DEQ for a certificate of compliance to allow for construction of the transmission line.

The KNF and the DEQ are the lead agencies and have prepared this final environmental impact statement (Final EIS) with the assistance of the cooperating agencies in compliance with the National Environmental Policy Act (NEPA) and the Montana Environmental Policy Act (MEPA). These laws require that if any action taken by the DEQ or the KNF may "significantly affect the quality of the human environment," an Environmental Impact Statement (EIS) must be prepared. This Final EIS also has been prepared in compliance with the USDA NEPA regulations (7 Code of Federal Regulations (CFR) 1b), the Forest Service's NEPA regulations (36 CFR 220), the Forest Service's Environmental Policy and Procedures Handbook (Forest Service Handbook 1909.15), DEQ's MEPA regulations (ARM 17.4.601 *et seq*.) and the U.S. Army Corps of Engineers' (Corps) NEPA implementation procedures for its regulatory program (Appendix B of 33 CFR 325). This Final EIS discloses the potential direct, indirect, and cumulative environmental impacts that would result from the proposed mine and alternatives and serves as a report required under the Major Facility Siting Act (MFSA). The document is organized into four chapters:

- Chapter 1. Purpose of and Need for Action: Chapter 1 includes information on the history of the proposed project, the purpose of and need for the proposed project, and the lead agencies' proposal for achieving that purpose and need.
- Chapter 2. Alternatives, Including the Proposed Action: This chapter summarizes how the KNF and the DEQ informed the public of the proposal and how the public responded. This chapter provides a more detailed description of MMC's Proposed Action as well as the lead agencies' alternative methods for achieving the project's purpose. These alternatives were developed based on key issues raised by the public and other agencies and include mitigation measures to reduce impacts.
- Chapter 3. Affected Environment and Environmental Consequences: This chapter describes the affected environment and environmental effects of implementing the Proposed Action or other alternatives. This analysis is organized alphabetically by resource.
- Chapter 4. Consultation and Coordination: Chapter 4 provides a list of preparers and agencies consulted during the development of the Final EIS.

The following appendices provide more detailed information to support the analyses presented in the Final EIS:

- Appendix A—1992 Board of Health and Environmental Sciences Order
- Appendix B—Names, Numbers, and Current Status of Roads Proposed for Use in Mine or Transmission Line Alternatives
- Appendix C—Agencies' Conceptual Monitoring Plans, Alternative 3
- Appendix D—State of Montana/USDA Forest Service Environmental Specifications for the 230-kV Transmission Line
- Appendix E—Past and Current Actions Catalog for the Montanore Project
- Appendix F—Supplemental Macroinvertebrate Data
- Appendix G—Water Quality Mass Balance Calculations
- Appendix H—Various Streamflow Analyses
- Appendix I—Visual Simulations
- Appendix J—Transmission Line Minimum Impact Standard Assessment
- Appendix K—Water Quality Data
- Appendix L—404(b)(1) Analysis
- Appendix M—Response to Comment on the Draft and Supplemental Draft EISs

Additional documentation, including more detailed analyses of project-area resources, may be found in the project record located at the KNF Supervisor's Office in Libby, Montana, and in the project record at DEQ's Environmental Management Bureau in Helena, Montana.

This disclaimer pertains to all geographic information system (GIS) maps within this document:

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1.2 Project Area Description

The Montanore Project is located 18 miles south of Libby near the Cabinet Mountains of northwestern Montana (Figure 1; all figures are bound separately in Volume 4 of this document). The ore body is beneath the Cabinet Mountains Wilderness (CMW). All access and surface facilities including the 230-kV transmission line would be located outside of the CMW boundary (Figure 2). The proposed operating permit areas for the mine facilities would be within Sections 13, 14, 15, 22, 23, 24, 26, 27, 35, and 36, Township 28 North, Range 31 West, Sections 2, 3, 9, 10, 11, 14, 15, and 29, Township 27 North, Range 31 West, and Sections 18 and 19, Township 28 North, Range 30 West, all Principal Meridian, in Lincoln and Sanders counties, Montana.

1.3 Background

1.3.1 Mineral Rights

On January 1, 1984, the CMW was withdrawn from mineral entry under provisions of the Wilderness Act, subject to valid existing rights. The Wilderness Act requires federal agencies, such as the KNF, to ensure that valid rights exist before approving mineral activities inside a congressionally designated wilderness. To establish valid existing rights, mining claimants must show they have made a discovery of a valuable mineral deposit on the claim(s) before the withdrawal date, and have maintained that discovery.

The discovery of mineral deposits for the Montanore Project dates back to the early 1980s. In 1980, Heidelberg Silver Mining Company (Heidelberg) located certain mining claims in Sections 29 and 30 of Township 27N, Range 31 West, P.M., Sanders County, Montana. Subsequently, in 1983, Pacific Coast Mines, Inc. (Pacific), a subsidiary of U.S. Borax and Chemical Corporation, located other mining claims in Sections 29 and 30, Township 27N, Range 31 West, P.M., Sanders County, Montana. The mining claims located by Pacific in 1983 included the lode mining claims HR (Hayes Ridge) 133 and HR 134 adjacent to Rock Lake. (These claims are shown on Figure 11.) This outcrop contained stratabound copper-silver mineralization, extending over a 200-foot vertical thickness.

The deposit is part of the Rock Creek-Montanore deposit, as described by Boleneus *et al*. (2005). The Rock Creek-Montanore deposit has two sub-deposits, the Rock Lake sub-deposit, which was discovered by Pacific, and the Rock Creek sub-deposit, which is proposed to be mined by RC Resources, Inc., a wholly owned subsidiary of Revett Silver Company. The Rock Creek portion of the deposit is separated from the Montanore (Rock Lake) portion by the Rock Lake Fault. Exploration drilling was conducted across the deposit in 1983 and 1984.

In 1984, Pacific leased Heidelberg's mining claims pursuant to the terms of a 1984 Lease and Option to Purchase Agreement (Lease Agreement). Subsequently, in 1988, Heidelberg was merged into Newhi, Inc. (Newhi), a subsidiary of Mines Management, Inc. (MMI). As a result of that merger, Newhi became the successor in interest to Heidelberg under the Lease Agreement. Also in 1988, Pacific assigned its interest in HR 133 and HR 134 and its interest in the Lease Agreement to Noranda Minerals Corporation (NMC), a Delaware based corporation and wholly owned subsidiary of Noranda Finance Inc. (Noranda Finance), part of Noranda, Inc.

In 1991, NMC filed an application with the Bureau of Land Management (BLM) for patent of the HR 133 and HR 134 mining claims (Patent Application MTM 80435). In 1993, the Forest Service issued a Mining Claim Validity Report recommending to BLM that a patent be issued to NMC for HR 133 and HR 134. In 2001, the BLM issued a patent to NMC for the portion of HR 134 that lies outside the CMW (Patent Number 25-2001-0140). The BLM issued a separate patent to NMC for the mineral deposits for HR 133 and the portion of HR 134 that lies inside the CMW (Patent Number 25-2001-0141). These two claims straddle the CMW boundary, and cover 22 acres inside the CMW, for which NMC received only the rights to the mineral estate with the federal government retaining the surface rights, and 14.5 acres outside the CMW, for which NMC received fee title (surface and mineral rights). These patented mining claims contain the surface exposure of the ore body proposed for mining by the Montanore Project. The ore body extends north of the patented claims.

In 2002, NMC terminated the Lease Agreement with Newhi. Pursuant to the terms of that agreement, NMC conveyed its interest in HR 133 and HR 134 to Newhi. In 2006, Newhi acquired all of the issued and outstanding shares of NMC. Immediately following the acquisition of NMC, NMC's name was changed to Montanore Minerals Corporation (MMC). MMI has unpatented lode mining claims, mill site claims, and tunnel claims on National Forest System lands that cover the proposed mine development east of the CMW in the Libby Creek drainage.

1.3.2 Previous Permitting and Approvals

1.3.2.1 General Mine and Transmission Line Approvals

The permitting process for the Montanore Project began in 1989 when NMC obtained an exploration license from the Montana Department of State Lands (DSL) and other associated permits for construction of an exploration adit from private land in upper Libby Creek. Soon after obtaining the exploration license, NMC began excavating the Libby Adit. NMC also submitted a "Petition for Change in Quality of Ambient Waters" (Petition) to the Board of Health and Environmental Sciences (BHES) requesting an increase in the concentration of select constituents in surface water and groundwater above ambient water quality, as required by Montana's 1971 nondegradation statute. After constructing 14,000 feet of the Libby Adit, NMC ceased construction in 1991 in response to elevated nitrate concentration in surface water and low metal prices.

Although exploration adit construction ceased in 1991, the permitting process continued. Specifically, the KNF, the Montana Department of Health and Environmental Sciences (DHES), the Montana Department of Natural Resources and Conservation (DNRC), and the DSL, DEQ's predecessor agency, prepared a Draft, Supplemental Draft, and Final EIS on the proposed project. The environmental review process culminated in 1992 with BHES's issuance of an Order approving NMC's Petition (BHES 1992) and the DSL's issuance of a Record of Decision (ROD) and DEQ Operating Permit #00150 (DSL 1992) to NMC. In 1993, the KNF issued its ROD (USDA Forest Service 1993a), the DNRC issued a Certificate of Environmental Compatibility and Public Need under the Major Facility Siting Act (MFSA) (DNRC 1993), and the Corps issued a 404 permit (Corps 1993). These decisions approved mine and transmission line alternatives that allowed for the construction, operation, and reclamation of the project.

1.3.2.2 Water Quality-Related Approvals

The BHES Order, issued to NMC in 1992, authorizes degradation and establishes limits in surface water and groundwater adjacent to the Montanore Project for discharges from the project (BHES 1992). The Order establishes numeric limits for total dissolved solids, chromium, copper, iron, manganese, and zinc in both surface water and groundwater, nitrate+nitrite in groundwater only, and total inorganic nitrogen (nitrate+nitrite+ammonia) in surface water only. For these parameters, the limits contained in the authorization to degrade apply. For the parameters not covered by the authorization to degrade, the applicable nonsignificance criteria established by the 1994 nondegradation rules apply, unless MMC obtains an authorization to degrade under current statute. Pursuant to BHES's Order, these limits apply to all surface water and groundwater affected by the Montanore Project and remain in effect during the operational life of the mine and for so long thereafter as necessary (BHES 1992). The Order also adopted the modification developed in Alternative 3, Option C, of the Final EIS, addressing surface water and groundwater monitoring, fish tissue analysis, and in-stream biological monitoring. The Order is presented in Appendix A.

The Order also indicates that land application and disposal (LAD) treatment, as then proposed, would satisfy the requirement in Administrative Rules of Montana (ARM) 16.20.631(3) (now ARM 17.30.635(3)) to treat industrial wastes using technology that is the best practicable control technology available, or, if such technology has not been determined by the Environmental Protection Agency (EPA), then the equivalent of secondary treatment as determined by the DEQ. In 1992, the DHES (now DEQ) determined that LAD treatment, with at least 80 percent removal of nitrogen, would satisfy the requirements of ARM 16.20.631(3). The Order requires the DEQ to review design criteria and final engineering plans to determine that at least 80 percent removal of nitrogen would be achieved.

In 1997, the DEQ issued a Montana Pollutant Discharge Elimination System (MPDES) permit to NMC (MT0030279) to allow discharges of water flowing from the Libby Adit to Libby Creek. Three outfalls were included in the permit: Outfall 001 – percolation pond; Outfall 002 – infiltration system of buried pipes; and Outfall 003 – pipeline outlet to Libby Creek. Surface discharge from the exploration adit ceased in 1998 and water in the adit flowed to the underlying groundwater.

1.3.2.3 Current Status of Existing Permits

As discussed above, NMC conveyed its interests in lode claims HR 133 and HR 134 to Newhi in 2002. By that time, many of NMC's permits for the Montanore Project were relinquished, terminated or expired, such as DEQ's air quality permit, the Corps' 404 permit, KNF's approval, and the State's certification of the transmission line. In 2002, NMC notified the KNF it was relinquishing the approval to operate and construct the Montanore Project. NMC's DEQ Operating Permit #00150 and MPDES permit remain in effect because reclamation of the Libby Adit was not completed.

In 2004, MMI submitted an application for a hard rock operating permit to the DEQ and a proposed Plan of Operations for the Montanore Project to the KNF. In 2005, MMI also submitted to the DEQ an application for a 230-kV transmission line certificate of compliance and an application for an air quality permit. The DEQ renewed the MPDES permit in 2006. A minor modification of the MPDES permit in 2008 reflected an owner/operator name change from NMC to MMC. In 2010, MMC applied to the DEQ to renew the existing MPDES permit and requested the inclusion of five new stormwater outfalls under the permit. MMC submitted supplemental information in 2011 (Geomatrix 2011b). In 2011, the DEQ determined the renewal application was complete and administratively extended the permit (ARM 17.30.1313(1)) until MMC receives the renewed permit. The DEQ issued a draft renewal MPDES permit in July 2015 and held a public hearing on the draft permit in August 2015. The DEQ will issue a final renewal MPDES permit with its ROD. MMC also held MPDES permit MTR104874 for stormwater discharges from the Libby Adit Site. These discharges were incorporated into the draft renewal MPDES permit.

In 2006, Newhi acquired all of the issued and outstanding shares of NMC pursuant to the terms of a Stock Transfer Agreement between Noranda Finance, Newhi, and MMI. Although the name of Noranda Minerals Corporation was changed to Montanore Minerals Corporation (MMC) immediately following Newhi's acquisition of NMC's shares, MMC (formerly NMC) remains the holder of DEQ Operating Permit #00150 and the existing MPDES permit for the Montanore

Project. Following the acquisition of NMC, MMI and MMC advised the agencies that MMC will be the owner and operator of the Montanore Project. Consistent with that indication, Newhi has re-conveyed HR 133 and HR 134 to MMC, and MMI and MMC have requested that the DEQ consider MMI's application for a hard rock operating permit as an application by MMC to modify the DEQ Operating Permit #00150 (Klepfer Mining Services 2008a). MMC submitted an updated Plan of Operations to the agencies in 2008 that clarified differences between the 2005 Plan of Operations and DEQ Operating Permit #00150. It also incorporated plans required by DEQ Operating Permit #00150 and additional environmental data collected since 2005 (MMC 2008).

1.3.2.4 Libby Adit Evaluation Drilling Program

In 2006, MMC submitted, and the DEQ approved, two requests for revisions to DEQ Operating Permit #00150 (MR 06-001 and MR 06-002). The revisions involved reopening the Libby Adit and re-initiating the evaluation drilling program that NMC began in 1989. The key elements of the revisions include: re-excavation of the Libby Adit portal; initiation of water treatability analyses; installation of ancillary facilities; dewatering of the Libby Adit decline; extension of the current drift; and underground drilling and sample collection.

Under the revisions, the Libby Adit would be dewatered and water would be treated before discharging to one of three MPDES permitted outfalls. The Libby Adit would be rehabilitated and the drift extended 3,300 feet. An additional 7,100 feet and 16 drill stations would be developed under the currently defined ore zones. An estimated 545,300 tons (246,000 cubic yards) of waste rock would be generated and stored at the Libby Adit site.

The evaluation drilling program (MR 06-002) is designed to delineate the first 5 years of planned production. An estimated 35,000 feet of primary drilling and 12,800 feet of infill drilling are planned. The drill core would be used to support resource modeling, mine planning, metallurgical testing, preliminary hydrology assessment, and rock mechanic studies for the full Montanore Project. If adit closure and site reclamation were necessary after completion of the evaluation drilling program, MMC would install a concrete-reinforced hydraulic plug in bedrock, reconstruct the original adit plug, remove all surface facilities, and regrade and revegetate the disturbed areas. Additional information about the evaluation drilling program and site operations and reclamation can be found in MMC's submittal, Notification to Resume Suspended Exploration and Drilling Activities for the Montanore Project (MMC 2006), on file with the lead agencies.

MMC requested a revision to its operating permit that involved the relocation of fuel and oil storage areas at the Libby Adit and the addition of more fuel storage capacity. The DEQ approved the revision in 2009 (MR 08-001).

In 2008, the KNF decided the best approach for disclosing the environmental effects of the Libby Adit evaluation program was to consider this activity as the initial phase of the overall Montanore Project in this EIS. The Libby Adit evaluation program would be the first phase of the Montanore Project in Alternatives 3 and 4.

1.4 Proposed Action

The 2005 Plan of Operations is considered as a new proposed Plan of Operations by the KNF because NMC relinquished the federal approval to construct and operate the Montanore Project in 2002. Both the KNF and the DEQ consider MMC's proposed 230-kV North Miller Creek transmission line to be part of the Proposed Action as the 1993 Certificate of Environmental Compatibility and Public Need for the 230-kV transmission line expired.

As proposed by MMC, the Montanore Project would consist initially of a 12,500-tons-per-day underground mining operation that would expand to a 20,000-tons-per-day rate. The surface mill would be located on National Forest System lands outside of the CMW in the Ramsey Creek drainage. The proposed project also would require constructing about 16 miles of high-voltage electric transmission line from a new substation adjacent to Bonneville Power Administration's (BPA) Noxon-Libby 230-kV Transmission Line to the project site. The Noxon-Libby 230-kV Transmission Line would be looped into the new ring bus substation named the Sedlak Park Substation at the tap point. BPA would design, construct, own, operate, and maintain the substation and loop line, and BPA's customer, Flathead Electric Cooperative, would provide power to MMC at that location. MMC would own and operate the 16-mile-long, 230-kV transmission line from the tap point to the project site. MMC's proposed 230-kV transmission line would be routed from the Sedlak Park Substation along US 2, and then up the Miller Creek drainage to the project site. The location of the proposed project facilities is shown on Figure 2.

The ore body would be accessed from two adits adjacent to the mill. Two other adits, an evaluation/ventilation adit and a ventilation adit, both with entrances located on private land, also would be used during the project. The evaluation/ventilation adit would be located in the upper Libby Creek drainage; the ventilation adit would be located on MMC's private land (patented claim HR 134) in the upper East Fork Rock Creek drainage near Rock Lake.

The mineralized resource associated with the Montanore subdeposit is about 135 million tons. MMC anticipates mining up to 120 million tons. Ore would be crushed underground and conveyed to the surface mill located near the Ramsey Adits. Copper and silver minerals would be removed from the ore by a flotation process. Tailings from the milling process would be transported through a pipeline to a tailings impoundment located in the Little Cherry Creek drainage, about 4 miles from the proposed plant site.

Access to the mine and all surface facilities would be via US 2 and the existing National Forest System road #278, the Bear Creek Road. (Road names and numbers are used interchangeably in this EIS; a complete list of all road names and numbers is in Appendix B) MMC would upgrade 11 miles of the Bear Creek Road, and build 1.7 miles of new road between the Little Cherry Creek Impoundment Site and the Ramsey Plant Site. Silver/copper concentrate from the mill would be transported by truck to a rail siding in Libby, Montana. The concentrate would then be shipped by rail to an out-of-state smelting facility.

Mining operations would continue for an estimated 16 years once facility development was completed and actual mining operations started. Three additional years may be needed to mine 120 million tons. The mill would operate on a three-shifts-per-day, seven-days-per-week, year-long schedule. At full production, an estimated 7 million tons of ore would be produced annually during a 350-day production year. Employment numbers are estimated to be 450 people at full production. An annual payroll of $12 million is projected for full production periods.

As proposed, the mine operating permit area would be 3,628 acres and the disturbance area would be 2,582 acres. The operating permit area would include 443 acres of private land owned by MMC for the proposed mine and associated facilities. All surface disturbances would be outside the CMW. MMC has developed a reclamation plan to reclaim the disturbed areas following the phases associated with evaluation, construction, operations, and mine closure. MMC's proposal is described in section 2.4, *Alternative 2—MMC's Proposed Mine*.

With minor exceptions, MMC proposes to construct, operate, and reclaim a new mine and transmission line in accordance with the terms and conditions of DEQ Operating Permit #00150 and in accordance with the terms and conditions of the other agencies' permits and approvals issued to NMC in 1992 and 1993. As indicated earlier, MMC and MMI have requested that the DEQ consider MMI's application for a hard rock operating permit as an application by MMC for modification to DEQ Operating Permit #00150, pursuant to ARM 17.24.119(3) (Klepfer Mining Service 2008a). MMC's requested changes to DEQ Operating Permit #00150 are:

- Construction of an additional underground ventilation infrastructure that would result in an acre of disturbance on private land near Rock Lake
- Relocation of the concentrate loadout facility to the Kootenai Business Park located in Libby (private land) resulting in less than 1 acre of disturbance
- Installation of a buried powerline along the Bear Creek Road (NFS road #278), which would be reconstructed for access
- Construction of a temporary electrical substation adjacent to the Ramsey Creek Road (NFS road #4781), which would be reconstructed for access
- A change in the construction technique proposed for the Little Cherry Creek Impoundment from downstream to centerline construction
- Installation of a water pipeline from the Libby Adit to the LAD Areas
- Changes required to conform DEQ Operating Permit #00150 to the alternative selected by the KNF in its ROD.

MMC and the DEQ agreed to hold the request for modification to the permit in abeyance until completion of the environmental review process.

Each mine and transmission line alternative would require an amendment to the Kootenai Forest Plan (KFP) for the alternative to be consistent with the 2015 KFP. The amendment would be completed in accordance with the regulations governing Forest Plan amendments found in 36 CFR 219 (1982) and FSM 1921.03. The analysis disclosed in this EIS satisfies the requirements for an evaluation for the amendment. The proposed amendments to the 2015 KFP are described in section 2.12, *Forest Plan Amendments*.

1.5 Purpose and Need

The following sections briefly describe the underlying purpose and need to which each major permitting agency (KNF, DEQ, BPA, and Corps) is responding in proposing the alternatives, including the Proposed Action (40 CFR 1502.13). MMC's project purpose and need also is discussed. Purpose(s) and need(s) are used to define the range of alternatives analyzed in the EIS. Each agency's statutory authorities and policies determine its underlying purpose and need. The KNF's and DEQ's overall purpose and need is to process MMC's proposed Plan of Operations to develop the Montanore copper and silver deposit, application for a modification to DEQ Operating Permit #00150, application for a transmission line certificate of compliance, and other permit applications, and to follow all applicable laws, regulations, and policies pertaining to each pending application. The BPA's need is to improve its transmission system to ensure continued reliable electric power to its customer, Flathead Electric Cooperative, and its purposes are to minimize costs while meeting BPA's long-term system planning objectives for the area, and to minimize impacts on the human environment through site selection and design.

1.5.1 Kootenai National Forest

As discussed previously, the Forest Service verified in 1985 and 1993 that valid rights to the minerals patented on HR 133 and HR 134 claims have been established within the CMW. Those rights are currently held by MMC. The role of the KNF under its primary authorities in the Organic Administration Act, Locatable Regulations 36 CFR 228 Subpart A, and the Multiple Use Mining Act is to ensure that mining activities minimize adverse environmental effects on National Forest System lands and comply with all applicable laws. The KNF has no authority to unreasonably circumscribe or prohibit reasonably necessary activities under the General Mining Law that are otherwise lawful. Through the Mining and Mineral Policy Act, Congress has stated it is the continuing policy of the federal government, in the national interest, to foster and encourage private enterprise in:

- The development of economically sound and stable domestic mining, minerals, and metal and mineral reclamation industries
- The orderly and economic development of domestic mineral resources, reserves, and reclamation of metals and minerals to help assure satisfaction of industrial, security, and environmental needs

MMC is asserting its right under the General Mining Law to mine the mineral deposit and remove the copper and silver, subject to regulatory laws. From the perspective of the Forest Service, the need is to:

- Respond to MMC's proposed Plan of Operations to develop the Montanore copper and silver deposit
- Ensure the alternative selected in the ROD would comply with other applicable federal and state laws and regulations
- Ensure the alternative selected in the ROD, where feasible, would minimize adverse environmental impacts on National Forest System surface resources
- Ensure measures would be included, where practicable, that provide for reclamation of the surface disturbance

1.5.2 U.S. Army Corps of Engineers

1.5.2.1 Basic Project Purpose

In accordance with the Clean Water Act, the Corps is required to consider and express the activity's underlying purpose and need from the applicant's and public's perspectives (33 CFR 325). From the Corps' perspective, the basic project purpose is to provide copper and silver to meet a portion of current and future public demands. Under the Guidelines, the Corps uses the basic project purpose to determine if a project is "water dependent." A project is water dependent if it must be located in, or in close proximity to, a water of the U.S. to fulfill its basic purpose. Providing copper and silver is not a water dependent activity. For projects that are not water dependent, practicable alternatives that do not involve special aquatic sites, such as wetlands, are presumed to be available. The 404(b)(1) Guidelines are discussed in more detail in section 2.13, *Alternatives Analysis and Rationale for Alternatives Considered but Eliminated*.

1.5.2.2 Overall Project Purpose

The overall project purpose is more specific to the applicant's proposed project than the basic project purpose. The overall project purpose is used for evaluating practicable alternatives under the 404(b)(1) Guidelines. The overall project purpose must be specific enough to define the applicant's needs, but not so restrictive as to preclude discussion of a range of alternatives. Defining the overall project purpose is the Corps' responsibility; the applicant's needs are considered in the context of the desired geographic area of the development and the type of project being proposed. From the Corps' perspective, the overall project purpose is to extract copper and silver from ore in northwestern Montana in order to meet demand.

1.5.2.3 Project Need

Over the past decade, global demand for copper and silver generally has been on an upward trend. The proposed project would partially fulfill society's demand for these commodities. The following sections discuss the demand and supply for copper and silver.

Because of its properties of thermal and electrical conductivity, malleability, and resistance to corrosion, copper has become a major industrial metal, ranking third after iron and aluminum in terms of quantities consumed. In 2012, building construction was the single largest market for copper, followed by electric and electronic products, transportation equipment, consumer and general products, and industrial machinery and equipment. Domestic (U.S.) consumption of copper in 2012 (1.7 million metric tons) exceeded domestic production (1.2 metric tons), a pattern that has existed for over 10 years. In 2012, the principal domestic mining states, in descending order of production—Arizona, Utah, New Mexico, Nevada, and Montana—accounted for 99 percent of domestic copper production; copper also was recovered at mines in three other states. Copper in all recycled scrap contributed about 33 percent of the U.S. copper supply (USGS 2013). China remained the largest worldwide copper user. Copper byproducts from manufacturing and obsolete copper products are readily recycled and contribute significantly to copper supply (USGS 2013). Average U.S. imports of copper over the past 5 years were 31 percent of apparent consumption. Chile and Canada provided 75 percent of copper imported into the U.S. between 2008 and 2011 (USGS 2013).

Of all the metals, pure silver has the whitest color, the highest optical reflectivity, and the highest thermal and electrical conductivity. Demand for silver is generated by four primary uses: electrical and electronics, coins and metals, photography, and jewelry and silverware. Together, these four categories represented 78 percent of annual silver consumption in 2012. Domestic (U.S.) consumption of silver in 2012 (190 million Troy ounces) exceeded domestic mine production (34 million Troy ounces), a pattern that has existed for over 10 years (USGS 2013). In 2012, new mine production provided about 75 percent of the world silver demand, with old scrap providing 20 percent (The Silver Institute 2013).

Mine production of silver in the U.S. over the past 20 years peaked in 2000 at 64 million troy ounces (USGS 2001), decreasing to 34 million troy ounces in 2012 (USGS 2013). In 2012, Alaska and Nevada were the leading U.S. silver producers. Average U.S. imports of silver over the past 5 years were 61 percent of apparent consumption. Mexico and Canada provided 74 percent of silver imported into the U.S. between 2008 and 2011 (USGS 2013).

1.5.3 Bonneville Power Administration

The BPA is a federal power marketing agency that owns and operates more than 15,000 circuit miles of transmission lines in the Pacific Northwest. The transmission lines carry most of the high voltage electricity (230-kV and above) from the resources of the federal Columbia River Power system and other interconnected private and federal projects. BPA's customers include publicly owned power marketers (public utility districts), municipalities, investor-owned utilities, and large direct service industries. The utility customers, in turn provide electricity to industry, homes, businesses, and farms.

BPA's transmission system in northwestern Montana provides reliable power to BPA's customers, including Flathead Electric Cooperative. BPA has a need therefore to improve its transmission system to ensure continued reliable electrical power for all of its customers. BPA's purposes are goals to be achieved while meeting the need for the project; the goals are used to evaluate the alternatives proposed to meet the need. Therefore, BPA will use the following purposes to choose among the alternatives:

- Increase BPA system capacity while maintaining BPA transmission system reliability
- Maintain environmental quality
- Minimize impacts on the human environment through site selection and design
- Minimize costs while meeting BPA's long-term transmission system planning objectives for the area

1.5.4 Montana Department of Environmental Quality

The Montana Environmental Policy Act (MEPA) and its implementing rules, ARM 17.4.201 *et seq*., require that EISs prepared by state agencies include a description of the purpose and benefits of the proposed project. MMC's project purpose is described in section 1.5.5, *Montanore Minerals Corporation*. Benefits of the proposed project include the production of copper and silver to help meet public demand for these minerals. The project would increase employment and tax payments in the project area. Employment and taxes are addressed in section 3.18, *Social/Economics*. Although the proposed project would help meet public demand for copper and silver, that topic is outside the scope of this EIS and is not addressed in Chapter 3.

The MFSA and an implementing rule, ARM 17.20.920, require that an application for an electric transmission line contain an explanation of the need for the facility. No electrical distribution system is near the project area. The nearest electrical distribution line parallels US 2 and it is not adequate to carry the electrical power required by the project. As discussed in Chapter 2, the lead agencies considered, but eliminated from detailed analysis, alternatives other than a new transmission line. A new transmission line is needed to supply electrical power to construct, operate, and reclaim the proposed mine facilities.

1.5.5 Montanore Minerals Corporation

MMC's project purpose is to develop the Rock Lake copper and silver deposit by underground mining methods with the expectation of making a profit. MMC's need is to receive all necessary governmental approvals and authorizations to construct, operate, and reclaim the proposed Montanore Mine, the associated transmission line, and other incidental facilities. MMC proposes to construct, operate, and reclaim the Montanore Project in an environmentally sound manner, subject to reasonable mitigation measures designed to avoid or minimize environmental impacts on the extent practicable.

1.6 Agency Roles, Responsibilities, and Decisions

Two “lead” agencies are responsible for the analysis of this project: the KNF and the DEQ. The cooperating agencies, the Corps, BPA, and Lincoln County, provided technical assistance as needed. A single EIS for the Montanore Project is being prepared to provide a coordinated and comprehensive analysis of potential environmental impacts. Before construction and operation of the proposed project could begin, various other permits, certificates, licenses, or approvals will be required from the two lead agencies and other agencies (see Table 5 at the end of this chapter). Table 5 is not a comprehensive list of all permits, certificates, or approvals needed, but lists the primary federal, state, and local agencies with permitting responsibilities. The roles and responsibilities of the agencies with primary environmental permitting and regulatory responsibilities are discussed in the following sections.

The major decisions to be made by the lead agencies and by other agencies are discussed briefly in this section. Federal and state agency decision-making is governed by regulations. Each agency’s regulations provide the conditions that the project must meet to obtain the necessary permits, approvals, or licenses and provide the conditions under which the agency could deny MMC the necessary permits or approvals.

1.6.1 Federal Agencies

1.6.1.1 Kootenai National Forest

1.6.1.1.1 Applicable Laws and Regulations

Most of the proposed disturbance areas would be on National Forest System lands managed by the KNF. The KNF is obligated under certain laws and regulations to evaluate and take action on MMC’s request to operate a mine, mill, and auxiliary facilities on National Forest System lands and associated private lands. The applicable major laws are summarized below:

- **1872 General Mining Law**—This law gives U.S. citizens the right to explore, locate mining claims, make discoveries, patent claims, and develop mines on National Forest System lands open to mineral entry.
- **1897 Organic Administration Act**—This act authorizes the Forest Service to regulate use and occupancy, such as mineral operations, on National Forest System lands. The Forest Service’s locatable minerals regulations are promulgated at 36 CFR 228, Subpart A. These regulations require that a proposed Plan of Operations be submitted for operations that might cause significant disturbance to National Forest System surface resources.
- **1955 Multiple-Use Mining Act**—This act affirms that unpatented mining claims may be used for prospecting, mine processing, and uses reasonably incident thereto and reinforces Forest Service authority to ensure mining activities are restricted to these uses.

- **1964 Wilderness Act**—This act allows mineral exploration and development under the General Mining Law to occur in wilderness to the same extent as before the Wilderness Act until December 31, 1983, when the Wilderness Act withdrew the CMW from mineral entry, subject to valid and existing rights. Holders of mining claims with valid existing rights within National Forest Wilderness are accorded the rights provided by the United States mining laws. Mining operations and access are subject to the 36 CFR 228 Subpart A regulations.
- **1970 National Mining and Minerals Policy Act**—This act states that the continuing policy of the Federal Government to foster and encourage private enterprise in the development of economically sound and stable domestic mining and mineral industries and the orderly and economic development of domestic mineral resources.
- **1972 Federal Water Pollution Control Act (Clean Water Act)**—This act as amended, is to protect and improve the quality of water resources and maintain their beneficial uses. Proposed mining activities on National Forest System lands are subject to compliance with Clean Water Act Sections 401, 402, and 404 as applicable.

  The DEQ, EPA, and the Corps all have regulatory, compliance and enforcement responsibilities under the Clean Water Act. If the proposed mining activity may result in any discharge into the navigable waters, the mining operator must obtain a 401 certification from the designated Clean Water Act entity. Pursuant to the Clean Water Act, MMC must obtain a 401 certification from the DEQ for proposed discharges into the navigable waters unless the DEQ waives its issuance (see section 1.6.2.1, *Montana Department of Environmental Quality*). The 401 certification from the Montana DEQ certifies that the operator's proposed discharges of fill permitted under a Section 404 permit are in compliance with all applicable water quality requirements of the Clear Water Act. Unless the 401 certification is waived, the mining operator must give a copy of the 401 certification to the Forest Service before the KNF can allow the operator to commence any activity that requires a 404 permit.
- The EPA has delegated responsibility for Section 402 of the Clean Water Act, which covers surface water discharges, to the DEQ (see section 1.6.2.1, *Montana Department of Environmental Quality*).
- **1973 Endangered Species Act (ESA)**—The KNF is required by this act to ensure that any actions it approves will not jeopardize the continued existence of a threatened or endangered (T&E) species or result in the destruction or adverse modification of critical habitat. The Forest Service prepared biological assessments (BAs) that evaluates the potential effect of the proposed project on T&E species, including measures the Forest Service would require to minimize or compensate for effects. The KNF submitted the BAs to the U.S. Fish and Wildlife Service (USFWS) for review and consultation in 2011. The BAs were revised in 2013 to provide additional information about the project and to make them consistent with current regulatory requirements (USDA Forest Service 2013a, 2013b).
- **1976 National Forest Management Act**—The National Forest Management Act requires the development, maintenance, and, as appropriate, the revision of land and resource management plans (forest plans) for units of the National Forest System. These forest plans provide for the multiple use and sustained yield of renewable resources in accordance with the Multiple-Use Sustained-Yield Act of 1960.

  While mineral development, such as the Montanore Project, is not regulated by the **National Forest Management Act**, or by the 2015 KFP, which was developed and revised pursuant to the **National Forest Management Act** (16 USC 528, 16 USC

1604(e), 36 CFR 219.1), per se, an approved plan of operations cannot be inconsistent with applicable 2015 KFP standards and guidelines. However, 16 USC 478 bars the Forest Service from prohibiting locatable mineral operations on lands subject to the United States mining laws either directly or by regulation amounting to a prohibition. This means that if applicable 2015 KFP standards and guidelines would not unreasonably restrict mining operations conducted pursuant to the United States mining laws, the approved plan of operations must reflect that direction. If the 2015 KFP purports to prohibit locatable mineral operations on lands open to the United States mining laws, or if the 2015 KFP direction would effectively amount to a prohibition of operations conducted pursuant to those laws for reasons such as the technical impossibility of complying with that direction, or the prohibitive cost of complying with that direction, then the 2015 KFP standards and guidelines must give way in light of 16 USC 478.

- **1980 Alaska National Interest Lands Conservation Act—**This act directed the KNF to provide access to non-federally-owned land (which includes patented claims and private mineral estates) within the boundaries of National Forest System lands, allowing landowners reasonable use and enjoyment of their property.
- **2015 Kootenai Forest Plan and EIS—**The 2015 KFP includes the forestwide desired condition to contribute to the economic strength and demands of the nation by supplying mineral and energy resources while assuring that the sustainability and resiliency of other resources are not compromised or degraded (FW-DC-MIN-01). The Montanore Project analysis tiers to the 2013 Forest Plan Final Environmental Impact Statement (USDA Forest Service 2013c) and the associated 2015 Errata for the Final EIS for 2015 KFP (USDA Forest Service 2015a, 2015b).
- **Title 36, Code of Federal Regulations, Part 228, Subpart A**—These regulations (36 CFR 228, Subpart A) provide rules and procedures for conducting locatable mineral operations on National Forest System lands. The regulations apply to operations conducted under the U.S. mining laws as they affect surface resources on National Forest System lands under the jurisdiction of the Secretary of Agriculture. Operations are defined as all functions, work, and activities in conjunction with prospecting, exploration, development, mining or processing of mineral resources, and all uses reasonably incident thereto, including roads and other means of access on lands subject to the regulation in this part, regardless of whether said operations take place on or off mining claims (36 CFR 228.3(a)). Special use permits may be needed if proposed facilities would not be owned or operated by the operator (MMC) or if facilities would remain in place after mining operations are completed, such as a transmission line or radio facilities. Regulations for special uses on National Forest System lands are contained in 36 CFR 251.

  The Forest Service's locatable minerals regulations require that mining activity be conducted, where feasible, to minimize adverse environmental impacts on National Forest surface resources. The KNF and the DEQ would share the responsibility to monitor and inspect the Montanore Project, and would require MMC to post joint reclamation bond to ensure that both federal and state reclamation requirements were met. As stipulated in a 1989 Memorandum of Understanding (MOU) between the Forest Service-Northern Region and the DSL, a joint reclamation bond can be held by the DEQ to ensure compliance with the reclamation plan associated with the operating permit and an approved Plan of Operations. If MMC defaulted on its obligations, the agencies may jointly collect or access the bond or one of the agencies may collect the bond with the concurrence of the other agency. Even if the reclamation bond is collected by one of the agencies, the bond must be expended in a manner that satisfies both federal and state reclamation requirements. The DEQ and the KNF would also require a reclamation bond to be posted for National Forest System lands affected by the transmission line. The DEQ also would require the posting of reclamation bond for private lands affected by the transmission line. Financial assurance is discussed in more detailed in section 1.6.3, *Financial Assurance*.

Kootenai National Forest Responsibilities to Federally Recognized Tribes. Federal agencies have government-to-government responsibilities to consult with federally-recognized American Indian Tribes. Among those tribes are the Confederated Salish and Kootenai Tribes and the Kootenai Tribe of Idaho who have retained off-reservation treaty rights in the project area through the Hellgate Treaty of 1855. The responsibilities of the KNF regarding tribal consultation are found in the following laws and treaties:

- Hellgate Treaty of 1855
- National Historic Preservation Act
- National Environmental Policy Act
- National Forest Management Act
- American Indian Religious Freedom Act
- Archaeological Resources Protection Act
- Native American Graves Protection and Repatriation Act
- Religious Freedom Restoration Act
- Food, Conservation, and Energy Act
- Interior Secretarial Order 3175

As a federal agency, the KNF is subject to Presidential Executive Orders. Applicable Executive Orders are discussed by resource in Chapter 3.

1.6.1.1.2 Decision

The KNF Supervisor will issue a decision on MMC's proposal in a ROD. The decision objective is to select an action that meets the legal rights of MMC, while protecting the environment in compliance with applicable laws, regulations, and policy. The KNF Supervisor will use the EIS process to develop the necessary information to make an informed decision as required by 36 CFR 228, Subpart A. Based on the alternatives developed in the EIS, the KNF will issue a ROD in which one of the following decisions will be made:

- Approval of the Plan of Operations as submitted
- Approval of a Plan of Operations with changes, and the incorporation of mitigations and stipulations that meet the mandates of applicable laws, regulations, and policy
- Notification to MMC that the KNF Supervisor will not approve a Plan of Operations until a revision to the proposed Plan of Operations that meets the mandates of applicable laws and regulations is submitted

The alternative selected by the KNF must meet the purpose of the Forest Service locatable mineral surface management regulations as described in 36 CFR 228, Subpart A and the Mining and Minerals Policy Act.

1.6.1.2 U.S. Fish and Wildlife Service

1.6.1.2.1 Applicable Laws and Regulations

The USFWS has responsibilities under the Endangered Species Act, Migratory Bird Treaty Act, and Bald Eagle Protection Act.

1.6.1.2.2 Decision

In its 2014 Biological Opinion on the grizzly bear, the USFWS indicated that it was the USFWS' biological opinion that the Montanore Project as proposed in the KNF's preferred Mine Alternative 3 and the agencies' preferred Transmission Line Alternative D-R is not likely to jeopardize the continued existence of the grizzly bear (USFWS 2014a). No critical habitat has been designated for this species, and therefore none would be affected. The USFWS concurred with the Forest Service's determination that the project may affect, but is not likely to adversely affect the Canada lynx (USFWS 2014b). The USFWS does not review or provide concurrence on no effect determinations but acknowledged the Forest Service's analysis that the project would have no effect on lynx critical habitat (USFWS 2014b).

In its 2014 Biological Opinion on the bull trout, the USFWS indicated that it was the USFWS' biological opinion that the project as proposed in the Forest Service's preferred Mine Alternative 3 and the agencies' preferred Transmission Line Alternative D-R is not likely to jeopardize the continued existence of the bull trout, and is not likely to destroy or adversely modify bull trout critical habitat (USFWS 2014c). The USFWS does not review or provide concurrence on no effect determinations but acknowledged the Forest Service's analysis that the project would have no effect on the Kootenai River white sturgeon (USFWS 2014b).

Both Biological Opinions concluded that the project would result in "take" as defined under the ESA and included reasonable and prudent measures to reduce the likelihood of incidental take and minimize adverse effects to both bull trout and designated critical habitat. Both Biological Opinions contained terms and conditions that implement the reasonable and prudent measures. The take of one grizzly bear deemed attributable to the mine would trigger re-evaluation of the situation by the USFWS to determine whether additional measures are needed to reduce the potential for future mortality (USFWS 2014a). The USFWS determined that the actual amount or extent of the anticipated incidental take of bull trout due to changes in habitat conditions in the affected streams is unquantifiable (USFWS 2014c).

1.6.1.3 U.S. Army Corps of Engineers

1.6.1.3.1 Applicable Laws and Regulations

MMC's construction of certain project facilities in waters of the U.S., including wetlands and other special aquatic sites, would constitute the disposal of dredged or fill materials. Such activities require a permit from the Corps under Section 404 of the Clean Water Act. MMC submitted a Section 404 permit application to the Corps for the agencies' preferred alternatives (Mine Alternative 3 and Transmission Line Alternative D-R) in 2011 (MMC 2011a). The application described the amount and types of wetlands and other waters of the U.S. that would be affected by proposed facilities. The permit application also included a draft conceptual mitigation plan to mitigate impacts on wetlands and other waters of the U.S. The Corps and the DEQ jointly issued a 60-day public notice on the permit application in 2011. In 2013, MMC submitted a Preliminary Mitigation Design Report for Impacts on Waters of the U.S. for Alternative 3 to Corps (NewFields Companies and Kline Environmental Research 2013). MMC submitted a revised Preliminary Mitigation Design Report in 2014 (MMC 2014a) and a Supplemental Report on the existing conditions of affected streams and wetlands (NewFields Companies and Kline Environmental Research 2014). The Corps will request 401 certification from the DEQ for the proposed discharge (see section 1.6.2.1, *Montana Department of Environmental Quality*). The Corps has the authority to take reasonable measures to inspect Section 404-permitted activities (33 CFR 326.4).

The Corps and the EPA have developed guidelines to evaluate impacts from the disposal of dredged or fill material on waters of the U.S. and to determine compliance with Section 404 of the Clean Water Act (40 CFR 230). The guidelines require analysis of “practicable” alternatives that would not require disposal of dredged or fill material in waters of the U.S., or that would result in less environmental damage. In the guidelines, the term “practicable” is defined as “available or capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes.” The Corps can only permit the least environmentally damaging practicable alternative.

1.6.1.3.2 Decision

The Corps will decide whether to issue a 404 permit based on MMC’s 404 permit application. The Corps can deny a Section 404 permit if the project would not comply with the 404(b)(1) Guidelines (40 CFR 230.10), or if the permit issuance would be contrary to the public interest (33 CFR 320.4). If the Corps decides to issue a Section 404 permit, it will issue a ROD or a Statement of Findings concurrently with the permit.

1.6.1.4 Bonneville Power Administration

1.6.1.4.1 Applicable Laws and Regulations

A number of federal laws and regulations address open access to BPA’s transmission system, including (i) the Bonneville Project Act, which gives preference and priority in power sales to public bodies and cooperatives; (ii) the Flood Control Act, which specifies that the Secretary of the Interior (now the Secretary of the Energy) must transmit and dispose of power/energy in a way that encourages widespread use of the power/energy and is sold at the lowest possible rates consistent with sound business principles; (iii) the Pacific Northwest Power Act, which requires BPA “whenever requested” to meet the net requirements of Northwest utilities; and (iv) the Columbia River Transmission System Act, which requires the BPA administrator to make available to all utilities on a fair and nondiscriminatory basis transmission system capacity not needed to transmit federal power. The BPA would provide a 230-kV power source from its Noxon-Libby 230-kV transmission line to its customer Flathead Electric Cooperative at the proposed Sedlak Park Substation. Under the new large single load provisions of the Northwest Power Planning and Conservation Act, the BPA is prohibited from providing power directly to the project. Flathead Electric Cooperative could serve the proposed mine under its existing power sales contract with BPA. The BPA would design construct, own, operate, and maintain the substation and the loop line, which would be paid for by MMC. The substation would be located at Sedlak Park.

1.6.1.4.2 Decision

Before deciding to provide electrical power to Flathead Electric Cooperative for MMC's project, the BPA will prepare a decision document for its part of the project. The BPA can deny approval for the electrical transmission line connection if significant environmental impacts at the connection location would occur, or if the interconnected electrical system would not allow adequate service to the mine and existing electrical customers if the mine were approved.

1.6.1.5 Environmental Protection Agency

The EPA has responsibilities under the Clean Air Act to review Draft EISs and federal actions potentially affecting the quality of the environment. The EPA evaluates the adequacy of information in Draft EISs, and the overall environmental impact of the Proposed Action and alternatives. The EPA also reviews 404 permit applications and provides comments to the Corps, and has veto authority under the Clean Water Act for decisions made by the Corps on 404 permit applications. The EPA has oversight responsibility for Clean Water Act programs delegated to and administered by the DEQ. The EPA may also intervene to resolve interstate disputes if discharges of pollutants in an upstream state may affect water quality in a downstream state.

1.6.2 State and County Agencies

1.6.2.1 Montana Department of Environmental Quality

1.6.2.1.1 Applicable Laws and Rules

The Montana legislature has passed statutes and the Board of Environmental Review has adopted administrative rules defining the requirements for construction, operations, and reclamation of a mine and transmission line, discharge of mining waters, discharge of emissions, storage of hazardous and solid wastes, and development and operation of public water supply and sewer systems. The DEQ is required to evaluate the operating permit modification, certificate, and license applications submitted by MMC under the following major laws and regulations:

- MEPA requires the state to conduct an environmental review when making decisions or planning activities that may have a significant impact on the environment. The MEPA and its rules define the process to be followed when preparing an EIS.
- The Montana Metal Mine Reclamation Act (MMRA) requires an approved operating permit for all mining activities that have more than 5 acres of land disturbed and unreclaimed at any one time. The MMRA sets forth reclamation standards for lands disturbed by mining, generally requiring that they be reclaimed to comparable stability and utility as that of adjacent areas. The MMRA describes the process by which a revision or an amendment to an approved operating permit is reviewed and processed. MMC must also obtain the necessary or modify any existing air and water quality permits. Mines that would have more than 75 employees must also have a valid approved Hard Rock Mining Impact Plan before operations.
- MFSA requires the DEQ to issue a certificate of compliance before construction of certain major facilities, such as the proposed transmission line. Before certification of the proposed transmission line, MMC must also obtain the necessary air and water quality permits.

- The Montana Water Quality Act, through MPDES permits, regulates discharges of pollutants into state surface waters through a permit application process and the adoption of water quality standards. Water quality standards, including the Montana nondegradation policy, specify the changes in surface water or groundwater quality that are allowed from a waste water discharge. A MPDES permit may also include limits for discharges of stormwater and will require the development of a stormwater pollution prevention plan. Montana Ground Water Pollution Control System permits are required for discharges of wastes to state groundwaters. Discharges to groundwater from mining operations subject to operating permits under the Metal Mine Reclamation Act are not subject to groundwater permit requirements (75-5-401(5), MCA).
- The Clean Air Act of Montana requires a permit for the construction, installation, and operation of equipment or facilities that may cause or contribute to air pollution.
- The federal Clean Water Act requires that applicants for federal permits or licenses for activities that may result in a discharge to state waters obtain certification from the state, certifying the discharge complies with state water quality standards. Section 404 permits issued by the Corps require 401 certification. The DEQ provides Section 401 certification pursuant to state regulations (ARM 17.30.101 *et seq.*).
- The Montana Public Water Supply Act regulates public water supply and sewer systems that regularly serve at least 25 persons daily for a period of at least 60 calendar days a year. The DEQ must approve plans and specifications for water supply wells in addition to water systems or treatment systems and sewer systems. Operators for community public water supply, waste water treatment, or sewer systems must be certified by the DEQ.
- The Montana Hazardous Waste Act and the Solid Waste Management Act regulate the storage and disposal of solid and hazardous wastes.

1.6.2.1.2 Decision

DEQ's authority to impose modifications or mitigations without the consent of MMC is restricted to modifications necessary for compliance with the MMRA, Montana Water Quality Act, Clean Air Act of Montana, and associated administrative rules. The DEQ can impose modifications to the proposed transmission line without MMC's consent under MFSA in accordance with 75-20-301, MCA. Grounds for DEQ denial of the application to modify DEQ Operating Permit #00150 would be a finding that the modification does not provide an acceptable method for accomplishing the reclamation required by the MMRA, or that it conflicts with Montana water and air quality laws. The DEQ must deny the application for a transmission line certificate of compliance if the findings required under 75-20-301 cannot be made.

Compliance with MEPA

The DEQ and the KNF have entered into an agreement describing how each agency will cooperate to fulfill the requirements of MEPA and NEPA. No decision is made under MEPA. The EIS is a disclosure document. All DEQ decisions are made pursuant to specific regulatory requirements. The DEQ is participating in the environmental review of the Montanore Project and may issue a modification to MMC's operating permit to make the federal and state approvals consistent. The DEQ also may issue a certificate of compliance for the proposed transmission line. The DEQ will issue a ROD or certificate containing its decisions pursuant to each project-related permit application. In general, for an application for an operating permit amendment or modification and a transmission line certificate of compliance, three decisions are possible:

- Approval of the application as submitted
- Approval of the application, and the incorporation of mitigations and stipulations that meet the mandates of applicable laws, regulations, and policy
- Denial of the application

Hard Rock Operating Permit

The DEQ Director may make a decision on MMC's application for a modification to DEQ Operating Permit #00150 no sooner than 15 days following transmittal of the Final EIS to the public, the office of the Governor, and the Environmental Quality Council. The DEQ may deny the application pursuant to 82-4-351, MCA, if the proposed mine or reclamation plan modification conflicted with the Clean Air Act of Montana, the Montana Water Quality Act, or reclamation standards set forth in the MMRA. The DEQ may also deny the modification based on the compliance standard of an applicant under 82-4-336 and 360, MCA. These sections of the MMRA require permittees to be in compliance at other sites they may have permitted under MMRA, require submittal of ownership and control information, and submittal of an adequate bond.

Transmission Line Certificate of Compliance

For MMC's proposed transmission line, MFSA requires the DEQ Director to determine:

- The basis of the need for the facility
- The nature of the probable environmental impact
- That the facility minimizes adverse environmental impact, considering the state of available technology and the nature and economics of the various alternatives
- In the case of an electric, gas, or liquid transmission line or aqueduct:
- What part, if any, of the line or aqueduct will be located underground
- That the facility is consistent with regional plans for expansion of the appropriate grid of the utility systems serving the state and interconnected utility systems
- That the facility will serve the interests of utility system economy and reliability
- That the location of the facility as proposed conforms to applicable state and local laws and regulations, except that the DEQ may refuse to apply any local law or regulation if it finds that, as applied to the proposed facility, the law or regulation is unreasonably restrictive in view of the existing technology, of factors of cost or economics, or of the needs of consumers, whether located inside or outside the directly affected government subdivisions
- That the facility will serve the public interest, convenience, and necessity
- That the DEQ or board has issued any necessary air or water quality decision, opinion, order, certification, or permit as required by 75-20-216(3)
- That the use of public lands for location of the facility was evaluated and public lands were selected whenever their use is as economically practicable as the use of private lands

This EIS serves as a report required by the MFSA (75-20-216, MCA). DEQ's decision on the transmission line must be made within 30 days after the final report (Final EIS) is released or may be timed to correspond to the ROD issued by a participating federal agency.

Permit Denial

The DEQ must deny certification for a project if the findings in 75-20-301, MCA, or implementing regulations cannot be made or if the transmission line would violate Montana air or water quality standards, based on the DEQ analysis. Without the approval of the mine by the KNF, MMC would likely withdraw the transmission line certificate application because a demonstrated showing of need for the transmission line could not be made. The DEQ may disapprove the transmission line, regardless of actions by other agencies. After issuance of the certificate, any other state or regional agency or municipality or other local government may not require any approval, consent, permit, certificate, or other condition for the construction, operation, or maintenance of a facility except that the DEQ and board retain the authority that they have to determine compliance of the proposed facility with state and federal standards and implementation plans for air and water quality.

Water Quality Permits

MPDES Permit. The status of MMC's existing MPDES permit is described in section 1.3.2.3, *Current Status of Existing Permits*. MPDES permits are required for discharges of wastewater to state surface water or to groundwater hydrologically connected to state surface water. MPDES permits regulate discharges of wastewater by imposing, when applicable, technology-based effluent limits and state surface water quality standards, which include numeric and narrative requirements, nonsignificance criteria, and Total Maximum Daily Loads (TMDLs). Montana Ground Water Pollution Control System permits are required for discharges of wastes to state groundwaters. Discharges to groundwater from mining operations subject to operating permits under the MMRA are not subject to groundwater permit requirements (75-5-401(5), MCA).

All Montanore facilities must be designed, constructed, and operated to prevent degradation of surface water or groundwater quality beyond that allowed by and specified in the BHES Order (Appendix A). The DEQ will follow EPA Region 8 guidance when determining types of wastewater as "process," "mine drainage," or "stormwater." The DEQ will use both Technology-Based Effluent Limits (TBEL) and Water Quality-Based Effluent Limits (WQBEL) in MPDES permit development or modification. The more stringent of the two, TBEL or WQBEL, would be applied for each specific parameter and would be the final effluent limit for parameters of concern in the discharge. The DEQ must also consider mixing zone applicability and TMDLs when applicable.

401 Certification. MMC will submit an application for a 401 certification to the DEQ. The DEQ has 30 days to review MMC's application and supplemental materials, and determine if the application is complete. At a minimum, "completeness" will require the 401 application fee and a complete description of the activity for which certification is sought, including information listed in ARM 17.30.103(2). The DEQ may request other technical information to complete the 401 decision.

Within 30 days of receipt of a complete application, MMC will be notified of the tentative decision to issue a 401 certification (with or without DEQ conditions) or deny the certification. The DEQ will provide public notice of the tentative determination and within 30 days of the close of the comment period make a final 401 certification decision. The DEQ and the Corps jointly issued a 60-day public notice on MMC's Section 404 permit application in 2011. Because MMC had not submitted an application for 401 certification to the DEQ, this public notice is no longer valid for the 401 certification process. The DEQ may deny the 401certification if the discharge would result in a violation of Montana water quality standards. The DEQ may also waive certification if the activity would cause minimal or no effect on state water quality or if the activity would require a MPDES permit.

318 Authorization (formerly 3A Waiver). The DEQ may authorize short-term surface water quality standards for total suspended sediments and turbidity for construction of the transmission line, access roads, the tailings impoundment, and other stream crossings (75-5-318, MCA). Any authorization would include conditions that minimize, to the extent practicable, the magnitude of any change in water quality and the length of time during which any change may occur. The authorization also would include site-specific conditions that ensure that the activity is not harmful, detrimental, or injurious to public health and the uses of state waters and that ensure that existing and designated beneficial uses of state water are protected and maintained upon completion of the activity. The DEQ may not authorize short-term narrative standards for activities requiring a MDPES permit.

Air Quality Permit

The DEQ will decide whether to issue an Air Quality Permit to control emissions of criteria air pollutants when the potential to emit is more than 25 tons per year. In 2006, the DEQ issued a Preliminary Determination on MMC's air quality permit application, which remained as preliminary pending a Final EIS. The DEQ issued a Supplemental Preliminary Determination in 2011 on MMC's updated air quality permit application that primarily addressed the new National Ambient Air Quality Standards (NAAQS) for oxides of nitrogen (NO_x) and sulfur dioxide (SO_2). The DEQ issued another Supplemental Preliminary Determination in 2015 that disclosed additional modeling to evaluate cumulative effects from nearby mines. When an environmental review is completed on the permit application, the final permit or determination may be included in the Final EIS, the ROD, or issued within 180 days after the application is ruled complete.

Public Water Supply and/or Public Sewer System Authorization

The DEQ will decide on issuance of a public water supply and/or public sewer system authorization. This program is responsible for assuring that the public health is maintained through a safe and adequate supply of drinking water. If the public water supply and/or sewer systems are not constructed within 3 years of authorization, a new application must be submitted.

Hazardous Waste Generator/Transporter Permit

The DEQ has adopted hazardous waste regulations that are equivalent to those promulgated by EPA. The DEQ will decide on issuing a permit for generators and transporters of hazardous waste for the Montanore Project. The permit review considers the applicant's record of complaints and convictions for the violation of environmental protection laws for 5 years before the date of the application. The DEQ would consider the number and severity of the violations, the culpability and cooperation of the applicant, and other factors. Annual registration is required.

1.6.2.2 State Historic Preservation Office

The State Historic Preservation Office (SHPO) advises federal and state agencies when a proposed project could affect eligible or potentially eligible historic properties (historic and prehistoric sites). The SHPO provides federal and state agencies with opinions on all historic properties' eligibility for listing in the National Register of Historic Places. SHPO also provides comments on the determination of effect on eligible historic properties. The KNF, the DEQ, and the SHPO will concur that the alternative selected in the ROD will have: 1) no effect; 2) no adverse effect; or 3) adverse effect on eligible historic properties. The lead agencies would require MMC to implement any protection, mitigation, and monitoring in plans reviewed and approved by the SHPO and possibly the Advisory Council on Historic Preservation. In 2010, the KNF and the SHPO entered into a Programmatic Agreement regarding the protection of historic properties within the Area of Potential Effect (APE) of the Montanore Project.

1.6.2.3 Montana Hard Rock Mining Impact Board

The Hard Rock Mining Impact Act (90-6-301 *et seq*., MCA) is designed to assist local governments in handling financial impacts caused by large-scale mineral development projects. A new mineral development may result in the need for local governments to provide additional services and facilities before mine-related revenues become available. The resulting costs can create a fiscal burden for local taxpayers. The Hard Rock Mining Impact Board (HRMIB), part of the Montana Department of Commerce (DOC), oversees an established process for identifying and mitigating fiscal impacts on local governments through the development of a Hard Rock Mining Impact Plan. Under the Impact Act, each new hard rock mineral development in Montana that would have more than 75 employees is required to prepare a local government fiscal Impact Plan. In the plan, the developer is to identify and commit to pay all increased capital and net operating costs to local government units that will result from the mineral development. A Hard Rock Mining Impact Plan developed for the original Montanore Project was approved in the early 1990s, and that approval was acquired by MMC when it acquired NMC. Because the Montanore Project as currently proposed would change employment projections, MMC submitted an amendment for consideration by the HRMIB. The HRMIB approved the amendment in 2008.

1.6.2.4 Montana Department of Natural Resources and Conservation

1.6.2.4.1 Applicable Laws and Regulations

The DNRC administers the following statutes and regulations that pertain to MMC's proposed mine and transmission line:

- The Montana Water Use Act requires a water rights permit before commencing to construct new or additional diversion, withdrawal, impoundment, or distribution works for appropriations of groundwater or surface water.
- Except for the transmission line, the Montana Flood Plain and Floodway Management Act requires a permit for new construction within a designated 100-year floodplain.
- A Montana land-use license or easement on navigable waters is required for any project on lands below the low water mark of navigable waters.
- The Streamside Management Zone requirements apply to any landowner or operator conducting a series of forest practices that will access, harvest, or regenerate trees on a defined land area for commercial purposes on private, state, or federal lands. Timber harvest is prohibited within 50 feet of any stream, lake, or other body of water.
- Except for the transmission line, a burning permit must be obtained from the DNRC to burn any slash or other material outside the open burning season of October 10 to November 31 and April 1 to May 31.

- The Conservation Districts Bureau of the DNRC administers the Montana Natural Streambed and Land Preservation Act. Any non-governmental entity that proposes to work in or near a stream on public or private land requires a 310 permit for any activity that physically alters or modifies the bed or banks of a perennially flowing stream.
- The Montana Dam Safety Act applies to the construction, repair, operation, and removal of any dam that impounds 50 acre-feet or more at normal operating pool level. This permit will not apply during mine operation, but may apply after mine closure if other safety criteria are not met.

1.6.2.4.2 Decision

Beneficial Water Use Permit

The DNRC will decide on issuance of a beneficial water use permit based on criteria set forth in 85-2-311, MCA. Denial of the permit must follow 85-2-310, MCA. A person having standing to file an objection may do so pursuant to 85-2-309, MCA. Valid objections received by the DNRC pursuant to 85-2-308, MCA, may require that the DNRC hold a contested case hearing pursuant to 2-4-601 *et al*., MCA, on the objection within 90 days from a date set by the DNRC. A person who has exhausted all administrative remedies available within the DNRC and who is aggrieved by a final written decision in a contested case is entitled to judicial review pursuant to 2-4-702, MCA.

Floodplain and Floodway Management Permit

The local floodplain administrator or the DNRC would make a decision on the permit application. The application process may take up to 60 days. DNRC's permit issuance is based on the danger to life and property downstream, availability of alternate locations, possible mitigation to reduce the danger, and the permanence of the obstruction or use (76-5-405, MCA).

DNRC Land Use License or Easement

The DNRC will review the application, conduct a field investigation if necessary, and file an environmental action checklist. A written report and recommendation is then submitted to the Special Use Management Bureau, which makes the final determination and recommends stipulations as necessary. A Land Use License can normally be reviewed, approved, and issued within 60 days upon the payment of the application fee and a minimum annual rental fee set by the DNRC. The license may be held for a maximum period of 10 years, with the ability to request renewal for an additional 10 years. An easement requires approval from the Board of Land Commissioners, which typically takes up to 90 days.

Streamside Management Zone

MMC must comply with the streamside management practices found in 77-5-303, MCA, or submit a request to conduct an alternative practice to the DNRC. Within 10 working days of receipt of the application for approval of alternative practices, the DNRC will determine if the application is approved, approved with modification, disapproved, incomplete, requires additional information or environmental analysis, or requires a field review. If a field review is required, the DNRC will make a decision on the application within 10 days of completing the field review.

Burning Permit

The DNRC Burning Permit outside the open burning season depends on air quality standards set by the DEQ. Review and issuance of the permit is done in coordination with the DEQ and depends on the air quality at the time of the request.

310 Permit

Except for streams affected by the transmission line, the Lincoln County Conservation District must receive a 310 permit application from MMC before activity in or near a perennial-flowing stream. Once an application is accepted, a team that consists of a conservation district representative, a biologist with the Montana Fish, Wildlife and Parks (FWP), and the applicant may conduct an onsite inspection. The team makes recommendations to the Conservation District Board, which has 60 days from the time the application is accepted to approve, modify, or deny the permit.

High Hazard Dam Permit

A high-hazard dam is any dam or reservoir with an impounding capacity of 50 acre-feet or more at the maximum normal operating pool, the failure of which would be likely to cause loss of life. If a mining operation proposes construction of a dam that has an impoundment capacity of 50 acre-feet or more, such as a tailings impoundment dam, the owner must apply to the DNRC's Dam Safety Bureau for hazard classification. The DNRC classifies the hazard of that dam by the potential loss of life downstream if the dam failed. If permitted by the DEQ under a hard-rock operating permit, construction and operation of such a dam would be regulated under MMRA, rather than a DNRC dam safety permit, during mine operation and closure until reclamation bond release. After the agencies released the reclamation bond, the impoundment would be subject to DNRC oversight and regulation if the impoundment met the definition of a high-hazard dam. The reclamation bond would not be released until the impoundment was reclaimed successfully. The DEQ intends that MMC's proposed impoundment meet high hazard dam safety requirements including the preparation of an Operations and Maintenance Plan and Emergency Preparedness Plan that met DNRC requirements, so the transition to regulation under a DNRC permit, if applicable, would be facilitated at mine closure.

1.6.2.5 Montana Fish, Wildlife and Parks

The FWP is responsible for the use, enjoyment, and scientific study of the fish in all state waters. FWP's approval, and designation of a licensed collector as field supervisor, would be required for monitoring, mitigation, and any transplanting of the fish within the project area. The FWP also administers applicable portions of the Stream Protection Act and cooperates with the DEQ in water quality protection.

The FWP also holds a conservation easement on some lands owned by Plum Creek Timberlands LP (Plum Creek) where the transmission line may be sited. The conservation easement was partially funded by the Forest Legacy Program for the purpose of preventing the land from being converted to non-forest uses. One of the stated purposes of the conservation easement is to "preserve and protect in perpetuity the right to practice commercial forest and resource management." Under the terms of the conservation easement, the FWP has reserved the right to prevent any inconsistent activity on or use of the land by Plum Creek or other owner and to require the restoration of any areas or features of the land damaged by such activity or use. Activities and uses prohibited or restricted include installing any natural gas or other pipelines or power transmission lines greater than 25-kV unless the FWP gives prior written approval.

1.6.2.6 Montana Department of Transportation

The Montana Department of Transportation (MDT) is responsible for the safe operation of the state-owned highways and transportation facilities, such as US 2. The MDT is responsible for approving approach roads onto state-owned highways and for approving utilities occupancy within MDT rights-of-way. The MDT reserves the right to modify or deny applications if the design puts the traveling public, the state highway system, or transportation facilities at risk.

1.6.2.7 Lincoln County Weed Board

The Lincoln County Weed Board administers the County Noxious Weed Control Act for any land-disturbing activities within its jurisdiction. MMC is required to submit a weed management plan to the Lincoln County Weed Board for approval.

1.6.3 Financial Assurance

1.6.3.1 Authorities

Pursuant to the Organic Administration Act and regulations adopted thereunder, a mine operator is required to submit a reclamation bond to the Forest Service before the Forest Service may approve a Plan of Operations for the mining activity. Similarly, pursuant to the MMRA and administrative rules adopted thereunder, a mine operator is required to submit a reclamation bond to the DEQ before DEQ may issue an operating permit or permit amendment. The reclamation bond may not be less than the estimated cost to the Forest Service or the State to ensure compliance with the respective federal and state reclamation requirements. The federal reclamation requirements include compliance with 36 CFR 228, Subpart A. The state reclamation requirements include compliance with the Clean Air Act of Montana, Montana Water Quality Act, the MMRA, the administrative rules adopted under the MMRA and the operating permit.

The reclamation bond may be in the form of a surety bond, an irrevocable letter of credit, a certificate of deposit, or cash. The bond for larger mining operations is usually in the form of a surety or irrevocable letter of credit because of the significant financial obligation that reclamation typically represents.

Agency engineers calculate the reclamation bond amount after an alternative has been selected for implementation and a ROD or decision is issued by each agency. In addition, the Forest Service requires that all bonds pertaining to Plans of Operations on National Forest System lands be developed or reviewed by a Certified Locatable Minerals Administrator. The training abilities and required knowledge of the administrator are outlined in FSM, Chapter 2890.

Pursuant to ARM 17.24.140, the total amount of the bond calculated by the DEQ must be in place before the issuance of an operating permit or permit amendment unless the applicable plan identifies phases or increments of disturbance which may be individually identified and for which individual, incremental bonds may be calculated. 36 CFR 228.13 requires submittal of a bond for reclaiming disturbances on National Forest System lands before approval of a Plan of Operations. The bond for the transmission line will be determined after a decision is made and an alternative is selected.

Pursuant to 33 CFR 332.3(n), the Corps requires sufficient financial assurances to ensure a high level of confidence that any compensatory mitigation project permitted under a 404 permit will be successfully completed in accordance with applicable performance standards. In some circumstances, the Corps may determine that financial assurances are not necessary for a compensatory mitigation project. In consultation with the project sponsor, the Corps determines the amount of the required financial assurances, which is based on the size and complexity of the compensatory mitigation project, the degree of completion of the project at the time of project approval, the likelihood of success, the past performance of the project sponsor, and any other factors the Corps deems appropriate. Financial assurances may be in the form of performance bonds, escrow accounts, casualty insurance, letters of credit, legislative appropriations for government sponsored projects, or other appropriate instruments, subject to the Corp's approval. If financial assurances are required, the 404 permit will include a special condition requiring the financial assurances to be in place before commencing the permitted activity. The Corps' financial assurance for 404-permitted mitigation is phased out once the Corps determines mitigation is successful in accordance with the plan's performance standards.

The Forest Service is required to review reclamation bonds annually for adequacy (FSM 2817.24b). Similarly, the DEQ is required to conduct an overview of the amount of each bond annually and a comprehensive bond review at least every 5 years (82-4-338(3), MCA). The DEQ may conduct additional comprehensive bond reviews if, after modification of a reclamation or operating plan, an annual overview, or an inspection of the permit area, the DEQ determines that an increase in the bond level may be necessary. When the existing bonding level of an operating permit or an amendment does not represent the costs of compliance with federal and state reclamation requirements, the DEQ is required to modify the bonding requirements. A complete description of DEQ's bond-review procedure is set forth in section 82-4-338(3), MCA.

A mine operator may propose modifications to its Plan of Operations and operating permit. The proposed modification is reviewed by the agencies and the appropriate level of environmental analysis is performed. If the modification is approved, the agencies then determine whether the modification affects the estimated cost to the Forest Service and the DEQ to ensure compliance with federal and state reclamation requirements. If an increase in bond is required, the operator must submit the additional bond amount before the approved modification can be executed.

There is no specific timeframe for bond release once reclamation activities have been completed. Bond release is performance based, and is granted or denied based on the agencies' evaluation. The Forest Service may not release a bond until the reclamation requirements of 36 CFR 228.8(g) are met. Pursuant to section 82-4-338(4), the DEQ may not release bond until the provisions of the MMRA, its associated administrative rules, and the operating permit have been fulfilled. In addition, pursuant to section 82-4-338(4), MCA, the DEQ is required to provide reasonable statewide and local notice of a proposed bond release or decrease. The DEQ may not release or decrease a reclamation bond unless the public has been provided an opportunity for a hearing and a hearing has been held if requested. All information regarding bond releases and decreases is available to the public upon request.

To avoid requiring a mine operator to submit duplicative bonds, the Forest Service and the DEQ have executed a MOU allowing the agencies to accept a joint bond that satisfies both federal and state reclamation requirements. Forfeiture of the reclamation bond may be caused jointly by the agencies or by one of the agencies acting with the concurrence of the other agency. Even if forfeiture of the reclamation bond is caused by one of the agencies, the bond must be expended in a manner that satisfies both federal and state reclamation requirements. To ensure administrative continuity and to conform to the intent of the MOU, the Forest Service as a co-permitting agency has adopted a 5-year schedule for reviewing the sufficiency of the reclamation bond. Guidance for Forest Service bonding can be found in Training Guide for Reclamation Bond Estimation and Administration (USDA Forest Service 2004).

1.6.3.2 Reclamation Costs

The bond amount is the agencies' estimated cost to complete site reclamation in the event the operator cannot or will not perform the required reclamation. The Plan of Operations submitted by MMC to the Forest Service for approval describes the proposed operation, the types of disturbances which may be expected under the proposed operation, and the reclamation proposed by MMC. During the course of this environmental review, the Forest Service analyzed, in addition to the proposed action alternative, a reasonable range of other alternatives. Additional modifications may be made in the course of developing stipulations to minimize environmental impacts. The Forest Service will identify a selected alternative and stipulations when its ROD for the mine is issued. The DEQ is participating in the environmental review and may issue a modification to MMC's operating permit to make the federal and state approvals consistent and may issue a certificate of compliance for the proposed transmission line. Assuming mining is ultimately approved, the agencies do not have all of the information required to complete a bond calculation until the federal ROD and the state operating permit modification for the mine and the state certificate of compliance for the transmission line have been issued. Therefore, the bond amount will be determined after the ROD, operating permit modification and certificate of compliance have been issued, and will be based on the information and requirements contained in the ROD, operating permit modification and certificate of compliance. Until these decisions are issued, bond amounts based on alternatives presented in the EIS would be based on incomplete information and may be misleading.

Reclamation at the Montanore Project would not be limited to near-term reclamation activities such as facilities removal, site regrading, and revegetation. The reclamation may include requirements to collect and treat mine-impacted waters, and site maintenance and monitoring for as long as necessary to ensure the protection of environmental resources.

The bond calculation can be divided into two parts. The first part of the calculation addresses reclamation tasks that can be completed soon after cessation of mining operations. Table 1 (all tables are at the end of this chapter) represents a typical bond summary sheet, which outlines both direct costs and indirect costs. Table 2 depicts a representative list of direct cost reclamation items specific to the Montanore Project, which would be reclaimed soon after mine closure. These reclamation items are referenced in the Plan of Operations and operating permit. A complete list of reclamation items would be developed once the ROD is signed and the Plan of Operation and operating permit is updated.

The indirect costs in Table 1 are calculated as a percentage of the direct costs, and they represent costs common to any mine closure project where the agencies assume responsibility for reclamation. Bonds are typically recalculated every 5 years (see section 1.6.3.1, *Authorities*), and an inflation factor is applied to the direct costs to account for cost increases over this intervening 5-year period.

The second part of the calculation addresses water treatment and long-term monitoring, which may continue for many years after mine closure (Table 3 and Table 4). Separating the cost estimates into two calculations allows the agencies to use a discounted cash flow approach for the long-term activities.

The bond amount also reflects the estimated cost for the agencies to contract, manage, and direct construction at the site during reclamation. For large projects such as Montanore, this often means the agencies will include the cost to retain a third-party to prepare the contract documents, to serve as the construction manager overseeing on-site reclamation, and to act as the liaison between the agencies and the various contractors performing the work.

1.6.3.2.1 Direct Costs

A reclamation cost calculation includes direct and indirect costs. Direct costs are assigned to reclamation tasks that are specific in scope and to which a cost can be assigned based on requirements outlined in the Records of Decision, certificate of compliance, and the approved Plan of Operations and operating permit. Examples of direct costs would include removal of surface facilities and roads, wetland mitigation, adit closure using concrete plugs, dewatering and capping of the tailings impoundment, installing permanent surface water diversions, revegetating disturbed areas, and removing the transmission line. Table 1 summarizes typical direct costs associated with the reclamation of a large mining project, such as Montanore. Table 2 provides representative line items of a mine reclamation cost estimate based on descriptions contained in the updated Plan of Operations. These line items would be updated after MMC submits an amended Plan of Operation and operating permit application.

The final slope angle of waste dumps, depth of topsoil cover, location and design of surface diversions, and seed mix are typical information contained in a reclamation plan and used by the agencies to estimate reclamation costs. Because the reclamation information in the Records of Decision and the approved Plan of Operations and operating permit are projections of future site conditions, often well in advance of closure, the actual disturbance area, quantity of salvaged reclamation materials, and quantity and quality of water being managed are estimates and final quantities may vary.

For most of the reclamation items, the agencies have enough information to estimate reclamation costs. Direct costs are estimated by the agencies using data from a number of sources. These include bids from past mine reclamation contracts awarded by the DEQ or the Forest Service, industry accepted references such as the Caterpillar Performance Handbook, (2010), RS Means cost data service (2009), Dataquest©, quotes from local contractors and vendors, and the Forest Service’s Training Guide for Reclamation Bond Estimation and Administration (USDA Forest Service 2004).

Water treatment costs are estimated using real time costs from existing mine water treatment plants at either operating mines or from abandoned mine sites under the jurisdiction of government agencies. Because water treatment costs can vary widely based on water quality and flow, there are frequently no comparable treatment plants which are suitable for direct comparison. In these instances, the agencies use EPA’s Treatability Manual (EPA 1983), a publication for estimating costs for treating industrial waste streams, and EPA’s Technical Report Construction Costs for Municipal Wastewater Treatment Plants: 1973-1978 (EPA 1980) as cross references to assist in calculating the bond. The agencies recognize uncertainties associated with long-term water treatment and the agencies make various assumptions to account for these uncertainties (see section 1.6.3.2.3, *Long-term Reclamation Bond Considerations*). In every instance, the bond estimate is annotated to identify the source of information used in the calculations and the assumptions made to account for missing or incomplete data.

1.6.3.2.2 Indirect Costs

The other cost component of the reclamation estimate is indirect costs, which are those costs that cannot be attributed to any one specific activity. Rather, indirect costs represent expenses necessary to the overall successful implementation and execution of the reclamation. Examples of indirect costs include contractor mobilization and demobilization, bid and scope contingency, engineering redesign, and project administration.

The agencies estimate indirect costs based on a percentage of the total direct cost. This approach is used in part due to the uncertainty associated with many of the indirect cost line items and the inherent difficulty in assigning costs to these uncertainties. For example, engineering redesign is considered an indirect cost because it is not known what design modifications, if any, may be necessary to take the mine site at the cessation of operations to final reclamation. Usually, some additional engineering design is required during final reclamation to account for incomplete data and changed site conditions from the time when the reclamation plan was initially developed during permitting to the moment of actual on-the-ground reclamation. The scope of possible modifications to the final reclamation plan is difficult to project during permitting, and consequently, this uncertainty is addressed through a percent multiplier of the direct cost. Cost data providers, such as RS Means, and various government agencies have suggested indirect cost percentages based on data they have compiled, and which both the DEQ and Forest Service have referenced and modified for their own use (DEQ 2001, USDA Forest Service 2004). Typically, the guidance suggests a range for indirect costs based on the dollar amount of the calculated direct costs and the level of certainty associated with the accuracy of the cost estimate. These ranges are intended as guidelines for the agencies, and there is latitude in their application depending on site-specific conditions, complexity of reclamation, potential environmental risk, and professional judgment.

1.6.3.2.3 Other Reclamation Costs

Third-Party Oversight

Should site reclamation become the agencies' responsibility, other activities and costs aside from those identified in previous sections can have an effect on a final reclamation cost. If an operator fails to reclaim a site adequately and forfeits the bond, the agencies frequently will retain the services of a third-party contractor, such as an engineering or construction management firm, to assume management of the mine site and oversee reclamation. They assist the agencies during closure of the mine site, and often assume the role of project manager. Their duties may include technical advisor, on-going site maintenance, environmental compliance, preparation of construction and environmental documents associated with site closure, and construction management during reclamation, with the agencies retaining overall responsibility for the site.

Interim Site Care and Maintenance

Frequently, a mine site will need to be maintained for some period of time before reclamation can begin in earnest. This is often due to legal processes and other restrictions, lead time to contract for the actual on-site reclamation work, and weather. During this interim period, mine-related activities, such as water treatment, may need to continue to ensure environmental protection. In the bond estimate, the agencies assume that they will have to manage a fully operational mine for some period of time before site reclamation commences. In the case of the Montanore Project, access to the site would be maintained, water management at the tailings impoundment and in underground workings would continue, ventilation and power to underground workings would be required, and any and all attendant care and maintenance activities would continue. The responsibility to maintain the mine systems requires the agencies to establish a physical presence at site, most likely by a third-party contractor. Thus, the agencies include a “Care and Maintenance” line item in the direct cost calculation. This site maintenance requirement may last from 6 months to 1 year and can be a significant expense.

Long-Term Site Monitoring and Maintenance

Other reclamation costs include site monitoring and maintenance for a period of time after initial site reclamation has been completed. This typically lasts from 5 to 20 years, but in some instances may be extended depending on the complexity and longevity of the risk of environmental impact. Activities associated with site monitoring and maintenance may include water sampling, diversion ditch maintenance, repair of recent erosion events, and revegetation. For large sites like Montanore that would have areas of extensive surface reconfiguration, some redesign and reconstruction of reclaimed areas may be required to address episodic reclamation failure. It may take several years before disturbed areas reach equilibrium and are self-sustaining. The agencies account for this maintenance need by assuming labor and material requirements and applying them over a specified maintenance period. Monitoring and maintenance is assumed to be needed annually for an initial period, usually projected at 5 to 10 years while reclamation becomes established, and then may be needed intermittently after that. The agencies’ bond calculation captures this initial annual phase as well as the future intermittent requirements.

Inflation

The agencies assume reclamation costs will rise from year to year and account for the cost increase by assigning an inflation factor to the reclamation estimate. The agencies use data provided by the Office of Management and Budget when determining an appropriate inflation factor (Office of Management and Budget 1992). The agencies have used 2 percent per annum as the increase in costs from one year to the next in recent bond calculations. A similar inflation rate would be used for the Montanore Project bond calculation. Annual inflation is applied to the direct costs over a 5-year period to account for the time between mandated bond reviews.

Long-term Reclamation Bond Considerations

Water Treatment

The agencies account for reclamation activities that may extend into the future, well after completion of site reclamation, by making assumptions about the frequency and level of effort required to ensure site reclamation is being maintained and is accomplishing its intended objectives. These obligations have been discussed previously in the Site Monitoring and Maintenance section. Other reclamation requirements may continue for a much longer time. One of these is water management, where maintaining protection of water quantity and quality can be a significant financial liability long after a mine has ceased operations.

MMC may be required to manage water during operations and closure, possibly requiring capture, storage, treatment, and water discharge systems that would be operated for a significant period of time after closure. In this event, the agencies would include costs associated with long-term water treatment in the reclamation bond calculation. Table 3 summarizes the entire calculation for long-term water treatment; Table 4 provides representative line items of such treatment.

Discounted Cash Flow Analysis and Net Present Value

The agencies calculate a long-term water treatment cost using a discounted cash flow (DCF) analysis, where the annual treatment costs are converted to a net present value (NPV). For purposes of a reclamation cost estimate, a NPV is the amount of money that must be put in an interest bearing account (trust account) on Day 1 of the mining operation so that it will provide sufficient revenue to pay for all future water treatment capital and operating costs. The time frame for water management and treatment at Montanore currently is unknown, but the agencies estimate it may be decades or more. For the Montanore Project, the agencies will likely project the DCF over 100 years. This time frame is in line with federal guidelines contained in the USDA's Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (USDA 1983). The net present value is sensitive to the discount rate used in the calculation, and going out beyond 100 years often makes little difference in the bond amount because those outlying years are heavily discounted. The agencies use four variables when calculating a bond for a water management and treatment system: 1) the annual cost of the system, 2) the rate of inflation, 3) the rate of return on money in the trust fund, and 4) capital replacement costs. In a DCF analysis, the first three variables are held constant from one year to the next over the projected 100-year time frame. If any of the variables deviate from their initial estimates over a 100-year period, the result may be either a shortfall in the amount of money in the trust fund needed to operate the water management system for a 100-year period or conversely, there may be a surplus of monies available to run the system. These variables are evaluated during each 5-year bond review.

The agencies refer to the Office of Management and Budget's Circular No. A-94, Appendix C, for guidance on nominal (market) and real (inflation-adjusted) interest rates to be used as the discount rate in the DCF analysis (Office of Management and Budget 1992). This publication provides Federal Government forecasts and recommendations on select discount rates for up to 30 years into the future. These rates are updated annually. For analyses beyond 30 years, the Office of Management and Budget recommends using rates for the 30-year time frame. The longer the forecast is projected, the more uncertainty there is in the accuracy of the forecast. The agencies use Federal guidelines and circulars as one source of information in developing their financial projections, but owing to the significant forward-looking time frames involved in this type of forecasting, they consult other sources of information and use professional judgment in arriving at the final bond estimate.

The agencies invest monies for long-term water treatment in government-backed securities that typically earn a lower interest rate than other type of investments but have less financial risk. Treasury bills, notes and bonds, are typical investment options. The longest term for government-auctioned treasury securities is also 30 years.

Table 1. Typical Mine Reclamation Bond Summary Sheet.

Direct Costs	**Tasks**		**Cost**
Task 1:	Reclaim Surface Facilities and Associated Surface Disturbance		$$$
Task 2:	Reclaim Tailings Impoundment and Associated Disturbance		$$$
Task 3:	Reclaim Underground Workings and Associated Disturbance		$$$
Task 4:	Regrading and Revegetation		$$$
Inflation	Inflation Cost @2% Per Year for 5 Years	10.4%	
Sub-Total Direct Costs:	Sub-Total of Direct Costs (Inflation Adjusted)		$$$
Indirect Costs	**Type**	**% of Direct Cost**	**Cost**
	Mobilization/Demobilization	%	$$$
	Contingency		
	Bid	%	$$$
	Scope	%	$$$
	Project Administration		
	Trustee Fees	%	$$$
	Legal Fees	%	$$$
	Contract Administration	%	$$$
	Engineering and Redesign	%	$$$
Subtotal Indirect Costs:			$$$
Subtotal:	(Subtotal Direct Costs + Subtotal Indirect Costs)		$$$$
Task 5	Long-Term Care and Maintenance		
Total Bond Amount:	(Subtotal + Inflation)		$$$$

Table 2. Representative Line Items for Montanore Project Reclamation.

Task 1: Reclaim Facilities and Associated Disturbance	
A. Libby Plant Site	
Bonded Item	Costs Calculated For:
Mill and Admin Building	Gutting, Demolition, and Disposal
Tailings Thickener Tank	Demolition and Disposal
Warehouse	Gutting, Demolition, and Disposal
	Disposal of Petroleum Products and Other Waste Materials
Substation	Hauling Off-Site
Chemical Storage	Gutting, Demolition, and Disposal
	Disposing Hazardous Waste and Other Chemicals
Propane Tank	Hauling Off-Site
Explosives Storage	Demolition and Disposal
	Removal and Disposal of Explosives
Fuel Tanks	Hauling Off-Site
Assay Lab	Gutting, Demolition, and Disposal
	Disposing Hazardous Waste and Other Chemicals
Septic System	Pumping, Excavation, Hauling Off-Site
Fresh Water Tank	Hauling Off-Site
Coarse Ore Stockpile Building	Demolition and Disposal
	Removing Any Remaining Material
Lined Sediment Pond	Pumping, Sediment Removal, Liner Removal
Security Gate House	Demolition and Disposal
Above Ground Conveyors	Demolition and Disposal
Concrete Foundations	Broken and Buried On-Site
Well	Plugging
Miscellaneous Surface Piping	Removal and Disposal
B. Libby Adit Site	
Bonded Item	Costs Calculated For:
Shop	Gutting, Demolition, and Disposal
	Disposal of Petroleum Products and Other Waste Materials
Generators	Hauling Off-Site
Lined Stormwater Pond	Pumping, Liner Removal
Water Treatment Plant	Gutting, Demolition, and Disposal
	Disposal of Hazardous Waste and Any Other Waste Materials
Leach Fields	Disconnect Surface Pipelines and Leave in Place
Percolation Pond	Dewater
Waste Rock Areas	Cap in place
Pumpback Sumps	Dewater
Fuel Tanks	Haul Off-Site
C. Other Surface Disturbance	
Bonded Item	Costs Calculated For:
Transmission Line	Removing and Reclaiming Corridor
Access Roads	Reclaim to Blend with Surrounding Topography
Libby Concentrate Loadout	Disposal of Concentrate and Cleaning Facility
Waste Rock Stockpile	Move Any Remaining Material

Task 2: Reclaim Tailings Impoundment and Associated Disturbance	
Bonded Item	Costs Calculated For:
Seepage Pumpback System	Pond Dewatering and Liner Removal
	Demolition and Disposal of Pumphouse; Haul Pumps Off-Site
Wells	Plugging
Piping Infrastructure	Removal of Any Surface Piping; Buried Piping Left in Place
Thickener Facility	Gutting, Demolition and Disposal
Cyclones and Piping Network	Removal and Disposal
Tailings Pipelines	Flushing Pipelines into Tailings Impoundment
	Removal of Pipelines from All Stream Crossings
	Removal of Pipelines if Less Than 3 Feet Below Surface
	Cut Pipelines at 0.5-Mile Intervals, Cap, Leave in Place
Tailings Pipeline Pump Stations	Haul Off-Site
Power Poles and Electrical Lines	Removal and Disposal
Tailings Impoundment Surface	Dewatering, Water Treatment, Capping as Needed
Tailings Embankment	Rip-Rap for Erosion Control
	Channel Excavation
Borrow Areas	Reclaim as Necessary
Task 3: Reclaim Underground Workings and Associated Disturbance	
A. Underground Workings	
Bonded Item	Costs Calculated For:
Explosives Magazines	Removal and Disposal
Underground Facilities	Disposing Hazardous Waste and Other Chemicals
	Disposal of Petroleum Products and Other Waste Materials
	Removal of Fuel Storage Tanks
Transformers	Haul Off-Site
Mobile Equipment	Remove Working Equipment
	Drain Fluids and Abandon Non-Functional Equipment
Other Large Equipment	Abandon Underground
B. Portal Areas	
Bonded Item	Costs Calculated For:
Libby Adit Site	Constructing Two Portal Plugs
Upper Libby Adit	Constructing Portal Plug
Rock Lake Ventilation Raise	Constructing Portal Plug
Task 4: Regrading and Revegetation	
Bonded Item	Costs Calculated For:
Dirt Moving	Regrading to Post-Mine Topography
Soil	Cover Regraded Areas with Soil or Suitable Material
Seeding	Seeding According to Proposed Reclamation Plan
Task 5: Long-Term Site Care and Maintenance (may be included in Discounted Cash Flow Calculation)	
Bonded Item	Costs Calculated For:
Surface Water Monitoring	Monitoring for Quality and Quantity
Groundwater Monitoring	Monitoring Wells; Possibly Springs
Surface Disturbances	Erosion Control and Weed Control

Table 3. Typical Summary Table for Long-Term Water Treatment Calculation.

Direct Costs	**Tasks**		**Cost**
Task 1:	Annual Capital Costs		$ Task 1
Task 2:	Annual Operating and Maintenance Costs		$ Task 2
Task 3:	Annual Water Quality Monitoring and Reporting		$ Task 3
Total Annual Direct Costs:			$ Direct Cost Sum
Indirect Costs	**Type**	**% of Direct Cost**	**Cost**
	Mobilization/Demobilization	%	$$$
	Contingency		
	Bid	%	$$$
	Scope	%	$$$
	Project Administration		
	Legal Fees	%	$$$
	Contract Administration	%	$$$
Subtotal Annual Indirect Costs:			$$$$
Total Annual Cost:	(Total Annual Direct Costs + Total Annual Indirect Costs)		$$$$
	Total Water Treatment Cost =		NPV of Total Annual Costs
Assumptions:	Long-term Water Treatment Liability Based on Discounted Cash Flow Analysis Assumed Rate of Inflation Over Water Treatment Period Assumed Rate of Return on Trust Fund Over Water Treatment Period Net Present Value (NPV) = Amount of Money Needed on Day 1		

Table 4. Representative Line Items for Long-term Water Treatment Costs.

Direct Costs to be Included in Water Treatment Bond Calculation (more line items may be included)	
Task 1: Capital Costs	
Bonded Item	Costs Calculated For:
Engineering and Design	Determining Appropriate Treatment Method; Designing Plant
Construction	Construction Based on the Chosen Treatment Method
	Assumed Replacement Period for Capital Infrastructure
Task 2: Operating and Maintenance Costs	
Bonded Item	Costs Calculated For:
Engineering	Troubleshooting and Redesign
Labor	Wages and Benefits
Materials	Equipment, Chemicals, Parts, etc.
Power	Electrical Requirements for Operating the Plant
Miscellaneous	Waste Disposal, Site Access, System Repairs, etc.
Task 3: Water Quality Monitoring and Reporting	
This will depend on the treatment method and required frequency	
Task 4: Reclaim Water Treatment Plant	
Bonded Item	Costs Calculated For:
Structure	Gutting, Demolition, and Disposal
Cleanup	Disposal of Hazardous Waste and Any Other Waste Materials
Dirt Moving	Regrading to Post-Mine Topography
Soil	Cover Regraded Areas with Soil or Suitable Material
Seeding	Seeding According to Proposed Reclamation Plan

Table 5. Permits, Licenses, and Approvals Required for the Montanore Project.

Permit, License, or Approval	Purpose
Kootenai National Forest	
Approval of Plan of Operations (36 CFR 228, Subpart A)	To allow MMC to explore, construct and operate a mine and related facilities, such as the 230-kV transmission line, on National Forest System lands. Approval incorporates management requirements to minimize or eliminate effects on other surface resources that include final design of facilities, and mitigation and monitoring plans as described in the ROD. Review of the proposed plans is coordinated with the DEQ and other appropriate agencies. Approval of the Plan of Operations is contingent on MMC accepting and incorporating the stipulations and mitigations (as listed in the ROD) into the Plan of Operations.
Special Use Permit(s) (36 CFR 251)	To allow construction and operation of facilities not otherwise covered by the approved Plan of Operations.
Road Use Permit	To specify operation and maintenance responsibilities on National Forest Service roads not covered by an approved Plan of Operations.
Mineral Material Permit	To allow MMC to take borrow material from National Forest System lands not covered by an approved Plan of Operations.
Timber Sale Contract	To allow MMC to harvest commercial timber from the project area on National Forest System lands. Harvesting would be conducted to clear the area for project facilities.
U.S. Fish and Wildlife Service	
Biological Opinion	To protect T&E species and any designated critical habitat. Consultation with the KNF.
404 Permit Review	To comment on the 404 permit to prevent loss of, or damage to, fish or wildlife resources. Consultation with the Corps.
U.S. Army Corps of Engineers	
404 Permit (Clean Water Act)	To allow discharge of dredged or fill material into wetlands and other waters of the U.S. Subject to review by the EPA, the USFWS, the KNF, and the DEQ. Coordinate with the SHPO.

Table 5. Permits, Licenses, and Approvals Required for the Montanore Project (cont'd).

Permit, License or Approval	Purpose
Montana Department of Environmental Quality	
Hard Rock Operating Permit Modification (MMRA)	To allow a change in an approved operating plan. Proposed activities must comply with state environmental standards and criteria. Approval may include stipulations for final design of facilities and monitoring plans. A sufficient reclamation bond must be posted with the DEQ before implementing an operating permit amendment or modification. Coordinate with the KNF.
Transmission Line Certificate (MFSA)	To allow the construction and operation of a 230-kV transmission line more than 10 miles long. Reclamation plans and bond can be required. Coordinate with the KNF, the FWP, the Montana Department of Transportation, the DNRC, the DOC, the Montana Department of Revenue, and the Montana Public Service Commission.
Montana Air Quality Permit (Clean Air Act of Montana)	To control criteria air pollutants when the potential to emit is more than 25 tons per year.
MPDES Permit (Montana Water Quality Act)	To establish effluent limits, treatment standards, and other requirements for point source discharges, including stormwater discharges, to state waters including groundwater. Coordinate with the EPA.
Public Water Supply and Sewer Permit	To allow construction of public water supply and sewer system and to protect public health.
Short-Term Water Quality Standard for Turbidity (318 authorization) (Montana Water Quality Act)	To allow for short-term increases in surface water turbidity during construction. Request may be forwarded from the FWP.
401 Certification (Clean Water Act)	To ensure that any activity that requires a federal license or permit (such as the Section 404 permit from the Corps) complies with Montana water quality standards.
Hazardous Waste and Solid Waste Registration (various laws)	To ensure safe storage and transport of hazardous materials to and from the site and proper storage and transport and disposal of solid wastes. Some classes of solid waste disposal is covered under the MMRA. Solid wastes may be addressed under an operating permit.

Table 5. Permits, Licenses, and Approvals Required for the Montanore Project (cont'd).

Permit, License or Approval	Purpose
Montana Department of Natural Resources and Conservation	
Beneficial Water Use Permit (Montana Water Use Act)	To allow the beneficial use of groundwater or surface water.
Floodplain Development Permit (Montana Floodplain and Floodway Management Act)	To allow construction of mine facilities within a 100-year floodplain.
310 Permit (Montana Natural Streambed and Land Preservation Act)	To allow mine-related activities that physically alter or modify the bed or banks of a perennially flowing stream.
Streamside Management Zone Law	To control timber harvest activities within at least 50 feet of any stream, lake, or other body of water.
Burning Permit	To control slash or open burning outside the open burning season.
Montana State Historic Preservation Office	
Cultural Resource Clearance (Section 106 Review)	To review and comment on federal compliance with the National Historic Preservation Act.
Montana Fish, Wildlife and Parks	
310 Permit (Natural Streambed and Land Preservation Act)	To allow mine-related construction activities by non-government entities within the mean high water line of a perennial stream or river. Coordinated with DNRC and the Lincoln County Conservation District. The FWP works with conservation districts to review permit and determine if a Short-Term Water Quality Standard for Turbidity (318 authorization) from the DEQ is needed.
Transmission Line Approval	To allow construction of the 230-kV transmission line across the Thompson Fisher conservation easement.
Montana Department of Transportation	
Approach Permit	To allow safe connection of mine-related roads to state highways.
Utility Occupancy and Location Agreement or Encroachment Permit	To allow mine-related utility or construction access roads within MDT rights-of-way.
Montana Department of Commerce, Hard Rock Impact Board/Lincoln County	
Fiscal Impact Plan (Hard Rock Mining Impact Act)	To mitigate fiscal impacts on local government services.
Lincoln County Weed District	
Noxious Weed Management Plan	To minimize propagation of noxious weeds.

Chapter 2. Alternatives, Including the Proposed Action

This chapter describes and compares the alternatives considered for the Montanore Project. It includes a detailed description and map of each alternative considered. This chapter presents the alternatives in comparative form, defines the differences between each alternative, and provides a clear basis for choice among options by the decision makers and the public. Because alternative development was in response to issues and concerns identified during scoping, public involvement and the significant issues identified for the project are discussed first. Following a discussion of the key issues, each alternative analyzed in detail is described. MMC's Proposed Action (Mine Alternative 2 and Transmission Line Alternative B) is described in detail. The other action alternatives incorporate many aspects of MMC's proposal and contain less detail. The last section of this chapter discusses the alternatives considered by the lead agencies in developing the alternatives, but that were eliminated from detailed analysis.

2.1 Public Involvement

2.1.1 Scoping Activities

A Notice of Intent (NOI) was published in the Federal Register on July 15, 2005. The NOI described KNF's and DEQ's intent to prepare an EIS for the proposed Montanore Project, set the dates for public scoping meetings, and solicited public comments. The NOI asked for public comment on the proposal until September 15, 2005. In addition, as part of the public involvement process, the lead agencies issued press releases, mailed scoping announcements, and held three public meetings. The public scoping meetings were held in Libby and Trout Creek, Montana and Bonners Ferry, Idaho in August 2005. Scoping activities are discussed in the Scoping Report (ERO Resources Corp. 2005). A public meeting on the proposed 230-kV transmission line was held in May 2005 to identify resources potentially affected by the proposed transmission line, suggested locations for the proposed line, alternatives to the proposed line, and mitigation measures for the proposed line. At the meeting, MMC presented information on the need for the proposed facility. Consultation and coordination is discussed in Chapter 4.

2.1.2 Issues

Based on the comments received during public scoping, the KNF and the DEQ prepared a Scoping Content Analysis Report that includes a summary of all comments received, organized by resource or issue (KNF and DEQ 2006). The KNF and the DEQ separated the issues into three groups: "key" issues that drove alternative development; "analysis" issues that were used in impact analysis; and non-significant issues. The KNF and the DEQ identified seven key issues; each issue is briefly discussed in the following sections. The indicators, baseline data, and analysis approach used to assess effects on these issues are described in *Issue Statements and Analysis Guidance* (ERO Resources Corp. 2006a), on file in the project record. Each resource section in Chapter 3 describes how the effects on each resource were evaluated.

2.1.2.1 Key Issues

2.1.2.1.1 Issue 1: Potential for acid rock drainage and metal leaching

Drainage from waste rock, tailings, and stormwater runoff may adversely affect water resources in the project area. Effects will be assessed through predicted changes in water quality due to acid generation and near-neutral pH metal leaching and release of elevated concentrations of trace elements as a result of weathering of mined materials, based on geochemical characterization data.

2.1.2.1.2 Issue 2: Effects on quality and quantity of surface water and groundwater resources

Groundwater Flow and Quality

Underground mining activities may affect groundwater in the mine area, which may indirectly affect Rock Lake and other waters in the CMW located above the mine. Appropriations from or discharges to groundwater, such as from the proposed LAD Areas and the tailings impoundment, may affect groundwater flows and quality. Under Montana law, the definition of appropriate includes to divert, impound, or withdraw, including by stock for stock water, a quantity of water for a beneficial use. Appropriations by the FWP and USDA Forest Service have slightly different meaning. Effects will be assessed through two-dimensional and three-dimensional models, which will evaluate potential quantity impacts on mine area groundwater and overlying and surrounding surface water during construction, operations, and post-mining periods. Effects on groundwater at other facility locations will be assessed through estimating changes in flow path, quantity, and quality from discharges.

Surface Water Flow

Changes in groundwater from underground mining operations, discharges, and altered topography may change surface water flow and lake levels. Effects will be predicted by evaluating changes in surface water flow in area springs, lakes, and streams. For lower-altitude spring and streamflows, changes will be estimated for appropriations from or discharges to streams.

Surface Water Quality

Discharges or flow from mined areas containing metals, nutrients, or sediments may affect surface water quality in project area lakes, streams, and rivers. Effects were predicted by estimating changes in selected water quality parameters.

2.1.2.1.3 Issue 3: Effects on fish and other aquatic life and their habitats

Discharges and changes in surface water flows may affect fish and other aquatic life; the threatened bull trout and designated critical habitat in the analysis area are particularly of concern. Riparian habitat alteration from construction and operation of mine and transmission line facilities may affect 2015 KFP’s Inland Native Fish Strategy (INFS) riparian management objectives (RMOs) for facilities located within riparian habitat conservation areas (RHCAs). The effects will be predicted by estimating changes in surface water and groundwater parameters, changes in habitat quality, and changes in abundance and composition of aquatic life.

2.1.2.1.4 Issue 4: Changes in the project area’s scenic integrity

The proposed mine and transmission line may change existing the visual character of the project area. Effects will be predicted by estimating change in line, color, texture, form, and character of the landscape, and evaluating compliance with the 2015 KFP’s scenic integrity objectives. Effects will also be assessed quantitatively by determining mine facilities and miles of transmission line visible from key observation points, important travel corridors, and the CMW.

2.1.2.1.5 Issue 5: Effects on threatened or endangered wildlife species

Grizzly Bear

Construction and operation of mine and transmission line facilities may impact grizzly bear habitat and increase grizzly bear mortality and displacement. Effects will be evaluated by estimating changes in percent of core habitat, percent open motorized route density (OMRD) greater than 1 mile per mile squared (mi/mi^2), percent total motorized route density (TMRD) greater than 2 mi/mi^2, and displacement effects in affected Bear Management Units (BMU) in the Cabinet-Yaak Recovery Zone (CYRZ). The effects in the Cabinet Face Bears Outside of the Recovery Zone (BORZ) will be estimated in the Final EIS by estimating changes in the baseline total linear miles of road and total linear miles of open road on National Forest System land. Effects within the Cabinet-Yaak Ecosystem Recovery Zone and Cabinet Face BORZ will also be assessed qualitatively by evaluating potential changes in effectiveness of grizzly bear movement corridors, human activity, and attractant availability.

Lynx

Construction and operation of mine and transmission line facilities may disturb or degrade lynx habitat. Effects will be evaluated by assessing the proposed activities compliance with the applicable objectives, standards, and guidelines of the Northern Rocky Lynx Management Direction in each affected Lynx Analysis Unit (LAU). Effects on lynx habitat components within the affected LAUs was also assessed. Effects also will be assessed qualitatively by evaluating connectivity between habitat blocks in affected and adjacent LAUs, linkage areas between LAUs, habitat for alternative prey, and traffic-related mortality risks in affected LAUs or adjacent LAUs.

2.1.2.1.6 Issue 6: Effects on wildlife and their habitats

Key Wildlife Habitats

Construction and operation of mine and transmission line facilities may impact the quality or quantity of old growth, snags, and down wood habitat. Effects will be predicted by determining the following:

- Acres of vertical structure removed in old growth
- Acres of edge habitat
- Acres of interior old growth
- Acres of snag habitat
- Coarse woody debris removed

Pileated Woodpecker

Construction and operation of mine and transmission line facilities may directly or indirectly cavity-nesting species, such as the pileated woodpecker. Effects will be evaluated based on impacts to important attributes of pileated woodpecker habitat including old growth, down wood and snag habitat and indirect disturbance to pileated woodpeckers.

2.1.2.1.7 Issue 7: Effects on wetlands and streams

Construction and operation of mine and transmission line facilities may affect, directly or indirectly, wetlands and other streams, altering wetland function and services. Effects will be predicted by estimating the number of wetland acres and feet of streams filled, dewatered, or otherwise affected. Changes in wetland function and values will be evaluated qualitatively.

2.1.2.2 Analysis Issues

Issues identified by the public and the lead agencies during project scoping not considered as key issues, but important enough to be considered in the effects analysis are listed in Table 6. The lead agencies developed measures to address these issues, where needed to mitigate effects. The indicators, baseline data, and analysis approach used to assess effects on these issues are described in *Issue Statements and Analysis Guidance* (ERO Resources Corp. 2006a), on file in the project record.

Table 6. Other Issues Evaluated in the EIS.

Air Quality	Monitoring	Vegetation
American Indian Consultation	Recreation	Wilderness and Roadless Areas
Cultural Resources	Social/Economics	Migratory Birds
Electro-magnetic Fields and Radio/TV Interference	Soils	Elk and White-tailed Deer
Geology: Subsidence	Sound	Mountain Goat
Geotechnical	Threatened and Endangered Wildlife Species – Gray Wolf	Forest Service Sensitive Species
Land Use	Transportation	Other Species of Interest – Moose and Montana Sensitive Species

2.1.2.3 Non-Significant Issues

Non-significant issues were identified by the lead agencies as those 1) outside the scope of the Proposed Action; 2) already decided by law, regulation, the 2015 KFP, or other higher level decision; 3) irrelevant to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence. The U.S. Council on Environmental Quality NEPA regulations in 40 CFR 1501.7 requires lead agencies to "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review…"

One issue identified by the public during project scoping, an alternative combining Rock Creek and Montanore Projects, was beyond the scope of this environmental analysis. During scoping, commenters indicated the NEPA process should explore the possibility of an alternative that combines both the Rock Creek and Montanore Projects into one. The Rock Creek Project on the western side of the Cabinet Mountains underwent 14 years of analysis involving agency, tribal, and public participation. The DEQ issued a ROD in 2001 and the KNF issued a ROD in 2003, selecting Alternative V for implementation. The KNF's ROD was remanded in 2010 and the KNF is preparing a Supplemental EIS (see section 3.3.1.1, *Rock Creek Project*). The DEQ's ROD remains in effect. The alternative of combining Rock Creek and Montanore Projects is discussed in section 2.13, *Alternatives Analysis and Rationale for Alternatives Considered but Eliminated.*

2.2 Development of Alternatives

The 2015 KFP describes desired conditions, objectives, standards, guidelines, and land suitability for project and activity decision making on the KNF, guiding all resource management activity (USDA Forest Service 2015c). This direction applies either forestwide or specific to management or geographic area allocations. MMC's proposal for the Montanore Project and the agencies' alternatives were originally developed under the 1987 KFP; in this Final EIS, each alternative has been evaluated in light of the management direction in the 2015 KFP.

In developing alternatives to the Proposed Action, the lead agencies considered the management direction of the 1987 KFP, as amended. One example would be the 1995 Inland Native Fish Strategy (INFS) which establishes stream, wetland, and landslide-prone area protection zones called RHCAs and sets standards and guidelines for managing activities that potentially affect conditions within the RHCAs (see section 2.13.2.1, *Inland Native Fish Strategy*). An INFS guideline for minerals management is to locate structures, support facilities, and roads outside of RHCAs. Where no alternative exists to siting facilities in RHCAs, the guideline is to locate and construct facilities in ways that avoid impacts on RHCAs and streams, and adverse effects on inland native fish. Section 2.1.2.1, *Key Issues* discusses that RHCAs were a key resource during the lead agencies' alternatives analysis. The INFS management direction was integrated into the 2015 KFP so all alternative development and issue analysis is still relevant.

Alternatives were developed based on requirements for alternatives under regulations and rules implementing NEPA, MEPA, MFSA, and Section 404 of the Clean Water Act. Federal agencies are required by NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not analyzed in detail (40 CFR 1502.14). NEPA regulations do not specify the number of alternatives that need to be considered in the EIS, but indicate that a reasonable range of alternatives should be evaluated (40 CFR 1502.14). NEPA regulations require analysis of a No Action Alternative in an EIS. Likewise under MEPA, the DEQ is required to consider alternatives that are realistic, technologically available, and that represent a course of action that bears a logical relationship to the proposal being evaluated (ARM 17.4.603(2)(b)). Alternative alignments for the transmission line were developed based on requirements of MFSA (ARM 17.20.1607).

In addition to satisfying NEPA requirements for the selection of alternatives, projects subject to permitting for discharge of dredged and fill material into wetlands and waters of the U.S. also must comply with the 404(b)(1) Guidelines (40 CFR 230). It is anticipated that one or more Montanore Project facilities would need a 404 permit from the Corps. The 404(b)(1) Guidelines specify "no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences." An alternative is considered practicable "if it is available and it is capable of being done after taking into consideration cost, existing technology, and logistics in the light of overall project purposes." Practicable alternatives under the Guidelines assume that "alternatives that do not involve special aquatic sites are available, unless clearly demonstrated otherwise." The Guidelines also assume that "all practicable alternatives to the proposed discharge which do not involve a discharge into a special aquatic site are presumed to have less adverse impact on the aquatic ecosystem, unless clearly demonstrated otherwise" (40 CFR 230.10(a)(3)).

To develop a reasonable range of alternatives, the lead agencies separated the proposed Montanore Project into components. *Components* are discrete activities or facilities (*e.g.*, plant site or tailings impoundment) that, when combined with other components, form an alternative. Options were identified for each component. An *option* is an alternative way of completing an activity, or an alternative geographic location for a facility (component), such as alternative geographic locations for a tailings impoundment or transmission line, or an alternative method of tailings disposal, such as thickened tailings. Options generate the differences among alternatives. An alternative is a complete project that has all the components necessary to fulfill the project purpose and need. Options with more favorable environmental characteristics were retained and other options were eliminated from further analysis. Section 2.13, *Alternatives Analysis and Rationale for Alternatives Considered but Eliminated*, describes the lead agencies' analysis of alternatives considered but eliminated from detailed analysis. Options comprising the Proposed Action were retained regardless of their environmental characteristics. Next, options for each component were combined into potentially viable alternatives. The transmission line was analyzed as a separate component from the mine facilities because any transmission line alternative could be combined with any mine alternative. Each component or alternative was developed to a level that allowed for comparison of significant environmental issues. If an action alternative were selected in the ROD, final design would be completed after the NEPA process was finished.

The MFSA requires that the proposed transmission line be approved if the findings listed in 75-20-301, MCA and related administrative rules can be made. Under this statute, the DEQ can approve a modified transmission facility or a transmission line alternative different from that proposed by MMC. Under 75-20-301(1)(c), MCA, the DEQ must find and determine that the facility minimizes adverse environmental impact, considering the state of available technology and the nature and economics of the various alternatives.

Besides the No Action and Proposed Action alternatives for both the mine facilities and transmission line, the lead agencies analyzed in detail two mine alternatives and three transmission line alternatives. The following sections describe these alternatives. In the two mine alternatives and three transmission line alternatives to the Proposed Action, the issues addressed by the modification and mitigations that comprise the alternatives are discussed. The mine alternatives are discussed in the first sections, followed by the transmission line alternatives. The most significant modifications in the alternatives are relocating project facilities, such as the tailings impoundment. These alternative locations are summarized in Table 7. Other mitigations or changes to MMC's proposed mine alternative are listed in Table 8. (A similar table of mitigation proposed for the transmission line is found in Table 36.) Unless modified by the lead agencies, MMC's Mine Proposal as described in Alternative 2 would carry over into the two other mine alternatives. Similarly, aspects of MMC's proposed transmission line alternative, the North Miller Creek Alignment, as described in Alternative B, would carry over into the three other transmission line alternatives, unless modified by the lead agencies. The agencies could select segments from portions of transmission Alternatives B, C-R, D-R, or E-R.

Table 7. Mine Alternative Comparison.

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Operating Permit Areas	3,628 acres	2,157 acres	2,979 acres
Disturbance Areas	2,582 acres	1,565 acres	1,924 acres
Primary Facilities			
Mill site	Ramsey Plant Site in valley bottom in Upper Ramsey Creek	Libby Plant Site between Libby and Ramsey Creek drainages	Same as Alternative 3
Adits and portals	Existing Libby Adit; two Ramsey Adits; Rock Lake Ventilation Adit	Existing Libby Adit; two additional Libby Adits; Rock Lake Ventilation Adit	Same as Alternative 3
Concentrate loadout location	Kootenai Business Park in Libby	Same as Alternative 2	Same as Alternative 2
Above-ground conveyor	1,200 feet long between Ramsey Adit portal and mill	6,000 and 7,500 feet long (depending on the option) between Libby Adit Site and Libby Plant Site mill	Same as Alternative 3
Tailings impound-ment and seepage collection pond	628 acres in Little Cherry Creek	608 acres between Poorman and Little Cherry creeks	Same as Alternative 2
Perennial stream diversion	Diversion of Little Cherry Creek 10,800 feet long around impoundment to Libby Creek	None	Same as Alternative 2
Land application disposal areas	Two; one along Ramsey Creek and one between Ramsey and Poorman creeks	None; any wastewater treated at Water Treatment Plant	Same as Alternative 3
Primary access road	NFS road #278 (Bear Creek Road) plus new access road; 20 to 29 feet wide	NFS road #278 (Bear Creek Road) plus new access road; 26 feet wide; up to 56 feet wide to accommodate haul traffic and public traffic	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Water treatment	Land application, Libby Adit Water Treatment Plant, or additional Water Treatment Plant, as necessary	Libby Adit Water Treatment Plant expanded to accommodate discharges during the estimated wettest year in a 20-year period; modified as necessary to treat parameters such as nutrients or metals to meet MPDES permitted effluent limits	Same as Alternative 3
Facility Details			
New adits: length, grade, and portal elevation	Ramsey Adits: 16,000 feet long, 8% decline; Elevation: 4,400 feet Rock Lake Ventilation Adit: Elevation: 5,560 feet	Upper Libby Adit: 13,700 feet long, 7% decline; Elevation: 4,100 feet New Libby Adit: 17,000 to 18,500 feet long, depending on option; 5% decline; Elevation: 3,960 feet Rock Lake Ventilation Adit	Same as Alternative 3
New access roads[†] To Plant Site:	1.7 miles connecting NFS roads #278 and #4781	0.7 miles of new road parallel to NFS road #278, connecting existing NFS roads #278 and #2317	Same as Alternative 3
Realigned NFS road #278 at impoundment	1.8 miles	0.2 miles	Same as Alternative 2
To Adit Portal:	0.3 mile to portal	None	Same as Alternative 3
To LAD Area 1	1.0 mile	None	Same as Alternative 3
To LAD Area 2	0.2 mile	None	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Pipelines Tailings	Double-walled high-density polyethylene on surface adjacent to access road; 6.4 miles to impoundment	Double-walled buried adjacent to access road; 4.2 miles to impoundment	Same as Alternative 3; 6.4 miles to impoundment
Reclaim water	Double-walled high - density polyethylene on surface adjacent to access road	Double-walled high - density polyethylene buried adjacent to access road	Same as Alternative 3
Tailings pump stations	At Poorman Creek crossing	At each crossing of Ramsey and Poorman creeks	Same as Alternative 3
Borrow areas	Four; 143 acres within impoundment footprint and 419 acres outside of impoundment footprint	Three; 124 acres within impoundment footprint and 92 acres outside of impoundment footprint	Five; 185 acres within impoundment footprint and 252 acres outside of impoundment footprint
Post-mining impoundment runoff	Riprapped channel to Bear Creek	Natural channel to Little Cherry Creek	Riprapped channel to Little Cherry Creek Diversion Channel

[†]Temporary roads within the disturbance area of each facility not listed.

Table 8. Comparison of Mitigation for Mine Alternatives.

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Mine Plan			
Final Mine Plan	Submit final plan to the lead agencies for approval	Same as Alternative 2 Fund an independent technical advisor to assist the agencies in review of MMC's subsidence monitoring plan, underground rock mechanics data collection, and MMC's mine plan Submit an Operations, Maintenance, and Surveillance Manual for the Libby Plant and tailings impoundment and a comprehensive Environmental Health and Safety Plan.	Same as Alternative 3
Barrier Zone	500 feet from Rock Lake and 100 feet from Rock Lake Fault	1,000 feet from Rock Lake and 300 feet from Rock Lake Fault until additional data collection and analysis completed and closer mining approved by the agencies	Same as Alternative 3
Underground Mine Barriers	Not proposed	Identify location of one or more barrier pillars before Construction Phase Leave one or more barrier pillar within mine, if needed to minimize post-mining changes in East Fork Rock Creek and East Fork Bull River streamflow and water quality during Operations Phase Construct concrete bulkheads at limited access openings in barrier pillars, if left in place, during Closure Phase	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Geotechnical Testing to Reduce Subsidence Risk	Underground geotechnical investigations conducted as the Libby Adit was completed; ongoing subsidence monitoring	Libby Adit evaluation program part of Alternative 3. Testing same as Alternative 2 with the following additions: Back-analyze the pillar failure at the Troy Mine using publicly available data to compare the Troy Mine design in effect at the time of the failure with the Montanore design; undertake numerical modeling to further evaluate expected design performance, to assess potential for shear failure at the pillar/roof or pillar/floor interface, and pillar columnization and sill stability between the two ore zones Conduct lineament analysis, mapping and statistical analysis of joint frequency and attitude, strain-relief overcoring, and further exploratory drilling Fund and facilitate biannual surveys of the underground workings by an independent qualified mine surveyor	Same as Alternative 3.
Final Closure Plan	Submit a revised reclamation plan to the lead agencies for approval	Update the closure plan, including a long-term monitoring plan, during the Construction Phase in sufficient detail to allow development of a reclamation bond Submit final closure and post-closure plan, including a long-term monitoring plan, 3 to 4 years before mine closure	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Water Management			
Long-term Maintenance of Little Cherry Creek Diversion Channel	Not specified	None needed	Fund a long-term maintenance account
Sanitary Wastes			
Evaluation and Construction Phases	Self-contained systems at Ramsey Plant Site and Libby Adit Site	On-site treatment and disposal at Libby Adit Site	Same as Alternative 3
Operations Phase	Closed sanitary system with waste stored in buried sewage tanks at Ramsey Plant Site; tanks pumped and disposed off-site during Operations Phase	On-site treatment and then pumped to tailings impoundment during Operations Phase	Same as Alternative 3
Closure Phase	Not specified	On-site treatment and disposal at Libby Adit	Same as Alternative 3
Sediment Ponds and Ditches in Mine Area	Designed for 10-year/24-hour storm	Ponds and ditches containing process water or mine drainage sized for 100-year/24-hour storm	Same as Alternative 3
Well Abandonment	Wells at tailings impoundment plugged and abandoned according to ARM 36.21.810 Other monitoring wells and water supply wells not specified	Any monitoring well used by MMC for monitoring during any project phase plugged and abandoned according to ARM 36.21.810 Any potable water supply well on National Forest System lands plugged and abandoned according to ARM 36.21.810.	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Water Rights			
Construction and Operations Phases	Not Proposed	Monitor Libby Creek flow at LB-2000, cease appropriating Libby Creek water whenever flow was less than 40 cfs at LB-2000, and treat and discharge water from the Water Treatment Plant at a rate equal to its Libby Creek appropriations during such times Monitor Ramsey Creek flow at RA-300; if baseflow changes in Ramsey Creek may adversely affect any senior right on Ramsey Creek during any mining phase, develop a plan during final design to convey treated water from the Water Treatment Plant to a location upstream of the point of diversion (RA-300)	Same as Alternative 3
Closure and Post-Closure Phases	Plug Ramsey and Libby adits at closure with single plug	Place two or more plugs in each adit to isolate the adits hydraulically from the mine void and to ensure groundwater from Libby and Ramsey creeks would not flow into the mine void Treat and discharge water from the adits at the Water Treatment Plant at a rate equal to its Libby Creek appropriations and diversions under the conditions described for the Construction and Operations Phases	Same as Alternative 3
Swamp Creek Water Right	Swamp Creek mitigation site not proposed	Water right not needed for rehabilitation of Swamp Creek site; Change of use of existing water right to instream flow right requested	Same as Alternative 3

Project Facility or Feature	**Alternative 2 MMC's Proposed Mine**	**Alternative 3 Agency Mitigated Poorman Impoundment Alternative**	**Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative**
Tailings Impoundment Design			
Impoundment Design		Use the most recent attenuation relationships that are based on instrumental records of attenuation collected in the United States and internationally Complete circular failure plane assessments through the near-dam tailings and dam section and through the dam crest and slope Update the pumpback well design and analysis using geologic and hydrologic data collected as part of geotechnical field studies, with a focus on minimizing drawdown north of impoundment Minimize and avoid, to the extent practicable, filling wetlands and streams Minimize and avoid, to the extent practicable, locating structures, such as the Seepage Collection Pond, in a floodplain Fund an independent technical review of the final design as determined by the lead agencies	Complete a pumpback well design and analysis using available geologic and hydrologic data, with a focus on minimizing drawdown south of impoundment Other mitigations same as Alternative 3
Other Facilities			
Temporary Ore Stockpile	333,000 tons of ore excavated during Construction Phase and stored temporarily in unlined stockpile at LAD Area 1	333,000 tons of ore excavated during Construction Phase and stored temporarily in unlined stockpile at Libby Adit; ore stockpile covered to eliminate stormwater contact	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Waste Rock Management Stockpile and Storage	Stored temporarily at unlined stockpile at LAD Area 1, Libby Adit Site, and/or Ramsey Adit portal, or hauled to the tailings impoundment area then used in impoundment dam.	Stored temporarily at stockpiles, lined if necessary, and then hauled to a lined, if necessary, location within impoundment footprint; then used in impoundment dam	Same as Alternative 3
Characterization	Collect representative rock samples from the adits; ore zones; above, below and between the ore zones; and tailings for static and kinetic testing	Same as Alternative 2; in addition, collect samples of the lead waste zone, altered waste zones within the lower Revett, and the portions of the Burke and Wallace Formations for static and kinetic testing; assess potential for trace metal release from waste rock; conduct operational verification sampling within the Prichard Formation during development of the new adits	Same as Alternative 3
Handling	Segregate potentially acid-generating materials and materials that could create near-neutral pH metal leaching as they were mined and placed under sufficient cover to minimize direct exposure to the atmosphere and precipitation	Same as Alternative 2; in addition, segregate potentially acid-generating materials and materials that could create near-neutral pH metal leaching from portions of the lower Revett and Prichard Formations for additional kinetic and metal mobility testing and provide for selective handling as indicated by test results	Same as Alternative 3
Waste Management Solid Wastes	Bury certain wastes underground in mined-out areas	No solid wastes other than waste rock buried underground in mined-out areas; reinforced concrete foundation material may be buried on National Forest System lands under certain conditions; all other building materials would be removed and disposed of at an approved off-site waste disposal facility	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
		Air Quality	
Tier 4 Engines	Not specified	Use Tier 4 engines, if available, or Tier 3 engines on underground mobile equipment and emergency generators during all project phases	Same as Alternative 3
Ultra-low sulfur fuel	Not specified	Use ultra-low sulfur diesel fuel in engines on underground mobile equipment and emergency generators during all project phases	Same as Alternative 3
		Recreation and Scenery	
New Recreational Facilities	Not specified	Design and construct a scenic overlook with interpretive signs south of the switchback on NFS road #231 (Libby Creek Road) downstream of the Midas Creek confluence with views of the tailings impoundment Develop a small (4 to 5 vehicle) graveled recreational parking area at the gate on the Poorman Creek Road (NFS road #2317) Develop a new hiking trail between Poorman and Ramsey creeks to provide non-motorized access to upper Ramsey Creek	Same as Alternative 3
Howard Lake campground host	Not specified	Pay the reimbursement funding for a volunteer campground host from Memorial Day through Labor Day at Howard Lake campground using an Volunteer Services Agreement for Natural Resources Agencies (Optional Form 301a) throughout the life of the project	Same as Alternative 3
Road Closure Inspection	Not specified	Inspect and maintain gates or barriers for access changes used in wildlife mitigation	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Night Lighting	Not specified	Shield or baffle night lighting at the Libby Adit Site and Libby Plant Site	Same as Alternative 3
Final Regrading Plans	Not specified	Develop final regrading plans for each facility to reduce visual impacts of reclaimed mine facilities	Same as Alternative 3
	Not specified	At the end of operations, place any waste rock not used in construction either back underground or use it in regrading the tailings impoundment	Same as Alternative 3
Clearing Operations	Not specified	Complete vegetation clearing operations under the supervision of an agency representative with experience in landscape architecture and revegetation Create clearing edges with shapes directly related to topography, existing vegetation community densities and ages, surface drainage patterns, existing forest species diversity, and view characteristics from Key Observation Points Avoid straight line or right-angle clearing area edges Avoid creation of symmetrically-shaped clearing areas Transition forested clearing area edges into existing treeless areas by varying the density of the cleared edge under the supervision of an agency representative	

Project Facility or Feature	**Alternative 2 MMC's Proposed Mine**	**Alternative 3 Agency Mitigated Poorman Impoundment Alternative**	**Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative**
Clearing Operations (continued)	Not specified	Transition forested clearing area edges into existing treeless areas by varying the density of the cleared edge under the supervision of an agency representative Mark only trees to be removed with water-based paint, and not mark any trees to remain Cut all tree trunks at 6 inches or less above the existing grade in clearing areas located in sensitive foreground areas such as within 1,000 feet of residences, roads, and recreation areas determined and identified by an agency representative before clearing operations	Same as Alternative 3
General Facility Location	Not specified	Locate above-ground facilities, to the greatest extent practicable, without the facilities being visible above the skyline as viewed from the Key Observation Points	Same as Alternative 3
Sound			
Mill Equipment	Not specified	Operate all surface and mill equipment so that sound levels do not exceed 55 dBA, measured 250 feet from the mill for continuous periods exceeding an hour	Same as Alternative 3
Intake and Exhaust Ventilation Fans	Adjust intake and exhaust ventilation fans in the Libby Adits so that they generate sounds less than 85 dBA measured 3 feet downwind of the Ramsey Adit portals	Same as Alternative 2 applied to the three Libby Adits	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Transportation			
Bear Creek Road Reconstructed Width	20 to 29 feet	26 feet	26 feet; up to 56 feet wide to accommodate haul traffic and public traffic
Other roads	Single lane	Same as Alternative 2, except up to 56 feet wide to accommodate mixed haul traffic and public traffic	Same as Alternative 3
Bear Creek Road south of impoundment	Left in current condition	Selected segments graveled with 6 inches of gravel at least 16 feet wide	Selected segments graveled with 6 inches of gravel at least 16 feet wide
Culverts	Install and/or extend culverts	Replace as necessary to comply with INFS standards and guidelines and Forest Service guidance, such as fish passage or conveyance of adequate flows	Same as Alternative 3
Bear Creek Bridge	Not replaced	Replace and widened to a width compatible with a 26-foot wide Bear Creek Road	Same as Alternative 3
Gated roads	Not specified	Install and maintain each closure; gates would have dual-locking devices to allow the KNF fire or administrative access	Same as Alternative 3
Development of Plans	Not specified	Develop and implement a final Road Management Plan, Transportation Plan, and Traffic Impact Study	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
		Noxious Weed Management	
Noxious Weed Management	Implement Weed Control Plan approved by Lincoln County Weed Control District	Same as Alternative 2 with the Weed Control Plan incorporating the following changes: Following KNF's and DEQ's approval of the final Weed Control Plan, submit it to the Lincoln County Weed Control District for approval Submit an annual report to the lead agencies describing weed control efforts Implement all weed best management practices (BMPs) identified in Appendix A of the KNF Invasive Plant Management Final EIS for all weed-control measures Include integrated noxious weed management in the environmental training To the extent possible, survey all proposed ground disturbance areas for noxious weeds before initiating disturbance; describe in final design plans the extent of which surveys and pretreatment would not be feasible; where noxious weeds were found, treat infestation the season before the activity was planned Pressure wash all off-road equipment including equipment for mining, vegetation clearing, road construction and maintenance, and reclamation before entering the project area	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Noxious Weed Management (continued)	Implement Weed Control Plan approved by Lincoln County Weed Control District	Develop and implement site-specific guidelines to be followed for weed treatments within or adjacent to known sensitive plant populations; evaluate all future treatment sites for sensitive plant habitat suitability; survey suitable habitats as necessary before treatment Consider winter vegetation clearing to reduce mineral soil exposure and the chance of spreading existing noxious weeds Continue to monitor/survey the project area for existing and new invader weed species and populations annually Treat noxious weeds along all haul and access roads yearly with the appropriate herbicide mix for the target species; broadcast treat every other year and spot treat the alternate years Prevent road maintenance machinery from blading or brushing through known populations of new invading noxious weed species; in areas where noxious weeds were established and activities require blading, brush and blade areas with uninfested segments of road systems to areas with noxious-weed infested areas; limit brushing and mowing to the minimum distance and height necessary to meet safety objectives in areas of heavy weed infestations	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Reclamation Plans			
Soil Salvage and Handling	Double-lift salvage at Little Cherry Creek Tailings Impoundment, Seepage Collection Pond, Borrow Areas, other potential disturbances within impoundment area. Single-lift salvage at Little Cherry Creek Diversion Channel, Ramsey Plant Site, Upper Libby Adit Site, LAD Areas, and road disturbances	Double-lift salvage at all disturbances where soil is to be salvaged except road disturbances. These disturbances include Poorman Tailings Impoundment, Seepage Collection Pond, Borrow Areas, other disturbances within impoundment area, Libby Plant Site, and Upper Libby Adit Site	Similar to Alternative 3, except double-lift salvage at Little Cherry Creek Tailings Impoundment and Little Cherry Creek Diversion Channel
	Not specified	Map soils not mapped at an intensive level before salvage to assure maximum amount of suitable soil was salvaged	Same as Alternative 3
	Not specified	Salvage soils at low moisture content to minimize compaction	Same as Alternative 3
Vegetation Removal and Disposition	As proposed in Plan of Operations	Prepare a Vegetation Removal and Disposition Plan for lead agencies' approval	Same as Alternative 3
	Not specified	Where possible, salvage, chip, and use limited amounts of slash as mulch	Same as Alternative 3
Soil Stockpiles	Stabilize soil stockpiles when they reach their design capacity and seed during the first appropriate season following stockpiling	Incrementally stabilize soil stockpiles (rather than waiting until the design capacity was reached) to reduce erosion and maintain soil biological activity	Same as Alternative 3
	First-lift soils stockpiled together at tailings impoundment	Segregate first-lift soils based on rock content and stockpiled separately at tailings impoundment	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
	Second-lift soils stockpiled together at tailings impoundment	Second-lift clay-rich glaciolacustrine soils stockpiled separately from other second-lift subsoils at tailings impoundment	Same as Alternative 3
	For road disturbances, salvaged soils stockpiled along entire road corridors	For road disturbances, salvaged soils stockpiled in clearings or in areas of recent timber harvest immediately adjacent to new roads	Same as Alternative 3
Soil Replacement	Embankment of Little Cherry Creek Tailings Impoundment would be covered with 24 inches of replaced soil using two lifts; rest of impoundment would be covered with 18 inches of replaced soil using two lifts	Entire tailings impoundment would be covered with 24 inches of replaced soil using two lifts	Same as Alternative 3
	Rocky and non-rocky topsoil would be used as upper 9 inches of respread soil on embankment of tailings impoundment	Rocky topsoil would be used as upper 9 inches of respread soil on embankment of tailings impoundment to minimize erosion	Same as Alternative 3
	Soil would be replaced using single lift at Ramsey Plant Site, Little Cherry Creek Diversion Channel, Libby Adit Site, road disturbances, and other potential disturbances	Soil would be replaced using two lifts at all disturbances requiring soil replacement except road disturbances	Same as Alternative 3, except soil would be replaced in the Little Cherry Creek Diversion Channel
Revegetation Seedbed preparation	Before soil replacement, embankment of tailings impoundment would be ripped; top of impoundment would not be ripped	Before soil replacement, entire tailings impoundment would be ripped to minimize compaction, break up surface crust and enhance rooting depth	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
	Apply organic amendments as needed or when soil tests demonstrate deficiencies	Agency-approved wood-based organic amendment would be incorporated into upper 4 inches of respread soil to improve nutrient content and the organic matter level to 1 percent by volume	Same as Alternative 3
	Use mycorrhizae-inoculated trees and shrubs if readily available	Mycorrhizae would be added to soil in areas where trees are to be planted	Same as Alternative 3
Seed Mixtures	Interim and permanent seed mixtures	Permanent seed mixture only	Same as Alternative 3
	Native and introduced species	Local native seed from the Forest Service Coeur d'Alene Nursery or the Kootenai Seed Mix	Same as Alternative 3
Tree and Shrub Density After 15 Years	283 trees/acre (assumes a 65 percent survival rate of 435 trees/acre planted) Unspecified (200 shrubs/acre planted)	400 trees/acre 200 shrubs/acre	Same as Alternative 3
Noxious Weeds	No more than 10 percent noxious weeds	Less than 10 percent cover of Category 1 weeds and 0 percent of Category 2 and 3 weeds; would not dominate an area greater than 400 square feet	Same as Alternative 3
Total Cover	60 percent live vegetation cover or 80 percent of control site total cover	80 percent of control site total cover	Same as Alternative 3
Monitoring Plan	3 consecutive years of success	20 years unless criteria achieved sooner	Same as Alternative 3
Mitigation Plans			
Wildlife (see Table 36 for additional mitigation for transmission line)			
Snags (Cavity Habitat)	Not specified	Leave snags in disturbance areas, unless required to be removed for safety reasons	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Mountain Goat	Not specified	Fund aerial surveys three times annually for 2 consecutive years before construction, and every year during construction activities	Same as Alternative 3
	Not specified	No blasting at adit portals from May 15 to June 15	Same as Alternative 3
Migratory Birds	Not specified	Fund and initiate annual monitoring of up to 12 Integrated Monitoring in Bird Conservation Regions transects	Same as Alternative 3
Gray Wolf	None proposed	Fund FWP personnel to implement adverse conditioning techniques before wolves concentrate their activity around the den site if a wolf den or rendezvous site was located in or near the project facilities	Same as Alternative 3
Lynx	None proposed	Fund habitat enhancement of lynx stem exclusion habitat on between 436 and 526 acres (depending on the transmission line alternative)	Fund habitat enhancement of lynx stem exclusion habitat on between 290 and 380 acres (depending on the transmission line alternative)
Grizzly Bear Road and Trail Access Changes Before Libby Adit evaluation program	None proposed	Seasonally change access (install gates) on 6 roads totaling 14.5 miles. Decommission or place into intermittent stored service 13 roads totaling 20.3 miles	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Before Construction	NFS road #4784 (upper Bear Creek Road) year-long for the life of the project NFS road #4724 (South Fork Miller Creek) on a seasonal basis (April 1 to June 30) for the life of the project	Decommission or place into intermittent stored service seven roads totaling 13.2 miles within the CYRZ. Place barriers on five roads year-round totaling 10.2 miles within the BORZ Decommission or place into intermittent stored service NFS road #4784 (upper Bear Creek Road) if the Rock Creek Mine mitigation restricting the road with an earthen barrier had not been implemented before Forest Service approval to initiate the Evaluation Phase Convert trail #935 in upper East Fork Rock Creek to non-motorized access	Same as Alternative 3
Land Acquisition for Physical Disturbance see Table 36 for additional mitigation of transmission line effects	Purchase, secure or protect replacement grizzly bear habitat (through conservation or acquisition) of 2,758 acres in the Cabinet-Yaak Ecosystem	Secure or protect replacement grizzly bear habitat (through conservation or acquisition) of 3,094 acres in the Cabinet portion of the Cabinet-Yaak Ecosystem and a 5-acre parcel near Rock Creek Meadows below Rock Lake	Same as Alternative 3 except protected habitat would be 3,812 acres in the Cabinet portion of the Cabinet-Yaak Ecosystem and the 5-acre Rock Creek Meadows parcel
Land Acquisition for Long-term Displacement Effects	Not proposed	Secure or protect replacement grizzly bear habitat (through conservation easement or acquisition) of 2,293 acres in the Cabinet portion of the Cabinet-Yaak Ecosystem.	Same as Alternative 3 except protected habitat would be 2,339 acres in the Cabinet portion of the Cabinet-Yaak Ecosystem

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Personnel Funding	Fund two new full-time wildlife positions, a law enforcement officer, and an information and education specialist	Fund three new full-time wildlife positions, a law enforcement officer before Evaluation Phase, an information and education specialist, and a bear specialist during Construction and Operations Phases	Same as Alternative 3
Other Measures	Report road-killed animals to the FWP as soon as road-killed animals were observed. The FWP would either remove road-killed animals or direct MMC how to dispose of them Not specified	Remove big game animals killed by any vehicles daily from road rights-of-way within the permit area and along roadways used for access or hauling ore Fund and maintain up to 35 bear-resistant refuse containers for employees and mine facilities Fund and maintain 100 bear-resistant garbage containers plus an additional 20 per year, after the first year of Construction Phase, for distribution to the community Fund fencing, electrification, and maintenance of garbage transfer stations in grizzly habitat in and adjacent to the Cabinet-Yaak Ecosystem Fund an initial 10 electric fencing kits for use at bear problem sites that can be installed by FWP bear specialists, and then 2 replacements per year Not use salt when sanding during winter plowing operations	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Fisheries and Other Aquatic Organisms Reduced habitat availability in Little Cherry Creek	Collect all fish in Little Cherry Creek and move the fish to the newly constructed Diversion Channel Implement various mitigation projects to mitigate fisheries loss	None needed for Little Cherry Creek; streams affected by Poorman Impoundment Site are non-fish-bearing streams	Diversion channel unlikely to provide adequate habitat; additional mitigation for fish and recreational fishing losses from Little Cherry Creek diversion
Reduced Habitat Availability (bull trout)	None proposed	In Copper Gulch, West Fork Rock Creek, Rock Creek, Flower Creek, or Poorman Creek, mitigation may include: Create genetic reserves through bull trout transplanting to protect existing bull trout populations from catastrophic events Rectify unnatural blockages to bull trout passage that are prohibiting access to spawning and rearing habitat Rectify other factors that are limiting the potential of streams to support increased production of bull trout Eradicate non-native fish species, especially brook trout, that are a hybridization threat to bull trout Develop final mitigation plans in cooperation with the KNF, USFWS, and FWP	Same as Alternative 3
Reduced Habitat Availability In Impoundment Site	Options for fisheries and stream improvements in Ramsey, Libby, Standard, and Snowshoe creeks and Howard and Kilbrennan lakes	Poorman Impoundment Site drainages not fish bearing Create 6,500 linear feet of stream on main Swamp Creek channel and two tributary channels	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Sediment	Optional inventory and implementation of sediment abatement projects	Fund maintenance of access changes described for grizzly bear mitigation Implement road improvements, such as installing culverts, on NFS roads #231 and #2316	Same as Alternative 3
Wetlands Wetland Mitigation of Jurisdictional Wetlands	Create or expand existing wetlands totaling 44.6 acres; final mitigation requirements determined by Corps during 404 permitting process; Feasibility of plan to replace the lost functions of all potentially affected wetlands uncertain	Rehabilitate 15 acres of degraded water along Swamp Creek; final mitigation requirements determined by Corps during 404 permitting process	Create or expand existing wetlands totaling 48.8 acres; final mitigation requirements determined by Corps during the 404 permitting process; Feasibility of plan to replace the lost functions of all potentially affected wetlands uncertain
Mitigation of Non-jurisdic-tional Wetlands	Not specifically proposed; included in jurisdictional wetland mitigation plan	Create or expand existing wetlands at four sites totaling 7.5 acres outside of the impoundment area	Same as Alternative 3
Mitigation for streams	Options for stream improvements in Ramsey, Libby, Standard, and Snowshoe creeks	Construct 6,500 linear feet of new meandering channel at Swamp Creek property. Replace a culvert on Little Cherry Creek with a bottomless, arched culvert Replace a culvert on Poorman Creek with a bottomless arched culvert Remove a bridge across Poorman Creek and re-establish floodplain Stabilize 400 feet of eroding area on NFS road #6212 Remove 21 culverts and restore riparian habitat on land acquired for grizzly bear mitigation	Construct 6,500 linear feet of new meandering channel at Swamp Creek property. Replace a culvert on Poorman Creek with a bottomless arched culvert Stabilize 400 feet of eroding area on NFS road #6212 Remove 21 culverts and restore riparian habitat on land acquired for grizzly bear mitigation

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Pre-construction Hydrologic Monitoring of Mitigation Sites	Not specified	Adequate hydrologic data previously collected	Six months (April–September) of monthly monitoring prior to development of sites without hydrologic data
Wetland Soil Management	Not specified	Wetland soils and sod salvaged and used at isolated wetland mitigation sites	Same as Alternative 3
Beneficial Water Use Permit Acquisition for Mitigation Sites	Not proposed	Obtain beneficial water use permit for isolated wetland mitigation sites if required by DNRC for water use	Same as Alternative 3
Mitigation Site Management	Mitigation sites on private land retained by MMC	Convey the title to or a perpetual conservation easement on the Swamp Creek mitigation site to the Forest Service after the Corps determined the sites' performance standards had been met Convey isolated mitigation sites, vegetated upland buffers, and adjacent existing wetlands contiguous to National Forest System lands to Forest Service Convey any water right used or obtained for wetland mitigation to Forest Service	Same as Alternative 3 Same as Alternative 3 Same as Alternative 3

2.3 Alternative 1—No Action, No Mine

In this alternative, MMC would not develop the Montanore Project, although the project as proposed NMC is approved under DEQ Operating Permit #00150. The Montanore Project, as proposed, cannot be implemented without a corresponding Forest Service approval of a Plan of Operations or DEQ's issuance of a transmission line certificate. The environmental, social, and economic conditions described in Chapter 3 would continue, unaffected by the construction and operation of the mine or a transmission line. The DEQ's Operating Permit #00150 and revised in Minor Revisions 06-001, 06-002, and 08-001 would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that did not affect National Forest System lands. The conditions under which the Forest Service could select the No Action Alternative or the DEQ deny MMC's application for an air quality permit, transmission line certificate, and MMC's operating permit modifications are described in section 1.6, *Agency Roles, Responsibilities, and Decisions*.

2.4 Alternative 2—MMC's Proposed Mine

2.4.1 Construction Phase

2.4.1.1 Permit and Disturbance Areas

Development of the Montanore Project would require construction of an underground mine and adits (underground access), and surface facilities, such as a mill, tailings impoundment, and access roads (Figure 1, Figure 2). In MMC's proposal, the mill and mine production adits would be located in the upper Ramsey Creek drainage, about 0.5 mile from the CMW boundary. An additional adit on private land owned by MMC in the Libby Creek drainage and a ventilation adit on private land owned by MMC east of Rock Lake would be used for ventilation. A tailings impoundment is proposed to be constructed in the Little Cherry Creek drainage, and would require the permanent diversion of Little Cherry Creek. Two LAD Areas between Poorman Creek and Ramsey Creek are proposed to allow for discharge of water to the surface. A portion of the waste rock may be stored temporarily at LAD Area 1 and at the Libby Adit Site. Permit area boundaries would be established around each of these facilities (Figure 3). The total operating permit area, a required description for the DEQ operating permit, would total 3,628 acres and the total permitted disturbance area would be 2,582 acres (Figure 3, Table 9). For analysis purposes, the lead agencies used a disturbance area to assess effects on surface resources. For maximum flexibility, MMC would bond to cover the full disturbance area even if no activities were currently proposed. This would allow MMC to construct temporary and seasonal roads and other facilities within these disturbance area boundaries as needed.

The underground mine would produce up to 20,000 tons of ore daily, or 7 million tons per year at full production. Currently delineated mineral resources, estimated at about 135 million tons, extend from Rock Lake to St. Paul Lake beneath the CMW (Figure 4). These estimates are based on 27 drill holes. The deposit has not been fully delineated and likely extends farther north than the available drilling information. Considering an expected ore extraction of 65 to 75 percent, waste rock dilution, and initial production rates, the mine is anticipated to have a production life of about 16 years. Three additional years may be needed to mine 120 million tons. MMC's proposed construction, operations, mitigation, and reclamation plans for the mine are described in the following sections.

A 230-kV transmission line to supply electrical power would be built from the Sedlak Park Substation to the Ramsey Plant Site. Facilities associated with MMC's proposed transmission line are discussed in section 2.8, *Alternative B—MMC's Proposed Transmission Line (North Miller Creek Alignment Alternative).*

Table 9. Mine Surface Area Disturbance and Operating Permit Areas, Alternative 2.

Facility	Disturbance Area (acres)	Permit Area (acres)
Existing Libby Adit Site	18	219
Rock Lake Ventilation Adit	1	1
Ramsey Plant Site and Adits	52	185
Little Cherry Creek Tailings Impoundment Site and Surrounding Area	1,928	2,458
Little Cherry Creek Tailings Impoundment and Seepage Collection Pond	628	
Borrow areas outside impoundment footprint	419	
Soil stockpiles	53	
Other potential disturbance (Diversion Channel, roads, storage areas)	828	
LAD Area 1 and Waste Rock Stockpile	247	261
LAD Area 2	183	226
Access Roads†		
Bear Creek Road (NFS road #278 from US 2 to Tailings Impoundment)§	79	10
Tailings Impoundment permit area to Ramsey Plant Site (NFS road #278 to new haul road to NFS road #4781)	48	172
Libby Adit Site (NFS road #2316 and #6210) to Ramsey Creek Road (NFS road #4781)	26	96
Total	2,582	3,628

†Disturbance area shown for roads excludes 33 feet of existing disturbance along roads.
§A small area of the Bear Creek Road would be within a permit area outside of the Little Cherry Creek Tailings Impoundment permit area (Figure 3).

In the first 2 years of the Construction Phase, MMC would upgrade NFS roads #278 (Bear Creek Road) and #4781 (Ramsey Creek Road); short segments of these roads would be realigned. About 10 miles of the Bear Creek Road (NFS road #278), from US 2 to the Bear Creek bridge, would be reconstructed to applicable road standards set by the either the KNF or Lincoln County. The road would be widened on its existing alignment to 20 to 29 feet wide and chip-and-seal paved. While NFS road #278 was upgraded, the Libby Creek Road (NFS road #231) would be used for access. Additional information about access is provided in section 2.4.1.6, *Transportation and Access*.

During the Construction Phase, MMC would construct the Ramsey Plant Site (Figure 5), two Ramsey Adits, and a Ventilation Adit near Rock Lake (Figure 4), tailings impoundment dams, transmission line, and other ancillary infrastructure necessary to initiate mining activities. Construction of a ventilation adit near Rock Lake, which would predominantly be a horizontal shaft (Figure 4), may be deferred until initial mine production commenced, depending on ventilation requirements. MMC also would undertake underground delineation drilling in the ore body. MMC also would develop the Libby Loadout Facility at the Kootenai Business Park in Libby for concentration storage and shipping. The Libby Loadout Facility is discussed in section 2.4.2.2, *Concentrate Shipment*.

US 2 south of Libby to the Bear Creek Road and the Bear Creek Road (NFS road #278) would be the primary access to the mine site. During the Construction Phase, the Bear Creek Road would be widened and surfaced with chip-seal. MMC would use the Libby Creek Road (NFS road #231) during reconstruction of the Bear Creek Road. MMC's road use for the project is discussed in section 2.4.1.6, *Transportation and Access*.

2.4.1.2 Vegetation Clearing and Soils Salvage and Handling

Before any construction, vegetation would be cleared and suitable soils salvaged. Merchantable timber would be measured, purchased from the KNF, and then cleared before soil removal. Non-merchantable trees, shrubs, and slash would be removed using a brush blade to minimize soil accumulation, piled into windrows, and burned. All requirements of the Montana Slash Disposal Law would be observed.

MMC would salvage and replace soils on most disturbed areas, except where slopes were too steep or where the water table was high. Proposed salvaged depths would vary between 9 and 65 inches, based on physical and chemical data collected during the baseline soils survey. Certain soils on a portion of the tailings impoundment would be salvaged in two lifts. The surface layer would be salvaged in other disturbances.

Soil stockpiles would be located in areas to minimize impacts from wind and water erosion, impacts from ongoing operations, and away from sensitive areas (*i.e.*, wetlands and streams) (Figure 6, Figure 7, and Figure 8). If necessary, stockpile locations would be modified to meet field conditions and accommodate quantities of soils actually salvaged. Soils with more than 50 percent rock fragments generally would not be salvaged. Soils with rock fragment contents up to 60 percent by volume would be salvaged in some areas to provide erosion protection on the tailings impoundment dam and portal patio slopes. Reclamation soil thicknesses would be adjusted, if necessary, according to results of interim reclamation and site-specific conditions, as determined by the lead agencies.

Soil would be salvaged and replaced without stockpiling when feasible, primarily at the tailings impoundment, or stockpiled as close as possible to redistribution sites. Active soil stockpiles would be protected to minimize wind and water erosion. Soil stockpiles would be constructed with 40 percent side slopes and 33 percent sloping ramps where possible. As stockpiles reached their design capacity, they would be stabilized and seeded during the first appropriate season following stockpiling. Fertilizer, mulch, and tackifier would be applied as necessary to promote soil stabilization and successful revegetation. Weed control would be an important aspect of the soil storage and protection. MMC's Weed Control Plan describes the measures that would be employed to minimize noxious weeds.

2.4.1.2.1 Stormwater Control and Discharges

MMC would use standard Best Management Practices (BMPs) for sediment control such as interim reclamation, diversions, berms, sediment fence, sediment traps and ponds, and straw bales. Revegetation practices would be used to control water erosion by providing a stabilizing cover. Interim stabilizing measures such as water sprinkling, mulch, and tackifiers would be used until vegetation becomes established. Sediment would be contained from processing and material handling operations in lined sediment control ponds. Soil would be salvaged in two lifts at the impoundment. Subsoil with increased rock fragment content would be placed on the 4H:1V tailings dam face.

The Ramsey Plant Site and adit portal patios would be constructed with a combination of waste rock and native cut-and-fill material. The waste rock at the Ramsey Plant Site would be placed so that it was surrounded by native material, thereby preventing direct contact of surface water runoff with waste rock. Surface runoff from the Ramsey Plant Site would be directed to a collection ditch on the southern side of the Ramsey Plant Site (Figure 5). The water would then flow by gravity to a lined mine/yard pond sized to accommodate the 100-year/24-hour storm event volume (including sediment), 4 hours retention of the thickener overflow, and 3 feet of excess capacity or freeboard as a safety factor. The mine/yard pond would be lined with clay or a geomembrane to achieve a very low permeability (less than or equal to 10^{-6} cm/sec). Excess water in the pond could be used as mill make-up water, stored in the tailings impoundment, or disposed at the LAD Areas (Table 14).

Runoff and seepage from the plant site fill slopes above Ramsey Creek would be collected in ditches and directed to an unlined sediment trap (Figure 5). The sediment trap would be designed to contain runoff from a 10-year/24-hour storm event. Excess water beyond the capacity of the trap would discharge 300 feet from Ramsey Creek through a constructed discharge point. Seepage to groundwater may be considered a discharge to surface water and subject to MPDES permitting requirements if it has a direct connection to surface water. MMC expects that a surface water discharge from the unlined sediment trap would be “intermittent” because, at build-out, most of the surface area of the pad would be covered with impermeable materials and any surface runoff would flow to the lined mine/yard pond. Water from the lined mine/yard pond would be used in the mill as needed. MMC expects a discharge to Ramsey Creek from exposed waste rock would only occur intermittently during construction.

The portal patio surface water would be stormwater runoff and would be directed down the access road, through a culvert at the Ramsey Creek bridge toward the mine/yard pond. A unlined sediment trap would be constructed below the portal patio and would be sized to handle a 10-year/24-hour storm event.

MMC would be responsible for snow removal from all access roads and the Ramsey Plant Site. All snow and ice removed from the site would be deposited according to mine drainage water management plans, including being left at the Ramsey Plant Site or Libby Adit Site or hauled to LAD Areas 1 and 2 or tailings impoundment. All debris removed from the road surfaces except snow and ice would be deposited away from the stream channels. Snow removal would be conducted in a manner to minimize damage to travelways, prevent erosion damage, and preserve water quality. Culverts would be kept free of snow, ice, and debris. MMC would not use salt on the roads.

In addition to the temporary diversion of Little Cherry Creek at the tailings impoundment, a permanent diversion ditch would be installed adjacent to NFS road #278 to direct runoff from the tailings impoundment (Figure 8). Diversion ditches would be constructed to capture runoff down gradient from all disturbances. Below the tailings impoundment, where possible, ditches containing runoff would be directed toward the Seepage Collection Pond; otherwise, appropriate BMPs would be used to handle stormwater that was not classified as mine drainage water or process water. Collection ditches/berms would be installed around the soil storage piles to reduce soil erosion/loss and control sediment impacts. Interim and concurrent reclamation would be employed where possible to reduce sediment delivery and enhance soil stability.

Stormwater associated with disturbance activities at the LAD Areas 1 and 2 (*i.e.*, access roads) would be directed toward the main access road and managed as part of the stormwater management system. A series of ditches and berms would be constructed to control runoff from the road surface. Other areas would use standard BMPs to reduce sediment delivery and to control erosion. A run-on diversion would be installed up gradient of LAD Area 1 to minimize the amount of water that would enter the site. The access road would provide run-on control to LAD Area 2.

2.4.1.3 Ramsey Plant Site and Adits

MMC would build a plant adjacent to Ramsey Creek (Figure 5), consisting of the following facilities:

- Mill and administration building and associated parking
- Tailings thickener tank
- Mine/yard pond
- Coarse ore stockpile building
- Warehouse
- Explosives storage
- Electrical substation
- Other miscellaneous facilities

Two parallel, 16,000-foot-long production adits would be excavated directly southwest of the Ramsey Plant Site (Figure 4). One adit would serve as the main conveyor adit for ore extraction and an exhaust airway. The other adit would provide an intake for fresh air underground and access for personnel and materials during operations. The adit portals would be outside the CMW boundary. Portal patios, which are flat working surfaces outside the adits, would be constructed by cutting into the sideslope, creating a vertical face for adit construction and an area for staging of supplies. Each adit would be about 30 feet wide by 30 feet high. During construction, four ventilation fans would be located outside of the adit portals, and include inlet and discharge attenuators to meet a total noise level of 85 dBA at 3 feet (Big Sky Acoustics 2006, 2015). Fan locations would be determined during final design.

During adit construction, a lined retention pond would be constructed at the Ramsey Plant Site to handle water during construction of the Ramsey Adits. Water would report to this pond from the adits. A pipeline would be installed to convey water to LAD Areas. The pond would provide storage of 62 acre-feet of water (1 week's storage of temporary inflows of 2,000 gallons per minute (gpm)). After the Starter Dam was built at the impoundment site (see section 2.4.1.5, *Tailings Impoundment*), water would be diverted to the impoundment area for storage and mill startup. The pond would then be enlarged and relined, once storage at the tailings impoundment were available, to the final size required for operations (shown as the mine/yard pond on Figure 5). The pond would be available for use during construction and would provide additional storage capacity/surge storage during mill start-up and other periods.

Underground development would include excavation of a crusher station and related ore and waste rock bins, and development of main mining benches, haulage drifts, and ore and waste passes. At the terminal end of the Ramsey Adits, MMC would build an underground primary rock crusher. MMC anticipates construction of the Ramsey Adits that would connect with the Libby Adit to the crusher station would begin about 6 months after project inception and take about 12 months. The Ramsey Adits would decline to the ore body at an 8 percent slope. MMC would construct the Ramsey Adits from both the surface at the Ramsey Creek portal and underground from the Libby Adit Site.

MMC would excavate a ventilation raise, the Rock Lake Ventilation Adit, beginning vertically from the center of the ore body and then horizontally to private land 800 feet east and 600 feet higher than Rock Lake (Figure 4). Air would be drawn into the ventilation raise to supply fresh air for underground workers. No fans or other facilities are proposed on the surface. The Rock Lake Ventilation Adit would be a combination of a drift from the ore body, a vertical raise, and a short adit to the surface. The portal opening would be about 15 feet wide by 15 feet high and gated with a steel grate or similar structure. The short adit from the vertical raise to the portal would be sloped back into the mine, collecting any water inflow back into the mine. Grouting and other water management techniques would be used to minimize inflow of subsurface water into the raise. The ventilation raise would be constructed from inside the mine and would not require any surface activities, with the exception of creating the surface opening. Total surface disturbance associated with the Rock Lake Ventilation Adit would be about 1 acre. The ventilation adit is not anticipated to be required to support mine construction activities but would be installed during the initial mine production period.

In 2006, MMC received DEQ approval for Minor Revision (MR 06-002) to extend the Libby Adit 3,300 feet to the ore body and to conduct underground evaluation drilling and geotechnical and hydrogeologic studies. MMC would use the Libby Adit Site for ventilation and a secondary escape route for underground workers (Figure 6). Additional drilling beyond the evaluation drilling would be completed during the pre-production phase of the project to provide information required for mine planning beyond the first 5 years of production.

2.4.1.4 Waste Rock Management

All waste rock produced during construction and operations would be stored in waste rock stockpiles in the Ramsey Plant Site or LAD Area 1, and then used for tailings embankment construction, Ramsey Plant Site and portal construction, or placed in mined out sections of the mine (Table 10) for ongoing tailings dam construction. During pre-production and possibly during operations, waste rock would be temporarily stored at an unlined area in the LAD Area 1 for future use in dam construction material. Waste rock stored in the LAD Area 1 waste rock stockpile would be no higher than 50 feet above the original ground contours. All waste rock would be removed from the stockpiles by the end of operations. For scheduling and construction reasons, some waste rock generated during adit construction would be stored temporarily near the adits (Libby Adit Site or Ramsey Plant Site). The majority of the waste rock would be directly

Table 10. Estimated Schedule for Waste Rock Production and Disposal, Alternative 2.

Project Stage	Tons	Bank Cubic Yards	Disposal Area
Evaluation Drilling	298,000	130,000	Temporary lined storage pile at Libby Adit Site, then to tailings embankment
Pre-production Waste Rock	1,548,000	668,000	Temporary unlined storage pile at both adit sites, then to tailings embankment
Initial Production	288,000	128,000	Tailings embankment
Production with Tailings	576,000	256,000	Tailings embankment
	144,000	64,000	Inside mine
Production Only	864,000	384,000	Inside mine
Total Waste Rock	3,718,000	1,630,000	
Ore	333,000	148,000	Temporary unlined storage pile near the Ramsey Adit portal, then to mill

Source: MMC 2008.

hauled to LAD Area 1 (Figure 7) or to the tailings impoundment area for dam construction. During operations, waste rock generated that would not be required for the tailings impoundment would be placed in mined out areas underground.

The waste rock sampling plan is described in MMC's waste rock management plan (Geomatrix 2007b). During mining, MMC would collect representative rock samples from the adits; ore zones; above, below, and between the ore zones; and tailings. MMC would conduct static and kinetic testing on these samples to evaluate the acid-producing potential. Acid-base accounting results, total sulfur analyses, and pH measurements would be documented.

Acid-generating materials would be segregated for special handling as they were mined and would be placed under sufficient cover to minimize direct exposure to the atmosphere and precipitation. Such locations could include the inner portions of the tailings dam and inside the mine workings. No rock materials would be used for construction before determination of its acid-producing potential. In addition, waste rock generated from the underground lead zone would be minimized, to the extent possible, due to higher lead concentrations present in this rock zone, and the greater potential for acid generation. Lead zone waste rock would be segregated from other waste rock and disposed underground.

All waste rock data would be evaluated with water quality monitoring data to determine whether any changes in water quality were the result of acid or sulfate production. Annual reports documenting sample location, methodology, detection limits, and testing results would be submitted to the lead agencies. Acid-base accounting results would be correlated with lithology and total sulfur analyses.

2.4.1.5 Tailings Impoundment

2.4.1.5.1 Tailings Deposition Method

Tailings management depends on the amount of solution or water mixed into or removed from the tailings, *i.e*., the slurry density, for purposes of deposition. The most appropriate method of tailings management for a given project depends on several factors including tailings characteristics, disposal site conditions, and project-specific factors such as production rates and environmental constraints. A detailed description of the agencies' analysis of tailings deposition methods available under current technologies is provided in section 6.0 of the *Tailings Disposal Alternatives Analysis* (ERO Resources Corp. 2011a) and summarized in section 2.13.7, *Surface Tailings Disposal Method Options.*

2.4.1.5.2 Site Location

MMC's proposed tailings impoundment site is 5 miles northeast of the Ramsey Plant Site, in the Little Cherry Creek watershed. The tailings impoundment would consist of several structures: a diversion dam, a starter dam, a main dam, two saddle dams, and a seepage collection system (Figure 8). The tailings impoundment has a design capacity of about 115 to 120 million tons and, at the planned operating period of 16 years, the tailings impoundment would have an excess capacity of an additional 22 million tons, or 3 years of production (Table 11). MMC would prepare a operation and maintenance manual and an emergency action plan consistent with the DNRC's requirements for high hazard dams.

Table 11. Daily and Total Tailings Production Estimates.

Time Frame	Daily Production (tons per day)	Total Production (tons)
Years 1-5	12,500	23 million
Years 6-10	17,000	31 million
Years 11-16	20,000	44 million
Years 17-19	20,000	22 million (excess capacity)
Maximum Capacity		120 million

2.4.1.5.3 Design Criteria

The design criteria for the Little Cherry Creek tailings impoundment is described in the Tailings Technical Design Report (Klohn Crippen 2005). The impoundment freeboard during operations would include the following: storage of 20 days of tailings discharge; storage of the design flood, which is the runoff from the two-week probable maximum precipitation (PMP) plus snowmelt; and freeboard of 3 feet above peak flood water surface.

Section 6.6 of the report indicates the design flood was determined in the following manner. Morrison Knudsen Engineers (1990) estimated the 24-hour probable maximum precipitation at the Little Cherry Creek impoundment site to be 11.9 inches, with an associated 3.9 inches of snowmelt. Applying a factor of safety of 2 to these values provides an estimated value of 32 inches, which is estimated to be equivalent to at least a two-week PMP, plus snowmelt. The required flood storage is therefore estimated as 32 inches over the total impoundment area or 1,170 acre-feet, which is equivalent to 15 feet of storage for the Starter Dam and 3 feet of storage for the Final Dam. Because of these design criteria, an emergency overflow structure in the impoundment was not included in the impoundment design of any alternative.

2.4.1.5.4 Diversion Dam and Channel

The initial step in constructing the tailings disposal facility would be the construction of a Diversion Dam and Channel. A permanent diversion dam and channel system would be constructed at the tailings impoundment area to route Little Cherry Creek around the tailings impoundment to an unnamed drainage (Drainage 10) in the Libby Creek watershed (Figure 8).

The Diversion Channel would consist of three main components: an "engineered" upper channel, a middle channel, and a lower channel. Overall length of the Diversion Channel would be 10,800 feet. The upper channel would convey the Probable Maximum Flood (4,150 cubic feet per second (cfs)) around the tailings impoundment. The upper channel would be 3,200 feet long, 40 to 60 feet deep, and 19 feet wide at the bottom. Within the upper channel, a secondary channel would be constructed. The secondary channel would be designed to contain the average annual high flow in the channel. Wetlands along the upper channel would be excavated. Excavated channel material would be used to construct the Diversion Dam and the Starter Dam; any remaining material from the excavation would be used to construct a portion of the South Saddle Dam. Excavated wetland soils may be used in wetland mitigation.

If the bedrock were deeper than anticipated or of poor quality, riprap would be used for erosion protection. The channel foundation would be lined with compacted silty clay/clay to keep surface flows above the riprap. The upper channel would include a 300-foot, stair-stepped chute structure at the channel outlet. This structure, which would be comprised of 3-foot-high gabions, would dissipate flow energy, minimize erosion potential, and increase channel stability. If erosion were observed during or at the end of operations, rockfill bars or gabions would be placed perpendicular to the natural stream channel below the Diversion Channel to provide energy dissipation and protect against erosion.

MMC identified two channels that could be used to convey water from the upper channel to Libby Creek: Drainage 10 and Drainage 5 (Figure 8). The northern drainage (Drainage 10) is currently a 3,800-foot long drainage that is primarily unchannelized in the upper part and has perennial channelized segments interspersed with unchannelized wet and dry segments in the lower part. The southern drainage (Drainage 5) is about 3,000 feet long with similar characteristics to Drainage 10. Flow in Drainage 5 does not appear to reach Libby Creek (Kline Environmental Research 2012). A larger culvert at NFS road #1408 west of Libby Creek would be installed. MMC proposed to install a control gate structure where Drainages 5 and 10 join to control flow in both drainages. Kline Environmental Research (2012) found that the two drainages were not joined and were separated by a small ridge. An energy dissipater would be constructed at the outlet section of both channels to reduce flow velocity of water entering Libby Creek. MMC identified a variety of measures that may be used to control erosion and sedimentation and to create aquatic habitat (Geomatrix 2006b).

After the upper engineered section of the Diversion Channel was constructed, and improvements to Drainages 5 and 10 were completed, MMC would construct a Diversion Dam across Little Cherry Creek. The Diversion Dam would initially act as a low water storage dam, which would direct Little Cherry Creek into the Diversion Channel. Initially, the Diversion Dam would be 60 feet high and have a crest elevation of 3,695 feet. The initial dam would have a low permeability center, with general fill in the upstream and downstream outer zones, and riprap on the diversion side to minimize erosion. The slopes would be steep (0.5H:1V) (Figure 9). Immediately before closure of the Diversion Dam, MMC would collect all fish in the existing stream section and move the fish to the newly constructed diversion channel. An intermediate holding pond or tank may be needed when relocating Little Cherry Creek fish. The old Little Cherry Creek channel below the tailings impoundment would no longer receive surface flows from above the Diversion Dam.

Toward the end of mine operations, when the tailings impoundment elevations would rise above the dam, it would be raised to a height of 83 feet (3,718 feet elevation) in conjunction with the tailings. Raising of the initial dam would be completed using a homogeneous low permeability fill material, with tailings providing support for the tailings impoundment side of the fill.

2.4.1.5.5 Borrow Areas

To supplement materials excavated during Diversion Channel construction, material would be excavated from borrow areas for use in the Starter Dam, North Saddle Dam, Diversion Dam, Diversion Channel, and other facilities. Material requirements and quality would vary by facility. Borrow material also would be required for rip rap, road material, reclamation capping, and other uses. MMC has identified four borrow areas, one within the impoundment area (Borrow Area A) and three west and south of the impoundment area (Borrow Areas B, C, and D), as sources of construction material (Figure 8).

2.4.1.5.6 Starter Dam

After the Diversion Dam and Channel were operational and Little Cherry Creek was diverted, a Starter Dam would be required to establish the initial impoundment area. The Starter Dam would be a 120-foot-high earthfill dam across former Little Cherry Creek, with a 30-foot-wide crest, and slopes of 2.5H:1V above 3,450 feet elevation and 4H:1V below 3,450 feet elevation on both the upstream and downstream sides of the dam (Figure 9). The fill would consist of locally available silt-sand-gravel glacial deposits from borrow areas. Waste rockfill from the underground mine development also would be used in the downstream portion of the dam (Table 10). The fill would be placed in maximum uncompacted lifts of 1 foot. All boulders larger than 1-foot diameter would be removed from the fill. Any wetlands within the Starter Dam footprint not filled during construction of the seepage collection system (see next section) would be filled with Starter Dam fill material. During Starter Dam construction, a temporary water reclaim/storage pond would be constructed upstream from the Starter Dam to hold water until the Starter Dam was complete.

Soft, clayey material is present beneath the south abutment of the Starter Dam. A portion of the clayey material would be excavated, stored within the disturbance area, most likely borrow areas, and backfilled with compacted fill to act as a “shear key” for stability (Figure 9). A shear key is an area excavated beneath the dam. Up to three shear keys (100 feet long by 35 feet wide) may be required under the final dam footprint. The extent of the glaciolacustrine clay and its strength would be assessed during final design to optimize the location and extent of the shear keys. Other soft, unsuitable materials, such as wetland soils under the footprint of the Starter and Main Dams, would be either excavated and transported as backfill for the borrow areas, or filled with suitable foundation material, such as general fill from borrow areas or Diversion Dam excavation. Final design for management of these types of materials would be submitted to the agencies for approval. A high-density, polyethylene (HDPE) geomembrane liner would be placed beneath the upstream portion of the Starter Dam fill, up to an elevation of 3,460 feet, and keyed into the low permeability zone of the dam (Figure 8 and Figure 9). Above an elevation of 3,460 feet, seepage control would be provided by a spigotted tailings beach and seepage collection drains.

2.4.1.5.7 Seepage Collection

In the 1992 and 1993 RODs and the DEQ Operating Permit #00150, the lead agencies required NMC to modify the impoundment design to minimize the seepage from the tailings impoundment to the underlying groundwater. MMC incorporated this requirement into the current tailings impoundment design. A seepage collection system would collect seepage from in and around the tailings impoundment. The collection system would consist of a Seepage Collection Dam and pond, underdrains beneath the dams and impoundment, blanket drains beneath the dams (Figure 9), and a pumpback well system, if required. The seepage collection system would be constructed concurrently with the Starter Dam.

The impoundment underdrain system would consist of a two main trunk drains, and a series of secondary lateral drains (Figure 8). One of the main drains would follow the former Little Cherry Creek channel. The lateral drains would be spaced 300 feet apart and would be constructed in the old stream channel, adjacent wetlands, and upland areas in the impoundment. The lateral drains would convey water to the main trunk drains, which would then convey water to the Seepage Collection Pond (see below). The lined water storage pond behind the Starter Dam would not have an underdrain system, but the main trunk would pass under the lined area to the toe of the Main Dam. To facilitate the construction of the trunk lines in the former Little Cherry Creek channel, compacted fill material would be placed in the former channel to facilitate the preparation of the main trunk drains. During construction of the seepage collection system, any wetlands uphill of the Main Dam would be filled. All drains would be placed in a geomembrane-lined trench and consist of a core of highly pervious 1- to 4-inch rock wrapped in geotextile and surrounded by sand and gravel filter material. Locally available sand and gravel alluvial material would be used to cover the drains to prevent the fine tailings from piping into the drain materials during operations.

The underdrain system beneath the Starter and Main dams would use the same design as the trunk drains. The majority of the system would be constructed along and in or above the former stream channel alignment. Lateral lines would be installed in the dam footprint and would be tied to the main trunk drains. The former stream channel and connected wetlands would be filled with sand material to provide a sand bedding to meet trunk and lateral drain design specifications. Blanket drains would be used to control the phreatic (water saturation) level within the Starter Dam, Seepage Collection Dam, North Saddle Dam, the South Saddle, and the Diversion Dam. The blanket drains would be placed under the downstream one-third of the dam footprint (Figure 9). Construction of the blanket drains would consist of a 3-foot thick sand filter and a sand/gravel drain.

After the Diversion Dam and Channel were operational and Little Cherry Creek was diverted, a Seepage Collection Pond and Dam would be built across former Little Cherry Creek, about 100 feet downstream of the tailings impoundment. The dam would collect seepage and runoff from the tailings impoundment (Figure 8). The dam would be designed as a homogeneous fill dam with a downstream toe filter/blanket drain. The dam would have 2.5H:1V slopes and a 30-foot-wide crest at an elevation of 3,325 feet (Figure 9). The final elevation of the dam would be controlled by the available storage developed by borrowing material from the interior of the pond. The pond would be lined with clay or a geomembrane to achieve a permeability of less than or equal to 10^{-6} cm/sec. The pond would be designed to hold one week of flow from the underdrain system and runoff from a 100-year/24-hour storm, or 2.6 acre-feet. An emergency spillway would be constructed in the right abutment of the Seepage Collection Dam. Water collected by the Seepage Collection Dam would be piped to the tailings impoundment and returned to the mill for reuse. The reclaim pumping system would be able to pump up to 2,000 gpm back to the impoundment.

MMC committed to implementing seepage control measures, such as pumpback recovery wells, if required to comply with applicable standards. Seepage pumpback wells could be installed along the downstream toe of the tailings dam. Given the heterogeneity of the foundation soils, additional wells could be required to ensure that all flow paths were intercepted. The wells may require active pumping, depending on the artesian pressures within the wells (Klohn Crippen 2005).

2.4.1.6 Transportation and Access

MMC would provide transportation to employees using buses, vans, and pickup trucks. Because transportation would be provided, the use of personal vehicles would be limited. The bus hub would be located in a convenient location in Libby, Montana, most likely the Kootenai Business Park. In addition to mine personnel traffic, necessary supplies for operations would be transported by road to the mine site. Deliveries of supplies would be scheduled for day shift, Monday through Friday only. During full production (20,000 tons/day), anticipated daily vehicle count including employee vehicles are shown on Table 12.

Table 12. Estimated Mine-Related Traffic during Operations on NFS Road #278.

Time	Vehicle and Capacity	Trips	Vehicle Total Per 24 Hours
Day shift 0800 to 1600	Concentrate trucks – 20-ton capacity	21	42
	Supply trucks – various capacity	5	10
	Pick-ups vans	10	20
	Employee transportation – buses/cars/pickups	5	10
Swing shift 1600 to 2400	Pick-ups vans	10	20
	Employee transportation – buses/cars/pickups	3	6
Night shift 2400 to 0800	Pick-ups vans	10	20
	Employee transportation – buses/cars/pickups	2	4
Total		**66**	**132**

Trip - 1 round trip = 1 vehicle in and out – counts as 2 vehicle passes
(vehicle up and back = 1 round trip, and equates to 2 vehicle passes)
Caravan of 3 vehicles up and back = 3 round trips. – equates to 6 vehicle passes
Source: MMC 2008.

Access road maintenance, including weed control, would be MMC's responsibility, unless additional use by the KNF or other interests would warrant a cost-share agreement. This responsibility would revert to the KNF or road owner following project completion.

The following sections describe road use and public access along the main access road (Bear Creek Road (NFS road #278) and in each proposed permit area. With the exception of the Bear Creek Road, all open roads in the proposed operating permit areas would be gated and restricted to mine traffic only. Some gated or barriered roads would be used throughout operations for mine traffic only. Table 13 lists only those roads whose status would change in Alternative 2. For example, NFS road #2317 is listed in Table 13 because a 1-mile segment is currently open and would be gated in Alternative 2. NFS road #5184 is not listed in Table 13 because it is currently closed and would remain closed throughout the life of the project.

2.4.1.6.1 Bear Creek Road (NFS Road #278)

The first 9.5 miles of the Bear Creek Road is paved with hot mix asphalt, and the asphalt road surface is chip-sealed and in poor condition Bear Creek Road crosses Bear Creek at MP 9.5; the bridge across Bear Creek is 14 feet wide. The remainder of the road is a native (dirt) surface. In order for MMC and the public to use the road safely together, some upgrading and widening of the road would be required. MMC is proposing to do these improvements and maintain the road as part of the project activities. About 10 miles of the Bear Creek Road (NFS road #278), from US 2 to the Bear Creek bridge, would be reconstructed to applicable road standards set by the either the KNF or Lincoln County. The road would be widened on its existing alignment and chip-sealed. The roadway width would be 20 to 29 feet wide. The disturbed area, included ditches and cut-and-fill slopes, is expected to be up to 100 feet wide. Road widening would be generally on the fill side of the road. Between US 2 and the start of the proposed permit area boundary at Bear Creek, 79 acres would be disturbed.

Table 13. Proposed Change in Road Status for Roads used during Construction, Operations, and Closure Phases in Alternative 2.

NFS Road #	Road Name	Location	Existing Status	Length (miles)	Proposed Status
1408	Libby Creek Bottom	Tailings Impoundment	Open	0.9	Gated, mine traffic only
2316	Upper Libby Creek	Libby Adit Site	Open	1.4	Mixed Mine Haul and Public Traffic
2317	Poorman Creek	LAD Area 1	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.1	Gated, mine traffic only
2317	Poorman Creek	LAD Area 1	Open	1.0	Gated, mine traffic only
2317B	Poorman Creek B	LAD Area 1	Impassable, open to snow vehicles 12/1-4/30	0.8	Gated, mine traffic only
278	Bear Creek	Tailings Impoundment	Open	1.1	Gated, mine traffic only
278L	Bear Creek L	Tailings Impoundment	Barriered year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.3	Gated, mine traffic only
278X	Bear Creek X	LAD Area 2	Barriered year-long to motor vehicles, open to snow vehicles 12/1-4/30	1.0	Gated, mine traffic only
4781	Ramsey Creek	Between LAD Areas 1 and 2	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	2.8	Gated, mine traffic only
4781	Ramsey Creek	Between LAD Areas 1 and 2	Open	1.2	Gated, mine traffic only
5003	Cherry Ridge A Extension	Tailings Impoundment	Barriered year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.8	Gated, mine traffic only
5170	Poorman Creek Unit	LAD Area 2	Open	0.2	Gated, mine traffic only
5181	L Cherry Loop H Cowpath	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.5	Gated, mine traffic only
5181A	Little Cherry Loop H Cowpath A	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.2	Barriered, no mine traffic
5182	Little Cherry Bear Creek	Tailings Impoundment	Open	1.6	Gated, mine traffic only

NFS Road #	Road Name	Location	Existing Status	Length (miles)	Proposed Status
5183	Little Cherry View	Tailings Impoundment	Impassable, open to snow vehicles 12/1-4/30	0.5	Gated, mine traffic only
5184	Bear-Little Cherry	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.7	Gated, mine traffic only
5184A	Bear-Little Cherry A	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.2	Gated, mine traffic only
5185	S Bear-Little Cherry	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.9	Gated, mine traffic only
5185A	S Bear-Little Cherry A	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.3	Gated, mine traffic only
5186	Ramsey Creek Bottom	LAD Area 2	Barriered year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.5	Gated, mine traffic only
6201	Cherry Ridge	Tailings Impoundment	Barriered year-long to motor vehicles, open to snow vehicles 12/1-4/30	1.2	Gated, mine traffic only
6201A	Cherry Ridge A	Tailings Impoundment	Barriered year-long to motor vehicles, open to snow vehicles 12/1-4/30	1.2	Gated, mine traffic only
6210	Libby Ramsey Creek	Libby Adit access	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	2.1	Gated, mine traffic only
6210	Libby Ramsey Creek	Libby Adit access	Open	0.4	Gated, mine traffic only
6212	Little Cherry Loop	Tailings Impoundment	Open	3.4	Gated, mine traffic only
6212H	Little Cherry Loop H	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.6	Barriered, no mine traffic
6701	South Ramsey Creek	Ramsey Plant	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.4	Gated, mine traffic only
8749	Noranda Mine	Libby Adit Site	Private; gated	0.5	Gated, mine traffic only
8749A	Noranda Mine A	Libby Adit Site	Private; gated	0.2	Gated, mine traffic only
8838	Little Cherry MS 10377 8838	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.2	Gated, mine traffic only
8841	Little Cherry MS 10377 8841	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	1.8	Gated, mine traffic only

The road would be designed to handle speeds of 35 to 45 mph. Design exceptions for slower speeds may be needed on some curves. Mine Safety and Health Administration regulations (30 CFR 56, Subpart H) require that all mines establish and follow rules governing speed, right-of-way, direction of movement, and the use of headlights to assure appropriate visibility, and that equipment operating speeds be consistent with conditions of roadways, grades, clearance, visibility, traffic, and the type of equipment used. MMC would post warning signs for speed limits and other important road conditions and require all mine-related vehicles to follow all traffic control restrictions, such as speed.

MMC would inspect the Bear Creek bridge for load capacity, but expects it would be sufficient for mine use. While NFS road #278 was upgraded in the first 2 years of the Construction Phase, the Libby Creek Road (NFS road #231) would be used for access.

Within the tailings impoundment area, the Bear Creek Road would be relocated and reconstructed in four locations (Figure 8). These sections, and non-realigned sections, would be chip-sealed and the roadway widened to 20 to 29 feet, consistent with the road north of Bear Creek. About 0.5 mile south of the tailings impoundment area and west of the Bear Creek Road, MMC would build 1.7 miles of new single lane road that would connect the Bear Creek Road with the Ramsey Creek Road (NFS road #4781) (Figure 16). A new, single lane bridge over Poorman Creek would be built (Figure 13). Public access on Bear Creek Road would not be restricted. Public access to the new mine access road would be restricted to mine-related traffic.

In all mine alternatives, the KNF would transfer ownership of the Bear Creek Road, from US 2 to the intersection with the Libby Creek Road, to the Lincoln County after it was reconstructed.

2.4.1.6.2 Little Cherry Creek Tailings Impoundment Area

The roads used to haul waste rock from the Libby Adit and the Ramsey Adits to the Little Cherry Creek Tailings Impoundment Area are shown on Figure 16. Except for a short segment of Bear Creek Road (NFS road #278) in the Little Cherry Creek Tailings Impoundment Area, mine haul roads would be restricted to mine traffic only. MMC would use a segment of the existing Bear Creek Road north of LAD Area 2 for mine haul. The crossing of the old Bear Creek Road across Poorman Creek would be built to accommodate the 100-year flow event and be constructed in compliance with INFS standards and guidelines and Forest Service guidance (USDA Forest Service 2008a, 2015b). It would either be a bridge or arched culvert. The crossing width would be consistent with the roadway width.

Besides the Bear Creek Road, Little Cherry Loop Road (NFS road #6212), NFS road #8838 and about a 1.6-mile long segment of NFS road #5182 are the only other roads within the tailings impoundment currently open to motorized access (Figure 16). Gates on the Little Cherry Loop Road (NFS road #6212) would be near the intersection with the Bear Creek Road on the north end and the tailings impoundment permit area boundary on the south end. NFS road #6212 would remain open to motorized access south of the proposed permit area boundary to the junction with Bear Creek Road. Gating the Little Cherry Loop Road (NFS road #6212) would restrict motorized access to NFS roads #5182 and #8838. At the end of operations, gates would be removed and motorized access reopened. A segment of the Little Cherry Loop Road (NFS road #6212) would be covered by the tailings impoundment and would not provide a loop between the Bear Creek Road.

Other NFS gated or barriered roads within the tailings impoundment that would be used during the construction, operations, and closure of the tailings impoundment include: #278L, #1408, #5181, #5183, #5184, #5184A, #5185, #5185A, #6201, #6212H, #8838, and #8841 (Figure 16). MMC does not anticipate using the following currently restricted or barriered roads within the proposed tailings impoundment operating permit area and they would remain closed: #5003, #6201A, and #8838. MMC would have to consult with the KNF before removing the gates or barriers on these roads and using them.

About 7.5 miles of realigned and new road would be needed from the Bear Creek bridge to the Ramsey Plant Site. Motorized access to upper Ramsey Creek and the Poorman Creek Road (NFS road #2317) via NFS road #4781 would be restricted by a gate at the intersection of the Bear Creek Road and the Poorman Creek Road (NFS road #2317). A new bridge across Ramsey Creek would be built between the Ramsey Plant Site and the Ramsey Adit portals (Figure 3). The bridge would be sized to allow for a 50-year flow event. A temporary crossing from the Ramsey Plant

Site to the Ramsey portal patio would be used and then removed following bridge construction. MMC would remove the bridge after it was no longer required to support mine operations and/or reclamation activities for the project.

2.4.1.7 Electrical Power

Electrical power at Libby Adit to dewater the currently flooded segments of the Libby Adit would be provided by three, Tier 3 225-kW electrical generators. Emissions from these generators are below the 25 tons per year that require an air quality permit (TRC Environmental Corp. 2007b). MMC anticipates the need for more power for drift development and drilling. A contractor, Cummins USA, has been issued an air quality permit (MAQP #4063-00) for portable diesel generator sets in various locations throughout Montana. MMC proposes to use these portable 800-kW Tier 2 generators at the Libby Adit under an “intent to transfer” notification for temporary power. Two of the three generators would operate at any one time with the other used as a backup. Under the conditions of the Cummins USA air quality permit, each generator cannot operate more than 6,450 hours in any rolling 12-month period for a total hourly use of 19,350 hours for three generators (DEQ 2007b).

For the Construction Phase, generators would be used to supply up to 1,622 horsepower (1,210 kW) of power. MMC’s Proposed Action in 2005 included Tier 2 equivalent diesel generators for use at the Ramsey Adit Site. To meet new Federal air quality standards finalized in 2010, MMC proposed the use of generators with emissions that would be equivalent to Tier 3 emissions. A temporary substation would be installed near the intersection of NFS road #6210 and the Ramsey Plant Site Access Road (Figure 7) to convey power for the Ramsey Adit activities.

A buried 34.5-kV transmission line along Bear Creek Road and the Ramsey Plant Access Road may be installed to replace the generators before the installation of the main transmission line. The line may be installed if it was needed and MMC acquired easements for its construction across private land on the Bear Creek Road. Flathead Electrical Cooperative would provide power for the 34.5-kV line and MMC would become a Cooperative member. Flathead Electrical Cooperative provides power to private owners along both the Libby Creek Road and the Bear Creek Road via above- and underground electric lines. MMC would upgrade the existing line to 34.5 kV and then extend the line if all necessary easements were acquired. Under Flathead Electrical Cooperative policies, an existing member cannot unreasonably withhold approval to extend the powerline to other members. If the buried 34.5-kV line was installed, which is anticipated to take about a year during reconstruction of the Bear Creek Road, power would be distributed from the temporary substation to the Libby Adit Site and Ramsey Plant Site, and the generators would be used as standby power during construction.

For full operations, a 230-kV transmission line would be installed that ties with the Noxon-Libby transmission line near Sedlak Park (Figure 1) to the Ramsey Plant Site Substation (Figure 5). After the Sedlak Park Substation was built and the main 230-kV transmission line (discussed under section 2.8, *Alternative B—MMC’s Proposed Transmission Line (North Miller Creek Alignment Alternative)*) was installed, the temporary substation would be relocated to the Ramsey Plant Site. One of the generators on the Libby Adit Site would then be relocated to the Ramsey Plant Site and provide standby power for mine operations, the remaining generator at the Libby Adit Site would no longer be required and would be removed from the site.

MMC would design, construct, own, operate, maintain, and reclaim the mill site substation. Peak demand is expected to be 50 megawatts; a transformer of the same size would be needed. A 50-

MW transformer may weigh 50 tons, which would necessitate reinforcing bridges and culverts on stream crossings on the Bear Creek Road and other access roads. The method and requirements of transporting the substation transformer and other mining equipment on access roads would be considered during final road design.

2.4.2 Operations Phase

2.4.2.1 Mining

2.4.2.1.1 Ore Body Characteristics

The ore body is composed of two nearly parallel mineralized horizons that range from 14 to 140 feet thick and are separated by a waste zone called the barren zone (Figure 10). In the 1980s, NMC originally designated the upper zone of the ore deposit as the B-1 Zone and the lower zone as the B Zone. Perhaps to avoid confusion with various beds identified by others (Hayes 1983, Boleneus *et al*. 2005), Mine and Quarry Engineering Services in the Preliminary Economic Assessment (2011) indicated the B zone was subsequently renamed Zone 2 and the B1 zone was subsequently renamed Zone 1. This EIS follows the renamed zone nomenclature. The average thickness of the Zone 1 is 30 feet and Zone 2 averages 34 feet. A barren lead zone, ranging in thickness from 0 to 200 feet and averaging about 30 feet, separates the two ore zones. The ore body outcrops near the northern end of Rock Lake, and plunges about 15 degrees to the north and northwest. The ore body may extend farther to the north and northwest. Overburden thickness ranges from 0 feet at the ore outcrop near the northern end of Rock Lake to more than 3,000 feet near St. Paul Lake. The ore consists of quartzite, silty quartzite, and siltite of the lower Revett Formation. Section 3.9, *Geology and Geochemistry* provides a more detailed discussion of the ore body geology. Rock strength tests were conducted on samples collected from drill cores collected in the early 1980s. Data from the test work were used in mine design, pillar sizes, and other important criteria.

2.4.2.1.2 Mining Method

The ore deposit would be mined using conventional room-and-pillar methods, with both diesel and diesel-electric underground equipment. A room-and-pillar method is where some ore is not mined to provide pillars or columns of ore (Figure 10). MMC's preliminary mine design is based on a rigid-pillar approach. Rigid-pillar design means that all the pillars are designed so that their strength exceeds the loads expected to be imposed on them, and therefore they should not fail or yield. Different pillar types, based on their location within the deposit, are planned to support the overburden ceiling.

Preliminary mine planning was based on a standard pillar size of 40 feet wide by 60 feet long, laid out in a regular grid basis (Figure 10). Average mining height of 48 feet and an entry width (area between pillars) of 40 feet were assumed for initial mine planning. Until a sill analysis can be conducted, pillars would be aligned between the upper and lower zones. Initial estimates indicate 65 to 75 percent of the mineable reserves would be removed. Actual pillar sizes would vary depending on the ore thickness, overburden thickness, local rock quality, and hydrologic conditions. MMC would develop the final pillar design after the Libby Adit and subsequent underground testing were complete.

As part of the Libby Adit Evaluation Phase, MMC would conduct additional underground core drilling before developing final mine plans. The drilling would be used to collect detailed information on underground geologic structures, ore thicknesses, ore grades, and hydrology.

Initial mine development would start in the central section of the deposit. Mining would progress generally toward the outcrop area and take 7 to 8 years to reach the upper portion of the deposit near Rock Lake. MMC would stop mining 500 feet from Rock Lake and 100 feet from the Rock Lake Fault (Figure 11). It is expected that the Rock Lake Fault varies in structural thickness. Drilling would define the fault zone and establish the starting point for the 100-foot barrier in advance of approaching the buffer zone. Before the final barrier pillar design/location was completed, MMC would not mine within the 100-foot buffer zone but would conduct hydrologic and geotechnical studies to determine whether closer mining could be conducted. The following parameters would be determined by exploratory drilling ahead of development and flow testing:

- Fault location and dip (slope)
- Hydraulic conductivities and storage capacities for the fault zone and adjacent transition zones
- Width of the fault and transition zones
- Water pressures in the fault and transition zones

Similar studies would be conducted on the Rock Lake barrier pillar if mining were proposed closer than 500 feet to Rock Lake. These studies would be reviewed by the lead agencies and approval would be required before MMC could mine within a smaller buffer area. Microseismic and conventional monitoring would be used to evaluate long-term stability. Monitoring sensors would be located in operating and abandoned sections of the mine. The sensors would be connected to a continuous monitoring system and would record the size and approximate location of seismic events.

During full production, ore would be hauled from the ore passes to the primary underground crusher using 26- and 50-ton electric haul trucks. Crushed ore would be sent to the ore stockpile building via a 1,200-foot overland conveyor for further crushing and ore recovery (Figure 5). The conveyor crossing at Ramsey Creek would be completely enclosed to minimize fugitive dust and a secondary containment trough would catch falling rock to prevent ore from falling into Ramsey Creek. Spillage within the conveyor structure would be shoveled onto the belt or removed at clean out points at either end of the structure.

2.4.2.1.3 Geotechnical Monitoring

Geotechnical monitoring would be completed to collect rock mechanic data and geologic information that were pertinent to mine design criteria and employee safety. The geotechnical monitoring would be an update to geotechnical monitoring procedures and methods specified in DEQ Operating Permit #00150 and the 1993 ROD. The monitoring would include logging drillholes and mapping of the mine workings and surface features. Rock quality analysis would evaluate fracture and fault frequency, orientation, and other properties, rock strength testing for stress, strain, and strength, and *in situ* geomechanical tests. Microseismic monitoring would be used to assess long-term stability. Microseismic monitoring would include installation of sensor stations in operating and abandoned sections of the mine, and continuous monitoring of sensor stations. Stress monitors would be located near or on faults, barrier pillars, sill pillars, and other important structures/features. Data would be compiled, assessed, and reported to the lead agencies in an annual report.

The monitoring plan would be developed as mine activities were initiated during construction. Mapping would be completed as the adits, development, and mining activities progress. Drilling would be completed as part of the delineation drilling that would occur in advance of mine development and mining. The core would be available to assess fractures, faulting, and establish if the monitoring plan should be modified to include any new features or address any new issue.

2.4.2.2 Milling

2.4.2.2.1 Ore Processing

The mill would operate 7 days per week, 350 days per year for a total processing capacity of 7 million tons per year (20,000 tons of ore per day). Initial production would be 12,500 tons per day (tpd). The milling process would involve five major steps: crushing, grinding, flotation, concentrate dewatering, and tailings storage (see Figure 24 in MMC 2008). Crushing would occur underground while the remaining processes would occur in the mill facility. Reagents added during the flotation process would separate the copper and silver minerals (sulfides) from the host rock (generally quartzite), producing a copper-silver concentrate.

Ore would be processed into a concentrate using a conventional milling process known as froth flotation. In froth flotation milling, finely ground ore is mixed with water and various reagents and air is forced through the mixture in a series of large tanks called flotation cells. Sulfide minerals, such as copper, attach to air bubbles (or froth) that float to the top of the cell and are skimmed off the surface of the flotation cells and collected. Silver is found in its native form and is attached to the sulfide minerals, such as bornite, associated with the ore deposit. Silver would be collected concurrently with the sulfide minerals. Potassium amyl xanthate would be used as the collector and methyl isobutyl carbinol as the frother. These would be the only reagents required for flotation of the Montanore ore minerals. A polyacrylamide flocculant, such as Percol 352, would be used to assist the settling of the concentrate and the fine fraction of the final tailings in their respective thickeners. Percol 352 contains acrylamide, a regulated volatile organic chemical in Montana. The proposed reagents are the same reagents used at the nearby Troy Mine. Material safety data sheets for the proposed reagents are presented in MMC's Plan of Operations (MMI 2005a, MMC 2008).

The non-mineralized rock, called tailings, which would consist mainly of quartzite, would sink to the bottom of the flotation cells (see section 2.4.2.3, *Tailings Management*). Bench-scale testing of Montanore Project ore and evaluation of the Troy Mine milling process, which processes an ore similar to Montanore ore, indicate that the mill process would operate at a near-neutral pH. MMC does not anticipate the need for pH control. Process chemicals may be required periodically for testing, pH modification, or cleaning the flotation circuit and other process circuits in the mill. The flotation process would continue through cleaner flotation cells and would be repeated several times to improve mineral recovery and concentrate quality. After the flotation circuit, the concentrate would be sent to a dewatering system and stored until it was transported to the Libby Loadout (Figure 12) for shipment to the smelter. The concentrate would be the final economic product of the milling process.

2.4.2.2.2 Concentrate Shipment

After dewatering, the concentrate would be stored in a covered building and then loaded into 20-ton, covered, highway trucks by a front-end loader. Truck covers would be used to minimize loss of concentrate. At peak production, about 420 tons of concentrate, or 21 trucks per day, would be trucked daily via NFS road #4781, a new access road (the Ramsey Plant Site Access Road) (Figure 3), NFS road #278 (Bear Creek Road), reconstructed sections of NFS road #278, and US 2 to Libby, and then to an unnamed road accessing the Kootenai Business Park to a loadout facility. The loadout would be next to the Troy Mine loadout. MMC would limit concentrate haulage to daylight hours and not during major shift changes. Concentrates would be stored at the loadout inside an enclosed building with rail access on private land at the Kootenai Business Park in Libby, Montana, (Figure 12) and then shipped via rail to a smelter. For storage and handling of concentrates, a new building would be erected and either an existing concrete pad or a new pad constructed for the building would be used. The facility would be covered to eliminate any precipitation and runoff issues. Trucks would back onto a concrete pad and dump concentrate into the concentrate building. A front-end loader would stack the concentrate in the building for shipping. Rail cars would be loaded by a conveyor belt fed by a front-end loader. Dust control devices would be used during rail loading activities to minimize fugitive dust. The rail car would be located inside an enclosed area to minimize fugitive dust associated with concentrate handling and loading. The openings of the rail car loadout building would be covered with heavy plastic strips or other similar devices. The railroad track would be extended to permit storage of rail cars. Covers for the rail cars would be used to minimize loss of concentrate.

MMC and the Kootenai Business Park have signed a letter of intent to operate the loadout facility. During final design, MMC would finalize this agreement and discuss retention of the facility for future use by the Kootenai Business Park. For purposes of planning, Kootenai Business Park and MMC expect the building would be retained.

2.4.2.3 Tailings Management

2.4.2.3.1 Tailings Pipelines

Tailings from the milling process would be separated at the mill and tailings impoundment into coarse-textured sand (sand tailings) and fine-textured clay (fine tailings) fractions. The sand fraction and water would flow as a slurry by gravity through a 10-inch diameter double-walled, HDPE pipe on the surface from the mill 6.4 miles to the tailings impoundment, where the slurry would be sent to cyclone separators (cyclones) for further separation of dam construction material. Fine tailings from the mill would be transported to the tailings impoundment through a 14-inch double-walled, HDPE or equivalent type pipeline. Reclaimed process water would be returned to the mill from the tailings impoundment in a 14-inch to 16-inch HDPE pipe or similar pipe (Figure 13).

The fine tailings would flow to a thickener northeast of the mill (Figure 5). Thickener overflow (water) would be diverted directly back into the process circuit or to the mine/yard pond (see section 2.4.2.4, *Water Use and Management*). All pipelines would be routed in part on the ground surface along the existing road (Figure 3). A pump station would be needed at a low spot near a new Poorman Creek bridge (Figure 13). This pump station also would pump tailings and water to the tailings impoundment to clear the line in the event of a temporary shutdown due to mechanical or power failure.

MMC designed measures to prevent or mitigate ruptures in the tailings pipelines. MMC would construct a second sand fraction tailings line to use when the first line was in need of repair or replacement. The pipelines would be double-walled and fitted with air release/vacuum valves to ensure consistent flow. An automated leakage sensing system would continuously monitor line operation, and the sensing system would include the installation of magnetic flowmeters on the tailings line at the mill and at the tailings pond. If a flow differential signal were received at the control room, an alarm would sound, and the mill would be systematically shut down, starting with the feed conveyors to the grinding mills. Valves on the tailings line at the mill would be closed. The final tailings pump would by-pass the cyclones and pump directly to the tailings thickener. Sensors would also be installed along each pipeline to monitor the space between the inner and outer pipes. If a leak were detected, the signal would be sent to the control room, and the shutdown procedures would be initiated. The surface pipelines between the mill and the tailings impoundment would be visually inspected each shift. An additional inspection would take place during scheduled maintenance shutdowns. The pipelines would be routed in a 24-foot-wide flat bottom ditch to contain any leakage from the pipelines. An unlined 6-foot-wide ditch paralleling the entire length of the road and pipelines would intercept any released tailings (Figure 13). Containment and surface water runoff ditches would be constructed with an earthen berm between them. This berm would ensure that in the event of a rupture of the double-walled pipe, all tailings would remain in the ditch and not come in contact with surface waters. A lined flume and trestle would be constructed (Figure 13) where the pipelines would cross Poorman Creek.

2.4.2.3.2 Main Dam and Saddle Dams

The tailings impoundment would consist of four primary structures: Starter Dam (discussed in section 2.4.1.5, *Tailings Impoundment*), Main Dam, North Saddle Dam, and South Saddle Dam (Figure 8). The Main Dam would be a compacted cyclone sand dam constructed by the centerline method to an elevation of 3,718 feet with a crest width of 30 feet, and downstream slope of 4H:1V (Figure 9). It would be constructed over the Starter Dam. The maximum dam height would be 318 feet and the final crest length would be 5,200 feet. The dam would be raised using up to 30 million tons of cyclone underflow (sand tailings) hydraulically placed and compacted in cells. The cyclone overflow (fine tailings) would be discharged in the impoundment to form a tailings beach on the dam face, forcing water away from the dam. If necessary, mine waste rock would be used in dam construction to supplement the volume of cycloned sands.

The sand shell of the dam would be constructed by hydraulic sluicing of the sand into cells oriented parallel to the dam crest. Dikes of sand pushed up by bulldozers would confine the perimeter of the cells. The cells would range between 100 feet to 150 feet wide, up to 400 feet long, and a maximum of 3 feet thick. Cell construction would begin at the toe of the dam and progress back and forth across the dam face until the downstream slice reaches the dam crest. For each year of construction, sand placement would start at the downstream toe of the dam and be raised up the dam slope to the required crest elevation. Because the final crest elevation would not be achieved until October at the end of each season, each year's dam raise would provide the required storage needed until October of the following year. This would ensure that adequate dam freeboard and tailings storage capacity would be available at all times.

A collection system would be installed at the downstream end of the cells to decant the runoff water and segregated finer tailings out of the cells. The outflow would be carried in a pipeline to the dam toe where the fines would be settled in the Seepage Collection Pond, before pumping the water back the tailings facility. When the sand built up at the discharge end of the cells to between 10 feet to 15 feet, the cell deposition would be advanced along the dam slope. The cycle would be repeated when the full length of the dam had been raised 10 feet to 15 feet.

The South Saddle Dam would be a combination of a compacted general fill starter and cycloned sands, and would be constructed in Year 8 (Figure 8). The starter would contain 280,000 cubic yards of general fill. General fill would be excavated from borrow areas within the impoundment area and available mine waste rock. A North Saddle Dam would be constructed of 170,000 cubic yards of compacted general fill material and would be constructed in Year 11 (Figure 8). A blanket filter and drain would be installed under the compact fill on the impoundment side or downstream portion of the North and South Saddle dams.

2.4.2.4 Water Use and Management

2.4.2.4.1 Project Water Requirements

The project water balance is an estimate of inflows and outflows for various project components (Figure 14). Actual volumes for water balance variables (*e.g.*, mine and adit inflows, precipitation and evaporation, dust suppression) would vary seasonally and annually from the volumes estimated. MMC would maintain a detailed water balance that would be used to monitor water use (the agencies' modified requirements are in Appendix C). During the Evaluation and initial Construction Phases, mine and adit inflows would be sent to the LAD Areas, or the Water Treatment Plant, if necessary. After the Starter Dam was constructed, some water would be stored at the Little Cherry Creek Tailings Impoundment Site for initial mill use. Discharge at the LAD Areas would be 500 gpm during the 3-year Construction Phase (Table 14). After mill operations began, all mine and adit inflows would be needed for mill operations, and no discharges would occur. Seasonal fluctuations in mine and adit inflows and water intercepted by the impoundment would be managed by storing water in the impoundment.

Sometime after the first 5 years of mill operations, additional water, or make-up water, would be needed at the mill. Make-up water requirements are expected to average 159 gpm over Project Years 16 to 24 (Table 14). Additional water rights would be required to provide adequate make-up water (see next section). In accordance with DEQ Operating Permit #00150, MMC would notify the lead agencies if long-term surface water withdrawals would be necessary. Groundwater withdrawals from alluvial wells also would be covered under these requirements. MMC would modify the aquatic life monitoring plan to take into account such withdrawals. Withdrawals would proceed only upon the lead agencies' approval of an updated aquatic life monitoring plan. MMC would not withdraw any surface water for operational use whenever flow at the point of withdrawal was less than the average annual low flow. In lieu of measured annual low flows, calculated low flow at the point of withdrawal using data from similar drainages, would be acceptable.

Table 14. Average Water Balance, Alternative 2.

Phase—>	Evaluation Phase Two Years		Construction Phase Three Years			Operations Phase 1st 5 Years	Operations Phase 2nd 5 Years	Operations Phase 3rd 5 Years	Closure Phase 1st 5 Years	Post-Closure Phase 2nd 5 Years
Project Year—>	**Project Year 1**	**Project Year 2**	**Project Year 3**	**Project Year 4**	**Project Year 5**	**Project Years 6-10**	**Project Years 11-15**	**Project Years 16-24**	**Project Years 25-29**	**Project Years 30-39+**
Production Rate—>	**0 tpd**	**0 tpd**	**0 tpd**	**0 tpd**	**0 tpd**	**12,500 tpd**	**17,000 tpd**	**20,000 tpd**	**0 tpd**	**0 tpd**
Component	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**
Mine and Adit Inflows										
Adit inflow	230	230	340	395	450	270	270	200	0	0
Mine inflow	30	30	30	30	30	110	110	170	0	0
Total inflow	**260**	**260**	**370**	**425**	**480**	**380**	**380**	**370**	**0**	**0**
LAD/Water Treatment Plant										
Inflows - mine and adit flows	260	260	370	425	480	0	0	0	0	0
Runoff from Libby Adit waste rock stockpile	3	3	0	0	0	0	0	0	0	0
Water from tailings impoundment seepage/runoff collection	0	0	134	75	20	0	0	0	500	500
Water treatment plant/LAD Area discharge	**263**	**263**	**504**	**500**	**500**	**0**	**0**	**0**	**500**	**500**
Mill Inflow										
Flows from mine/adit	0	0	0	0	0	380	380	370	0	0
Water from tailings impoundment seepage/runoff collection	0	0	0	0	0	1,328	1,854	2,222	0	0
Make-up water (not specified)	0	0	0	0	0	0	89	159	0	0
Subtotal	**0**	**0**	**0**	**0**	**0**	**1,708**	**2,324**	**2,751**	**0**	**0**
Mill Outflow										
Water transported with tailings at deposition	0	0	0	0	0	1,702	2,315	2,742	0	0
Water in concentrate	0	0	0	0	0	6	9	9	0	0
Subtotal	**0**	**0**	**0**	**0**	**0**	**1,708**	**2,324**	**2,751**	**0**	**0**

Phase—>	Evaluation Phase Two Years		Construction Phase Three Years			Operations Phase 1st 5 Years	Operations Phase 2nd 5 Years	Operations Phase 3rd 5 Years	Closure Phase 1st 5 Years	Post-Closure Phase 2nd 5 Years
Project Year—>	Project Year 1	Project Year 2	Project Year 3	Project Year 4	Project Year 5	Project Years 6-10	Project Years 11-15	Project Years 16-24	Project Years 25-29	Project Years 30-39+
Production Rate—>	0 tpd	0 tpd	0 tpd	0 tpd	0 tpd	12,500 tpd	17,000 tpd	20,000 tpd	0 tpd	0 tpd
Component	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)
Tailings Impoundment Inflow										
Precipitation on stored water pond	0	0	0	117	176	176	448	713	851	470
Seepage collection pond net precipitation	0	0	89	177	266	266	266	266	41	15
Runoff captured from impoundment dam/beach/ catchment area	0	0	46	93	139	139	124	124	25	0
Runoff from waste rock stockpile within impoundment	0	0	4	4	4	4	12	0	0	0
Water transported with tailings at deposition	0	0	0	0	0	1,702	2,315	2,742	0	0
Water released from fine tailings consolidation	0	0	0	0	0	27	54	71	125	24
Water released from sand tailings consolidation (dams)	0	0	0	0	0	69	228	407	14	7
Groundwater interception/ seepage collection	0	0	0	0	0	246	246	246	246	246
Subtotal	0	0	139	391	585	2,628	3,693	4,570	1,302	761
Tailings Impoundment Outflow										
Dust suppression	0	0	5	5	5	12	24	33	33	0
Evaporation	0	0	0	109	163	163	415	662	790	436
Water retained by tailings voids	0	0	0	0	0	1,011	1,374	1,628	0	0
Water recycled to mill (water treatment plant/LAD Area in pre/post operations)	0	0	134	75	20	1,328	1,854	2,222	500	500
Seepage to groundwater	0	0	0	0	0	15	25	25	25	25
Change in water stored in impoundment	0	0	0	203	397	100	0	0	(45)	(200)
Subtotal	0	0	139	391	585	2,628	3,693	4,570	1,302	761

MMC proposes that mine and adit water discharged to the LAD Areas would receive treatment through the land application (*i.e*., mine and adit water would not receive treatment before land application). MMC would use the Water Treatment Plant at the Libby Adit Site or install a new water treatment facility at the Ramsey Plant Site, if necessary to meet MPDES permitted effluent limits. The initial startup of the mill would require a large quantity of water. MMC would store sufficient water during construction to facilitate the mill startup process. The construction of the Starter Dam would be initiated concurrent with the Ramsey Adits development. Untreated water from the Ramsey Adits would be piped to the lined mine/yard pond at the Ramsey Plant Site, or LAD Area 1 and 2 until the Starter Dam was completed. After the lined pond behind the Starter Dam was built, water from the Ramsey Adits would be conveyed to the lined water reclaim pond behind the Starter Dam until the desired water quantity was achieved. Once this level of water was achieved in the Starter Dam, Ramsey Adit discharges to LAD Areas 1 and 2 for treatment and disposal would resume. During mine operations, the water reclaim pond would be maintained, within the impoundment area, at a minimum capacity of 30 million gallons for water clarification. Pond location would move throughout the life of the tailings impoundment but would remain along the approximate centerline of the tailings impoundment. Initially, the reclaim water pond would be located near the Starter and Main Dams and progress to the west. All lateral drains beneath the reclaim water pond would be underlain by either the geomembrane liner, or tailings before being covered with the reclaim pond. Water from the tailings impoundment would be pumped back to the mill in a 14- to 16-inch-diameter, 1-inch-thick double-walled HDPE or similar surface pipeline that would parallel the tailings pipelines. Post-closure water use and management is discussed on page 105.

2.4.2.4.2 Water Rights

MMC holds two 1902 surface water rights on Libby Creek, one for mining near the Libby Adit site in Section 15, Township 27N, Range 31West (with a maximum diversion of 44.9 gpm between April 1 and December 19, and maximum volume of 50.97 acre-feet), and one for domestic use in the same section (15 gpm year-round, and a maximum volume of 1.5 acre-feet). MMC also holds a 1989 groundwater right for mining near the Libby Adit site in Section 15, Township 27N, Range 31 West with a total diversion of 40 gpm year-round. These rights would likely be sufficient to meet anticipated uses for drilling and potable water use during the Evaluation Phase and potable water use and dust control during all other phases, but insufficient for mining uses. MMC estimated that water rights of 200 to 300 gallons per minute would be sufficient to cover water deficits. MMC did not apply for any beneficial water use permits for Alternative 2.

2.4.2.4.3 Wastewater Discharges and Water Treatment

The DEQ issued a MPDES permit to NMC in 1997 for Libby Adit discharge to the local groundwater or Libby Creek. Three outfalls were included in the permit: Outfall 001 – percolation pond discharging to groundwater; Outfall 002 – drainfield with three infiltration zones discharging to groundwater; and Outfall 003 – pipeline outlet to Libby Creek. The percolation pond has an estimated capacity of 25 acre-feet (8.1 million gallons). If the pond reaches capacity, an overflow pipe routes water to a direct discharge to Libby Creek (Outfall 003) (DEQ 2006). Since MMC began dewatering of the Libby Adit, it has only reported discharges to Outfall 001. The DEQ renewed the permit in 2006. A minor modification of the MPDES permit in 2008 reflected an owner/operator name change from NMC to MMC. In 2010, MMC applied to the DEQ to renew the MPDES permit and requested the inclusion under the permit of five new stormwater outfalls needed in Alternative 3 for the next 5 years. MMC submitted supplemental information in support of the renewal application in 2011 (Geomatrix 2011b). The status of the requested permit renewal is discussed under Alternative 3.

During operations, MMC would maintain the permitted outfalls at the Libby Adit Site. Before construction, MMC would apply for additional outfalls for discharges of wastewater and stormwater. Potential wastewater discharges associated with Alternative 2 would include:

- Seepage or percolation to groundwater from LAD Areas 1 and 2
- Stormwater runoff and/or seepage from waste rock stockpile(s) at LAD Area 1
- Stormwater runoff from the Ramsey Plant Site and portal
- Stormwater runoff from the Little Cherry Creek Impoundment Site
- Stormwater runoff from access roads used for the mine or transmission line

Tailings seepage that did not reach surface water would be considered a discharge to groundwater. Discharges to groundwater by projects covered by a Hard Rock Operating Permit are exempted from Montana's groundwater discharge permitting requirements. The EPA established Effluent Limitations Guidelines (ELGs) applicable to mines that produce copper and silver and mills that use the froth-flotation process for the beneficiation of copper and silver (40 CFR 440.100 through 105). The following discharges subject to the ELGs would include, but not be limited to: mine and adit drainage, tailings impoundment seepage, tailings impoundment dam runoff, runoff from facilities constructed of waste rock if subjected to precipitation and commingled with mine drainage or process water, and runoff of excess water from LAD Areas 1 and 2. The discharges would be regulated at an outfall in a MPDES permit. The following discharges would be subject to Montana's stormwater regulations, but not to the ELGs: soil and waste rock stockpiles, access roads, parking areas, and runoff or seepage of facilities not constructed of tailings. Management of stormwater discharges are discussed in the prior section 2.4.1.2.1, *Stormwater Control and Discharges*.

Land Application Disposal

MMC constructed and operates a Water Treatment Plant to treat adit and mine inflows from the Libby Adit. MMC proposed to use the LAD Areas for treatment and disposal of adit and mine inflow water from the Ramsey Adits. MMC would dispose of adit and mine inflows during construction and operations at LAD Areas 1 and 2 between Ramsey and Poorman creeks (Figure 7) using spray irrigation techniques. As part of the overall water management plan, MMC would use the Water Treatment Plant at the Libby Adit Site or install a new water treatment facility at the Ramsey Plant Site if necessary to meet MPDES permitted effluent limits. If land application of excess water resulted in BHES Order limit or nondegradation criteria exceedances, MMC would treat the additional water at the Water Treatment Plant instead of discharging it to the LAD Areas.

Concurrent with the Ramsey Adit completion, MMC would construct a 10-acre lined surge pond at LAD Area 1 (Figure 7). The surge pond would convey water to the spray irrigation system. During construction, mine and adit water from the Libby Adit could be discharged via the existing outfalls 001, 002, and 003 or LAD Area 1. MMC plans to install a pipeline from the Libby Adit area to the LAD Areas.

Wastewater would be disposed of through irrigation of 200 total acres at the two LAD Areas. MMC proposes to operate both LAD Areas concurrently, with the anticipated capability of irrigating at a peak rate of 558 gpm (279 gpm annually or 558 gpm over 6 months, Geomatrix 2007b). The combined LAD Areas would have a capacity of 2,000 gpm of water during the 6-month growing season. If disposal of higher quantities of water were required due to greater than expected mine dewatering rates, the water would be stored in the tailings impoundment and/or discharged to one or more of the supplemental LAD Areas following any necessary treatment to meet MPDES permitted effluent limits (see section 2.4.2.4.4, *Excess Water Management*).

Each LAD Area would have above-ground irrigation pipes and sprinklers 4 to 8 feet above the ground surface. The LAD Areas would require selective tree thinning to allow a 50-foot unrestricted spray radius around each sprinkler. Typical operation would cycle all sprinklers once per week and apply about one inch of water per cycle. The maximum application rate per sprinkler would be about 4 inches per month and 24 inches over the 6-month growing season. The average application rate is 0.04 inch per hour; the application rate would vary depending on climate and site-specific conditions. Additional detail about LAD operations is found in MMC's Plan of Operations (MMI 2005a, MMC 2008).

The LAD Areas would be 300 feet or more from any perennial stream (Figure 7). In addition, sprinkler systems would be designed so that areas within 100 feet of ephemeral drainages could be shut off during periods of surface water runoff. MMC is evaluating the option of using snow-making equipment to convert stored water into snow during the winter season. This snow would be spread over LAD Areas 1 and 2. Snow-making would only be performed after an assessment was completed and approved by the lead agencies regarding potential for excess loading to LAD Areas 1 and 2 during the winter season.

Infiltration and/or runoff from stormwater on the waste rock stockpile at LAD Area 1 would subject to MPDES permitted effluent limits. MMC proposes to collect LAD Area 1 surface water runoff in an unlined ditch extending northward along NFS road #4781 and routed into an unlined sediment retention pond (Figure 7). A second unlined ditch and pond are proposed for runoff from LAD Area 2. These two ponds would be sized to contain runoff from a 10-year/24-hour storm event. An overflow from either pond is proposed to discharge pipe to Poorman Creek via overland flow. Seepage from unlined ponds would discharge to groundwater. To reduce stormwater-mine drainage commingling on the LAD Areas, runoff from undisturbed upgradient areas would be diverted around both LAD Areas. LAD Areas 1 and 2 would be used seasonally.

The Waste Rock Stockpile at LAD Area 1 would be a staging area for temporary and intermittent placement of waste rock during construction of the tailings impoundment dams. In addition, MMC anticipates minimal to no surface water discharges from LAD Area ponds due to the design capacity (10-year/24-hour storm event).

Tailings Seepage

As part of the conditions of DEQ Operating Permit #00150, MMC designed an underdrain system to collect tailings water from beneath the tailings impoundment to minimize seepage to underlying groundwater (Figure 8). Water collected by the underdrain system would flow beneath the tailings dam, down a short segment of the former Little Cherry Creek, and be captured by the Seepage Collection Dam. MMC estimates 25 gpm of tailings water seepage would not be collected by the underdrains and would discharge to groundwater. A pumpback well system downgradient of the impoundment, if required to comply with applicable standards, would collect tailings seepage after it mixed with groundwater beneath the impoundment (see section 2.4.2.4.3, *Seepage Collection*).

2.4.2.4.4 Excess Water Management

The LAD Areas and tailings impoundment would be the primary wastewater storage and disposal areas. MMC would use a number of techniques for managing project-related inflows and discharges, such as the existing Water Treatment Plant, grouting fractures and joints to reduce groundwater inflows, storage in the tailings impoundment coupled with enhanced evaporation (evaporating water by spray irrigation, either at the tailings impoundment or LAD Areas 1 and 2), and LAD Area/Supplemental LAD Area. These techniques are briefly discussed in the following sections.

Water Treatment Plant

The Water Treatment Plant at the Libby Adit Site could be used to treat 500 gpm mine and adit water at its current capacity. Actual flow rate would depend on mine and adit water quality. The existing infrastructure at the Libby Adit Site would allow piping of the water from the Ramsey Adit and mine workings via the Libby Adit. A series of collection sumps would be constructed to remove sediment before discharge to the Water Treatment Plant.

Collection and segregation of “clean” groundwater from normal mine drainage water in areas where large water inflows occur could reduce the volume of water requiring treatment. The technique involves drilling an array of holes into a water-producing zone and directing the water into a collector pipe. The inflowing groundwater would be unaffected by mining activities and could be discharged without treatment while maintaining compliance with MPDES permitted effluent limits. Segregation of water may be difficult and not practical or feasible. This technique would not affect the water balance, but could reduce the mine water volume needing treatment.

Underground Water Management - Grouting

The bedrock encountered by the adits and mine would have low permeability. Several large faults and many smaller fractures, capable of storing and transmitting groundwater, would be encountered during mine development. To reduce the amount of water entering the adits and mining areas, MMC would grout areas where water was flowing into the adits and mine workings. Drilling would occur ahead of drift development to allow identification of potential inflows. Grouting would be used as the primary mechanism to reduce adit and mine inflows.

Tailings Impoundment Storage

An estimated 71 million gallons of water (220 acre-feet) would be required to initiate mill operations, and MMC plans to slowly build this water inventory during construction activities. The lined Starter Dam would be designed to hold the required amount of water for mill startup.

During Starter Dam construction, a temporary water retention structure upstream from the Starter Dam would be constructed to hold water temporarily until the Starter Dam was complete. Once the tailings facility was in full operation, MMC expects the impoundment would have ample storage capacity to hold excess water.

Winter Discharge/Supplemental LAD Areas

If necessary, LAD Areas 1 and 2 could be used in the winter months using snowmaking equipment for primary treatment of discharges. This method would be used sparingly as it would delay startup of LAD Areas 1 and 2 in the summer. MMC identified supplemental LAD Areas near the two Ramsey Creek LAD Areas 1 and 2 and the Little Cherry Creek impoundment for discharge of wastewater (Figure 15). Borrow pits at the tailings impoundment would be available for untreated water disposal and are anticipated to be required only to handle excess water or temporary increases in water during construction. If the borrow pits were used for land application, wastewater would be applied at a rate that would increase evaporation and plant consumption of water.

Temporary Diversions

Temporary diversion ditches within the tailings impoundment would be used to control water from undisturbed areas. In the event of surplus water, MMC would divert water collected by the temporary diversion ditches within the tailings impoundment, but above the expanding tailings pond. These ditches would divert surface runoff from undisturbed lands within the tailings impoundment perimeter into the Little Cherry Creek diversion, thereby reducing the amount of water entering the tailings impoundment.

Enhanced Evaporation, Infiltration, and Dust Control

Enhanced evaporation would be accomplished by spraying within the tailings impoundment and when land applying untreated water at the LAD Areas. Managing water through a sprinkling system would result in substantial evaporation during certain periods of the year. In addition to evaporation, the LAD Areas would provide infiltration where vegetation would consume some of the water applied. MMC plans to use water to control dust from the tailings beaches. This would consume/evaporate a portion of the water generated from the project.

2.4.2.5 Fugitive Dust Control

Measures to control and minimize fugitive dust are provided in MMC's Application for Air Quality Permit (TRC Environmental Corp. 2006a). A final fugitive dust control plan would be developed and implemented. MMC would use BMPs during construction, operation, and closure to control wind and water erosion. All appropriate precautions would be taken to minimize fugitive dust from all construction and operation activities related to the project, including concentrate transfer and loading activities at the Libby Loadout. These measures would include using mine or adit water or applying dust suppression agents on unpaved roads and work areas on an as-needed basis.

Dust emissions from ore crushing, conveying, and other handling activities would be controlled with water sprays, wet Venturi scrubbers, and enclosures. Such control devices would be included on the primary crusher located underground, the conveyor belt, and the ore stockpile located adjacent to the mill facilities.

MMC's expects that seasonally, dust control at the tailings impoundment would occur continuously, but the decision to operate sprinklers at the tailings impoundment would be made based on regular inspection of the tailings impoundment during the day and on-site weather criteria to be established as part of the fugitive dust control plan. The presence of visible emissions, observed through shift inspection of the tailings impoundment by environmental personnel trained in visual opacity monitoring and by shift operators staffing the tailings impoundment, would prompt sprinkler operation. In addition, specific thresholds for weather conditions such as wind speed, precipitation, and humidity would be developed as part of the fugitive dust control plan to indicate the potential for fugitive dust emissions to occur, prompting sprinkler operation. Weather conditions and sprinkler operations if required would be documented (TRC Environmental Corp. 2006a).

All transfer operations and storage areas at the Libby Loadout would be completely enclosed. Concentrate transported by haul truck to the loadout would be dumped in an enclosed storage bin, and then transferred to rail cars. Loaded rail cars waiting for consolidation into a unit train would be covered to prevent wind losses and water pollution. The potential accumulation of concentrate along the haul truck turn-around, at the concentrate storage area, and along the railroad tracks would be limited, and would be managed by regular clean-up with sweepers (TRC Environmental Corp. 2006a). Groundwater monitoring wells would be installed at the loadout (Figure 12). Regular visual inspections would be completed by site personnel on reclaimed areas to evaluate where fugitive dust emission control measures were in place and properly functioning.

2.4.2.6 Waste Management

During the initial development phase, temporary, fully contained systems would be brought to the site. The self-contained units would be located at the Ramsey Plant Site and the Libby Adit Site. Once construction was completed or they were no longer required, the units would be removed from the sites.

During operations, MMC would install a closed sanitary system that would function similar to the self-contained units and would collect all gray and black water associated with the office, mill, and administration areas. MMC would install buried sewage tanks adjacent to the mill/office building complex and portable toilets would be located underground. Low-flow toilets and shower heads would be installed to minimize the amount of waste water generated. All sanitary waste would be pumped and disposed off-site. MMC anticipates one or two truck trips per week would be necessary to remove sanitary wastes.

Solid waste (excluding domestic/sanitary) would be transported off site to the Lincoln County landfill. MMC anticipates that no hazardous wastes would be generated by the operation. MMC would manage and dispose of any hazardous waste in accordance with applicable federal and state regulations. MMC would dispose of certain materials (ventilation bag, plastic pipe, lumber, and other similar materials) that were used for underground operations and that were damaged or exceed their useful life, would be placed in mined out sections of the mine. Records would be kept on disposal of materials underground and would include the general types of material disposed and the location of the disposal area in the mined out areas.

2.4.2.7 Communications

Communications for the project would be provided by both a telephone system and a two-radio system. Telephone and data communications would be via new, buried utilities (the 34.5-kV electric line) along the Bear Creek Road from Libby if MMC acquired easements for its construction across private land on the Bear Creek Road. Telephone and data communications would be placed on the 230-kV transmission line structures if easements could not be acquired. MMC currently has radio communications to the Libby Adit Site and would use this system for secondary emergency communications. MMC is currently approved to use the local county emergency radio system to communicate with emergency responders. In addition, a fiber optic line would be included on the transmission line and would provide communications between the substations. No additional disturbance would be required for any of the communication systems for the project.

2.4.2.8 Project Employment

Construction would commence during Year 1, with the hiring of 135 employees, and would last about 3 years (Table 15). Construction employment would peak at 155 employees during Year 2. During Years 3 and 4, construction employment would be 65 employees. Total operations employment during Year 1 would be 30 employees, and is expected to reach 450 employees from Years 6 through 16 of the project. The mine is expected to operate 24 hours per day, 7 days per week, for 350 days per year. Maintenance repair and security activities would be scheduled during the remaining 2 weeks of the year.

Much of the construction work would be equipment and specialty services required for project development. Each vendor or supplier may have a local distributor or hire local construction employees to assist in the installation or construction of their particular piece of the project. MMC expects up to 80 percent of the construction workers would be hired locally. MMC is committed to local hire and would encourage contractors to use local hire where possible, including partnerships with local businesses. MMC would work with local job services and educational institutions to outline the types of jobs and skills necessary for training purposes.

2.4.3 Closure and Post-Closure Phases

MMC's reclamation goal is to establish a post-mining environment compatible with existing and proposed land uses and consistent with the 2015 KFP. Specific objectives are: 1) long-term site stability, 2) protection of surface water and groundwater, 3) establishment of a self-sustaining native plant community where applicable and possible, 4) wildlife habitat enhancement, 5) protection of the public health and safety, and 6) attaining post-mining land use. The reclamation plan would be periodically revised to incorporate new reclamation techniques and update bond calculations. Before temporary or final closure, MMC would submit a revised reclamation plan to the lead agencies for approval.

2.4.3.1 Closure and Reclamation of Project Facilities

MMC would accomplish reclamation objectives by stabilizing disturbed areas during and following operations. MMC developed specific plans for each disturbed area.

2.4.3.1.1 Rock Lake Ventilation Adit

Table 15. Projected Project Employment.

Year	Construction			Production			
	1	2	3	1	2-5	6-10	11-16†
Production Rate (tons per day)	0	0	0	12,500	12,500	17,000	20,000
Construction‡	135	155	65	65	0	0	0
Operations	30	130	246	246	246	450	450
Total	165	285	311	311	246	450	450

†Production would continue for 3 to 4 more years if 120 million tons were mined; much lower employment during the 10- to 20-year closure period.
‡Construction employment includes a 23-person crew for the transmission line construction.
Source: MMC 2008.

The Rock Lake Ventilation Adit would be plugged with concrete and any surface disturbance regraded. The adit location is steep and is bare rock; salvaging and replacing soil would not be feasible. If the site had salvageable soil and it could be safely removed, it would be salvaged and seeded. At closure, soil would be replaced and the area reseeded.

2.4.3.1.2 Ramsey Adits and Portals

Adit portals would be permanently closed upon completion of operations. Closure techniques would depend on whether water was produced at the opening. Dry openings would be sealed by using a concrete plug and backfilling with waste rock recovered from the portal patio. MMC would use water inflow data obtained during mining to predict the amount and quality of water expected from the adits. For entries producing water, a water-retaining plug would be installed in competent bedrock. Design of the water-retaining plug would be determined by hydrologic and geotechnical data. Water-retaining plugs may be located deeper into the adit than a dry plug; thus, mine entries from the portal to the plug would be backfilled. Final plugging design for “wet” openings would be prepared for lead agencies’ approved before cessation of operations.

2.4.3.1.3 Ramsey Plant Site

The mill building, conveyors, bridges, administration offices, substations, and other facilities associated with this area would be dismantled and removed once they were no longer required to support mine operations or closure activities. MMC expects the majority of the Ramsey Plant Site facilities be removed, sold, scrapped, and/or disposed locally. Concrete foundations would be broken up and buried on-site. Inert materials would be placed underground for disposal and would be identified in the final closure plan. Buried utilities and pipelines would be left in place and the segment of the system that was exposed at the surface would be cut off 2 feet below the regraded surface and plugged.

The portal opening would be covered with material from the patio and graded to meet adjacent topography (Figure 17). The remaining portal patio area would be regraded to blend with the adjacent topography and promote runoff away from the disturbed area. The slopes would be graded to 2H:1V slope. All portal areas would be soiled and seeded. The sediment control structure located below the portal patio would be regraded so it would not retain runoff once vegetation cover was established on this area. The access road from the Ramsey Creek bridge would be ripped and graded to match the surrounding topography. The bridge would be removed and the area regraded to minimize sediment delivery to Ramsey Creek.

The Ramsey Plant Site would be constructed using a cut and fill sequence supplemented by a quantity of waste rock from the mine operations. Once all the buildings were removed, a portion of the fill material used to construct the mill site would be “pulled” back up the slope away from Ramsey Creek and placed into the cut side of the area. If the cut slopes were not stabilized by interim reclamation at plant closure, the slopes would be reduced to a 2H:1V slope. It is estimated that 87,250 cy of material would be graded during reclamation of the plant site. Internal roads and parking areas would be graded to blend in with the proposed final slope and revegetated using seeding and mulch. The Ramsey Access Road (NFS road #4781) would be reclaimed to pre-operation conditions.

2.4.3.1.4 Libby Adit Site

The DEQ currently holds a reclamation bond to cover reclamation of 11.6 acres at the Libby Adit Site, including plugging the existing adit, associated with its approval of Minor Revision 06-002. The KNF has not approved the activities described in Minor Revision 06-002 that may affect

National Forest System lands. Activities associated with the Montanore Project that are outside the scope of Minor Revisions 06-001 and 06-002 would be a pipeline to LAD Area 1 and 2 from the Libby Adit Site, temporary utilities, and the road connecting the adit site with the tailings impoundment. Reclamation of the Libby Adit Site would follow procedures described for the Ramsey Plant Site. All structures would be removed, and above- and below-grade features would be resloped (Figure 18). The water well would be plugged in accordance with state regulations and all surface piping would be removed to below the ground surface. Internal roads and parking areas would be graded to blend in with the original slope and revegetated using seeding and mulch. Because the Libby Adit Site is on private land, MMC would maintain control of the property with a fence after mining was complete. The agencies would require a bond for long-term monitoring and maintenance, and possible long-term, post-closure water treatment in order to ensure ground and surface waters would be protected from unanticipated impacts.

2.4.3.1.5 Waste Rock Stockpile and LAD Areas

MMC expects all waste rock to be used in various construction activities. It is anticipated that no waste rock would remain at the LAD Area 1 stockpile after cessation of mining operations. Soil removed from this area before its use would be replaced, and the area revegetated.

The surge pond and sprinkler systems at LAD Areas 1 and 2 would be removed when discharge at the LAD Areas was no longer needed. MMC expects to use the LAD Areas after mining cessation to discharge tailings water (see discussion of Tailings Impoundment reclamation below). Any piping used to convey water from the operations to the LAD Areas would be removed and disposed offsite. Concrete outflow boxes would be broken up and buried on site. Surface disturbance from the access road, diversion ditch, and surge pond would be reclaimed and revegetated.

2.4.3.1.6 Tailings Impoundment and Borrow Areas

Tailings Impoundment and Dams

The basic reclamation plan for the tailings impoundment would consist of the following operations:

- Where possible, concurrently distributing soil and revegetating tailings impoundment dam lifts as completed during mine life. Trees would be planted on the reclaimed dam faces. Depositing sand-fraction tailings into the tailings impoundment during the final year of operation to produce the desired tailings gradient at closure (Figure 19).
- Drying the tailings impoundment surface by promoting natural drying/consolidation of tails, and evaporation. Revegetated areas on the tailings surface. If water quality met applicable standards, tailings waters (supernatant of free standing water and water in the tailings mass at closure squeezed out of the tailings mass as the reclamation cap was placed) would be disposed through LAD Areas 1 and 2 or constructed wetlands peripheral to the tailings impoundment. If required, the Water Treatment Plant may be needed to meet MPDES permitted effluent limits.
- Grading the tailings surface as it dried enough to support equipment to eliminate any surface water ponding. The North Saddle Dam would be removed and the surface runoff from the reclaimed tailings impoundment surface would flow overland via a diversion ditch toward the northwest and ultimately into Bear Creek (Figure 19).

- Adding excess waste rock or borrow to help consolidate tailings, produce final reclamation gradients, and give structural support for placing the reclamation cover system.
- Replacing stockpiled soil salvaged from the site during construction in two lifts and revegetating all disturbances through seeding and planting.

All mechanical facilities associated with the tailings impoundment, including the above-ground pipelines, would be removed. All areas associated with the tailings impoundment would have soil replaced and revegetated following operations. The diversion structures for Little Cherry Creek above the reclaimed tailings impoundment would be reclaimed during operations and would remain, routing runoff into the permanent Diversion Channel to Libby Creek (Figure 19).

To minimize potential gully formation at the tailings dam crest, 83,000 cubic yards of riprap would be placed on the dam crest and uppermost part of the dam face. The coarse tailings portion of the dam face would be ripped and covered with 15 inches of rocky subsoil followed by 9 inches of topsoil. Nine inches of non-rocky subsoil followed by 9 inches of topsoil would be placed over the regraded surface of the tailings impoundment and the South Saddle Dam face. The riprap and rocky subsoil would either be excavated from within the impoundment footprint during impoundment and dam construction or excavated from borrow areas.

At closure, the tailings would continue to settle as the tailings consolidate, forcing some of the entrained water in the tailings mass to the surface. Dewatering activities would be implemented to remove this water while incrementally placing the reclamation cover as dewatering activities progressed. An estimated average of 4 feet of fill would be needed to create the proposed final grade needed before soil was placed on the tailings impoundment surface. The fill would either be excavated from within the impoundment footprint during impoundment and dam construction or excavated from borrow areas. It would take up to 20 years for settling and consolidation to stop and to complete the entire cover on the tailings impoundment surface. During operations, MMC would use conventional methods to estimate the amount of tailings settling. MMC would use the estimate to design the final reclaimed pond surface configuration and to determine the amount of earthwork that would be required. MMC anticipates that a shallow depression may form in the center of the tailings impoundment due to tailings settlement. Sand-fraction tailings would be used in the last year of operations to help create the final gradient needed. During grading activities, the depression would be filled with sand tailings, mine waste rock, and/or material from the North Saddle Dam. The amount of tailings consolidation would dictate the final soil and fill volume needed to meet plan designs and would be updated periodically during the life of the project.

During the last year of operations, when the tailings dam crest had been completed to its ultimate operating level, the remaining portion of the cycloned coarse tailings (370,000 cy) would be deposited into the impoundment along the eastern and southern sides of the impoundment and would form a berm. The berm would be graded to the northwest at a 0.5 to 1 percent slope (Figure 19). The final tailings topography would be contoured to direct surface water runoff toward Bear Creek. The North Saddle Dam would be removed so that runoff would drain from the reclaimed tailings impoundment surface toward the Bear Creek drainage. MMC would design a riprapped channel to Bear Creek. The design would incorporate features that provide for stability of this transition zone so that sediment delivery was not increased. Post-operation topography would be achieved primarily by spigoting arrangements in the final years of operation. A small, rockfill check dam would be located just beyond the northwest end of the reclaimed impoundment. The check dam would be designed for the 100-year storm event. Sediment would be removed from behind the dam, if necessary. The final runoff diversion ditch on the upper end of the tailings impoundment to divert water toward the northwest would be left (Figure 19). This ditch would be riprapped with rock to prevent erosion and would be designed for long-term stability. The ditch would be sized to convey the 100-year storm event.

Borrow Areas

The borrow areas would remain until the impoundment reclamation plan was completely implemented to ensure no fill material was required. The borrow area slopes would be reduced to at least a 2H:1V slope and graded to ensure stormwater does not leave the borrow area. The bottom of the borrow pit would be ripped to reduce water retention. Once the areas were no longer needed, the areas would be covered with soil and reseeded.

Post-Closure Water Management

At the end of operations, excess water would be present in the tailings impoundment. The volume of accumulated water would vary monthly in response to precipitation and evaporation and discharges to the LAD Areas 1 and 2. To enhance the removal of water and tailings consolidation, the use of evaporation by spraying on the tailings impoundment surface or LAD Areas 1 and 2, or other approved methods would be employed.

Following cessation of mining, the tailings impoundment would be partitioned to provide an area for water storage. The water level within the tailings would be lowered so construction equipment can work on the surface. Dewatering the top few feet of tailings would be accomplished by promoting natural drying and evaporation. MMC anticipates some difficulty in dewatering the tailings in the center portion of the tailings impoundment surface containing the fine tailings. The tailings in this area would have low bearing capacity. Subgrade reinforcement, such as a geotextile, may be needed for construction equipment to work on the tailings surface. MMC estimates that 10 percent of the area would require this technique and would likely be focused in the area where the final impoundment pond existed.

Seepage through the tailings dams would continue following reclamation. The seepage collection system would remain in place. Seepage to the underdrain system is expected to decrease from 930 gpm to 200 gpm 10 years after closure, reaching a steady state rate of 50 to 100 gpm over a longer period (Klohn Crippen 2005). Seepage collected in the pond would be pumped to the tailings impoundment where it would evaporate, be distributed to LAD Areas or Water Treatment Plant, if necessary, or be used to irrigate reclaimed areas. Seepage from the tailings not collected by the underdrain system is estimated to decrease from 25 gpm during operations, and 22 gpm at closure, to 17 gpm in the first 10 years after closure, and stabilizing at 5 gpm over the long term (Klohn Crippen 2005). The seepage would mix with the underlying groundwater and be intercepted by the pumpback well system, if required to comply with applicable standards. MMC would operate the seepage collection and the pumpback well systems until seepage from the underdrain system and groundwater adjacent to the reclaimed impoundment met BHES Order limits or applicable nondegradation criteria without additional treatment. Long-term treatment may be required if BHES Order limits or nonsignificance criteria were not met. The length of time these closure activities would occur is not known, but may be decades or more.

Following removal, the Seepage Collection Dam and Pond would be graded to blend in with the original slope (Figure 19). After BHES Order limits or applicable nondegradation criteria were met and the Seepage Collection Dam and Pond was removed, seepage from the underdrain system would flow down the former Little Cherry Creek drainage to Libby Creek. Seepage not intercepted by the underdrain system would mix with underlying groundwater and flow to the former Little Cherry Creek or Libby Creek.

2.4.3.1.7 Roads

Roads retained after mine operations and reclamation plans are discussed in MMC's Road Use Technical Memo (MMC 2007). MMC's general road reclamation approach would be as follows:

- Bear Creek Road – The Bear Creek access road (NFS road #278), from US 2 to south of the tailings impoundment, would not be returned to its pre-mine width and the roadway would remain 20 to 29 feet wide. Cut-and-fill slopes associated with widening the Bear Creek access road from US 2 to the new Ramsey Plant access road would be reclaimed immediately following construction.
- New Roads – All new roads, except the Bear Creek access road, constructed for the project would be reclaimed, which would include grading to match the adjacent topography and obliterating the road prism.
- Open Roads – Reclamation of open roads upgraded for operations previously open to the public use would be completed to allow the road to be retained and used in a manner consistent with the pre-operational conditions. The surface would be bladed and sediment control systems inspected and replaced, as necessary. The bridge on NFS road #6210 would be removed and would be reclaimed consistent with open roads.
- Closed or Restricted Roads – Closed roads used for mine operations would be reclaimed to pre-mine conditions. Access restrictions would be upgraded or installed (gates, kelly humps, etc.) as required by the KNF, and the road surface would be scarified and seeded.

Available soil would be salvaged from disturbed areas and redistributed on fill and cut slopes where possible. Where soils were not salvaged during road construction, the road surface would be scarified and prepared for seeding. Soil would not be respread on cut slopes in consolidated material. Resoiled slopes would be broadcast seeded or hydroseeded with the planned seed mixture, dozer tracked where possible, and fertilized and mulched as necessary. Planting of trees and bareroot shrubs is not planned for the roads that were not completely obliterated. MMC would inspect sediment control features and repair or replace controls as needed.

2.4.3.1.8 Monitoring Wells

Monitoring wells associated with the tailings impoundment would be removed and plugged according to ARM 36.21.810. The well casing would be removed below the ground surface, and the well covers removed and disposed off-site. The small area associated with the monitoring well would be regraded to blend with the natural surroundings. The area would be ripped if appropriate and soil would be placed consistent with the general soils placement plans.

2.4.3.2 Interim and Concurrent Reclamation

To maximize site stabilization, weed control, and early completion of final reclamation, MMC would identify appropriate areas each year for interim and concurrent reclamation. Interim reclamation would be conducted in areas where disturbance was required during construction and/or operations. Potential interim reclamation areas include soil stockpiles, road cut/fill sections, borrow pits, plant site fill slopes, and other similar areas. Concurrent reclamation would be completed in areas where mine activities were completed and where no additional disturbance was anticipated. Potential concurrent reclamation areas include the tailings impoundment dam face, borrow pits, temporary roads, and other similar features. Interim and concurrent reclamation would be carried out using the same techniques, seed mixtures, and fertilizer types/application rates as described in the final reclamation activities for the project. Where possible, interim and concurrent reclamation would occur within the same year of disturbance. The necessity for additional reclamation in areas where interim reclamation had occurred would be evaluated by the lead agencies at closure.

2.4.3.3 Revegetation

Compaction and handling would be minimized as much as possible. Soil replacement depths would average 24 inches on the tailings impoundment dam and 18 inches on all other disturbed areas. Soils would be removed in two lifts on a portion of the tailings impoundment area. The areas selected for double lift salvage would have more rock fragments in the subsoil.

Before soil redistribution, compacted areas, especially the adit portal areas, roads, soil stockpile sites, and facilities area, would be ripped to reduce compaction. Ripping would eliminate potential slippage at layer contacts and promote root growth. Soil salvage and redistribution would occur throughout the life of the operation.

Selection of plant species for revegetation was based on pre-mine occurrence; post-operation land use objectives; establishment potential; growth characteristics; soil adaptation and stabilizing qualities; wildlife palatability; commercial availability; and expected moisture, temperature, and soil conditions. Two plant mixtures are proposed: one dominated by species typically found in moist, relatively cool sites, and one with species suited to a wider range of growing conditions. Seed mixtures may be modified, with the lead agencies' approval, due to limited species availability, poor seed quality, site differences, poor initial performance, or advances in reclamation technology. Forbs would not be used in seed mixtures used on roadsides to avoid attracting bears. Seed mixtures would be dominated by native species. Before reclamation, MMC would submit seed information such as seed content and germination testing results to the lead agencies. The lead agencies would adjust seed mixtures as appropriate for site conditions and to meet any 2015 KFP changes.

Seeding rates were designed to average 90 to 100 live seeds per square foot for drill seeding and roughly twice that for the broadcast seeding. Drill seeding would occur on slopes of 33 percent or less. Rocky slopes, areas where organic debris had been spread, or slopes greater than 33 percent would be broadcast or hydroseeded.

On slopes of 33 percent or less, the seedbed would be disced and harrowed. After seeding, straw mulch would be applied at 0.5 to 1.5 tons per acre and anchored with a straw crimper. Some hydroseeded areas of slopes steeper than 33 percent would be mulched with a cellulose fiber mulch and a tackifier. Fertilizer application rates would be based on soil tests; phosphorus fertilizer would be applied before seeding; and nitrogen fertilizer would be applied in growing seasons after seeding.

Tree and shrub seedlings would be planted in selected areas of the Ramsey Plant Site, the Libby Adit Site, and the tailings impoundment. Shrubs and trees would not be planted on soil stockpile sites, portal patios, or along road corridors. Planting density would be 435 trees per acre and 200 stems per acre for shrubs. Seedlings would be planted either continuously in strips on steeper slopes or in highly visible areas, or in randomly placed groupings on level to gently sloping areas. Containerized seedlings would be used when available. When bareroot stock was used, planting densities would be increased by 10 to 15 percent, depending on planting success of containerized stock versus bareroot stock.

Interim revegetation would take place on certain disturbed areas, such as roads, stockpiles, transmission lines, pipelines, and other areas, to reduce erosion and sedimentation. These areas would be broadcast seeded with the interim seed mixture, mulched, and fertilized as necessary. As the tailings dam increased in height, only final slopes would be reclaimed using the permanent seed mixture. All other unreclaimed disturbances would be reclaimed within 2 years after mining completion.

If feasible, seed or plant materials would be collected on site, and soils used for planting trees and shrubs would be inoculated with mycorrhizae. Seeds of species preferred by grizzly bears may be collected and used to supplement existing seed mixtures. When available, blister-rust resistant species would be used.

Reclamation equipment would be worked along contours where possible to minimize creation of erosion channels. Crawler tracking or dragging would be used when work on slopes must be perpendicular to contours. Windrows of woody debris or logs would be placed parallel to slope contours and the bases of long fills. Reclaimed sites would be inspected periodically throughout the reclamation effort to assess progress toward meeting reclamation objectives. Slopes would be visually inspected for rills, gullies, and slope failures and repaired as needed.

2.4.4 Temporary Cessation of Operations

Although a temporary cessation of operations is not planned, uncontrollable circumstances may cause a short-term stoppage in operations. Temporary cessation of operations refers to the suspension of ore processing and/or mining for an anticipated period of up to 1 year. Major steps to be undertaken would include the following:

- Continuing mine dewatering
- Maintaining water management (including treatment, etc.)
- Maintaining all monitoring activities
- Clearing and repairing site drainage and sedimentation control structures to ensure proper runoff and sedimentation control over a sustained period of time
- Contouring and seeding areas susceptible to erosion
- Securing monitoring wells, pumps, and intake structures to prevent equipment damage
- Maintaining access roads to insure project access
- Inspecting, repairing, or replacing signs and fencing around the property
- Implementing facility inspections
- Controlling noxious weeds
- Continuing dust suppression activities on the tailings beach and dam face

MMC would maintain the operation so that startup could be initiated quickly when the situation causing the temporary closure was eliminated. Staffing levels may be reduced to levels necessary but would provide staffing and coverage properly to maintain the facilities and permit. MMC would notify the lead agencies 30 days before any project startup. If the temporary closure were required for an extended period of time (greater than 1 year), MMC would meet with the lead agencies to discuss the project and issues that should be addressed in a temporary closure plan. MMC would submit the temporary closure plan that would outline the specific activities necessary to provide interim protection of resources.

After 5 years of any cessation of mine development or operation, for reasons other than litigation, the KNF would consult with MMC, DEQ, USFWS, Corps, tribal representatives, and other interested agencies on interim or final reclamation plans to be implemented and the timeframes for implementation.

2.4.5 Monitoring Plans

MMC would conduct operational and post-operational monitoring and provide monitoring results to the lead agencies in the annual report for hydrology, aquatic life, tailings impoundment, air quality, revegetation, and cultural resources. Proposed monitoring associated with waste rock is described in section 2.4.1.4, *Waste Rock Management* and monitoring associated with wetlands is described in section 2.4.6.1.3, *Monitoring*.

2.4.5.1 Hydrology

Surface water and groundwater would be monitored during operations at various locations throughout the project area. Groundwater monitoring would consist of periodic groundwater level measurements and collection of samples for laboratory analysis. Proposed monitoring well locations would be located above and below all major project facilities. MMC would install the groundwater monitoring wells before mine construction to establish pre-construction conditions. If the lead agencies determined additional monitoring wells were required for land application in the tailings area, these would be installed before construction activities.

Surface water monitoring would be conducted during the life of the project in conjunction with monitoring of aquatic life. Surface water monitoring would consist of periodic streamflow measurements and collection of samples for laboratory analysis. Any adit discharge would be monitored for quality and flow. Water levels in the tailings impoundment would be measured periodically. Sediment sampling at LB 2000/L2 downstream of the confluence of Little Cherry Creek with Libby Creek would be conducted daily during construction activities, every other day during initial mine operations, and once per week during mine operations/reclamation.

MMC would implement monitoring at Rock Lake to estimate existing groundwater discharge to the lake that would allow subsequent detection of small changes in discharge due to possible dewatering effects of the project. Water budget variables would be measured or estimated, including evaporation, precipitation, surface water inflows and outflows, groundwater inflows and outflows, and continuous lake levels. The lake monitoring system design and evaluation would be coordinated with the lead agencies. If substantial increased mine inflows occurred near Rock Lake, MMC would submit continuous lake level data, weather permitting, and any other lake level data accumulated during the year, within 5 working days and would provide data and evaluation at an increased frequency as determined by the lead agencies.

MMC would collect monthly samples to establish pre-construction conditions in the Little Cherry Creek groundwater wells from March, or as soon as weather permits, through November of the same year. Monitoring wells at LAD Areas 1 and 2 would be sampled monthly whenever mine water was discharged to the LAD Areas 1 and 2, and would continue for at least 1 year following the cessation of discharges. If nitrate or ammonia concentrations increased in groundwater, MMC would notify the lead agencies within 2 weeks and initiate twice-a-month monitoring of all adjacent surface water and groundwater stations.

At the end of the first monitoring year and following submittal of the annual report, MMC would meet with the lead agencies to discuss the monitoring results and evaluate the effectiveness of the LAD system. Following the annual review, the lead agencies would decide whether a change in monitoring or operations would be required. MMC would present the details of the additional monitoring in the final water management/treatment plan to be submitted to the lead agencies for approval that may be deemed necessary based on the annual reviews.

MMC would prepare a report briefly summarizing hydrologic information, sample analysis, and quality assurance/quality control procedures following each sample interval. Data would be submitted to the lead agencies by MMC within a reasonable time (5 to 7 weeks) after each sampling trip. MMC would submit an annual report to the lead agencies summarizing data over the year. In the annual report, MMC would present a detailed evaluation of the data. Data would be analyzed using routine statistical analysis, such as analysis of variance.

2.4.5.2 Aquatic Life and Fisheries

MMC would monitor aquatic insect and periphyton populations at nine sampling locations in the project area. Sampling locations would include one each in Ramsey, Poorman, Little Cherry, and Bear creeks, and five in Libby Creek. MMC would monitor during three periods: in April before runoff, in August during late summer flows, and in October before ice forming in the streams. MMC would monitor fish populations in Libby Creek at 2-year intervals in four stream reaches in lower Libby Creek. Population densities of each fish species captured during the monitoring would be estimated. The condition of all captured fish would be recorded. MMC would estimate the seasonal variation in fine sediment loading (embeddedness) at each sampling station using the “substrate score” methodology. If bull trout spawning or bull trout redds were observed at the four fish monitor stations (L1, L3, L9, and Be2), the surface embeddedness monitoring would be supplemented with the “McNeil Core” substrate sampling methodology, using five representative core samples.

MMC would measure background concentrations and document potential changes in the concentrations of cadmium, mercury, and lead in the fish of Libby Creek. Each year, for 5 years, MMC would collect 10 cuttbow trout, each greater than 4 inches in size, and 10 adult sculpins from Libby Creek at three stations. Collections would be completed during the late-summer to early fall low-flow period. Tissue samples, including homogenized flesh and skin from each fish, would be analyzed to determine cadmium, mercury, and lead concentrations. Thereafter, MMC would resample each site at a 3-year interval to document the trends in bioaccumulation of these metals. MMC would tabulate sampling data and present the monitoring results in the annual reports.

2.4.5.3 Tailings Impoundment

The monitoring consists of four primary areas to be monitored: milling and material production; water balance; geotechnical stability and dam construction; and environment and closure (Table 16).

Reconciliation of the mass balance would be carried out on an annual basis, in conjunction with the water balance. Milling, production, and cyclone records would be kept to document "as-built" conditions. Records of dam construction, including borrow, mine waste rock, and cyclone sand volumes would be maintained. During operations, annual surveys of the impoundment, including water stored of the pond, would be carried out to assist in the reconciliation of mass balance.

The water balance would be reconciled on an annual basis, in conjunction with the mass balance. Records of all flows would be reconciled and the water balance also would use the measured precipitation and evaporation rates on site and observations of areas of beaches and water ponds.

Groundwater monitoring wells would be installed downstream of the Main Dam and downstream of the Seepage Collection Dam. The groundwater monitoring wells would be installed along the two representative hydrogeological sections of Libby Creek and Little Cherry Creek. The location of groundwater monitoring wells would be determined during final design. The wells would be installed at various depths to monitor the main hydrogeologic units including both shallow and deep soil/weathered rock units. Additional wells would be installed downstream of the North Saddle Dam and South Saddle Dam, later in the life of the mine. A preliminary schedule of monitoring wells is presented in Table 16; final well number and locations would be determined during final design. Flow measurement weirs also would be installed downstream of the Seepage Collection Dam and, during operations, in any areas of observed flows. Flow in the Little Cherry Creek Diversion Channel would be measured monthly, and dam seepage flows would be measured quarterly.

During operations, stability monitoring would include the following:

- Piezometers in the dam foundation and fill
- Inclinometers extending through the potential clay units in the foundation
- Seepage monitoring

Electric piezometers would be installed in the dam foundation to measure pore pressures during construction, with particular attention to areas where the glaciolacustrine clay is present in the foundation. Appropriate "trigger" levels would be established, in conjunction with the detailed stability analysis, to provide a management tool to respond to higher than predicted responses. Piezometers also would be installed in the cycloned sand section to monitor the "drawdown" of cyclone water within the dam fill. The piezometers cables would be buried and led to a common readout station at the toe of each dam. Continuous data reading equipment would be installed.

Table 16. Tailings Impoundment Monitoring, Alternative 2.

Technical Area	Item	Monitoring Parameters	Frequency	Comments
Milling and Materials	Thickener underflow feed line to tailings impoundment	Tons and Gallons	Daily	Compiled monthly and reconciled on an annual basis with the water balance Reconcile mass balance with density of tailings (dam and impoundment)
	Secondary cyclone feed line to dam.	Tons and Gallons	Daily	
	Secondary cyclone – underflow and overflow	Tons and Gallons	Daily	
	Water storage in impoundment	Volume of water	Annually	
Dam Volumes	Cycloned sand, borrow, and mine waste rock)	Tons and cubic yards per year	Annually	Annual reconciliation of fill materials
Water Balance	Reclaim pumping rates (volume)	Gallons/day	Daily	Compiled monthly and reconciled on an annual basis
	Irrigation pump rates	Gallons/day	Daily	
	LAD application rates	Gallons/day	Daily	
	Underdrain collection flows	Gallons/day	Weekly	
	Precipitation	Inches	Daily	
	Evaporation	Inches	Daily	
	Approximate pond areas	Acres	Monthly	
	Approximate wet and dry beach and dam areas	Acres	Monthly	
Water Quality	Reclaim water	All parameters listed in Operating Permit #00150 or MPDES Permit MT0030279	Monthly	
	Mine water		Monthly	
	Groundwater seeps		Quarterly	
	Groundwater monitoring wells - Main dam (10) - South dam (1) - North dam (2)		Quarterly	

Technical Area	Item	Monitoring Parameters	Frequency	Comments
Geotechnical Stability	Piezometers - Main dam (10) - South dam (2) - North dam (2) - Diversion dam (2)	Piezometric levels	Monthly	Monitoring of potential pore pressures in the clay; and "normal" dam monitoring
	Inclinometers - Main dam (3)	Deformation (inches)	Monthly	To be located in areas of potential clay
Dam	Material properties	Density and gradation	Weekly	A QA/QC plan would be implemented to measure and monitor density and gradation
Environment	Dust	Visual	Monthly	Routine observations to document potential dust and wildlife use of area
	Wildlife	Visual	Monthly	
Closure†	Consolidation of tailings (10 - settlement plates)	Inches of settlement	Quarterly to annually	
	Piezometers in the impoundment (10)	Phreatic level	Quarterly to annually	
	Revegetation plots	Acres of replanting	Quarterly to annually	

†The operational monitoring would continue for the decommissioning stage until "steady state" conditions were met. Frequency would progressively decrease to quarterly and annually.
Source: Klohn Crippen 2005.

Inclinometers would be used to monitor potential deformation of the dam foundation. The inclinometers would be installed in areas of glaciolacustrine clay and would be extended up through the dam fill. Quarterly observations of any seepage would be documented. The seepage observations would include evidence of piping, flow estimate, and water quality.

Construction QA/QC of dam construction activities would be carried out by a qualified consultant. Responsibilities of the site engineer(s) during construction would be detailed in a field manual before construction and would include standard field and laboratory quality control tests.

Observations would be taken and documented during operations, such as dust from the tailings beaches, including length of time dust was generated, and aerial extent of dried area. The use of the area by wildlife, such as waterfowl, also would be noted.

The monitoring would continue into the closure stage, although the frequency of records would be reduced accordingly as steady state conditions were reached. The following monitoring would be carried out during the Closure Phase:

- Piezometers would be installed within the tailings impoundment area to monitor the progressive “drawdown” of the phreatic surface
- Settlement plates would be installed over the tailings impoundment area to monitor the consolidation/settlement of the tailings to help confirm predicted consolidation behavior for closure
- Monitoring of the success of the ongoing progressive revegetation would be continued until steady state conditions were reached

Stability monitoring of the dam would be performed during operation and after closure. The downstream slope and toe of the tailings dam, the North and South Saddle dams, the Diversions Dam, and the Seepage Collection Dam would be visually inspected daily for evidence of seepage exiting the slope or the downstream toe. A V-notch weir would be located at the downstream toe of the dam to monitor seepage rates. If seepage were noticed, both the seep location and estimated quantity of flow would be recorded and the project geotechnical engineer immediately contacted for inspection and recommendation for mitigation measures, if necessary. During operations, the dam and associated structures would be inspected weekly and measurements taken of freeboard adequacy; beach width; cracking, sloughing, depressions, and erosion of the dam and abutments; changing trends in seepage quantities, piping, and wet spots; and the condition of the Diversion Channel.

2.4.5.4 Air Quality

MMC committed to implementing the monitoring requirements developed by the DEQ for the draft air quality permit. The monitoring plan is summarized in this section and discussed in the DEQ’s Supplemental Preliminary Determination (DEQ 2015a). MMC would install, operate, and maintain three air monitoring sites near the mine and facilities. The exact location of the monitoring sites would be approved by the DEQ. MMC would begin air monitoring at the commencement of mill facilities or the tailings impoundment and continue air monitoring for at least 1 year after normal production was achieved. MMC would analyze for metals shown in Table 17 on the PM_{10} filters once the mill facilities and tailings impoundment were operational. At that time, the DEQ would review the air monitoring data and determine if continued

Table 17. Required Air Quality Monitoring, Alternative 2.

Location	Site	Parameter	Frequency
Plant Area	Site #1	PM_{10}[1] $PM_{2.5}$[3] As, Cu, Cd, Pb, Zn[2]	Every 3rd day according to EPA monitoring schedule
Tailings Area (Up-drainage)	Site #2	PM_{10}[1] $PM_{2.5}$[3] As, Cu, Cd, Pb, Zn[2]	Every 3rd day according to EPA monitoring schedule
Tailings Area (Down-drainage)	Site #3	PM_{10}[1]/PM_{10}[1] Collocated As, Cu, Cd, Pb, Zn[2] $PM_{2.5}$[3]/$PM_{2.5}$[3] Collocated	Every 3rd day according to EPA monitoring schedule (Collocated every 6th day)
		Windspeed, Wind Direction, Sigma theta[4]	Continuous

[1] PM_{10} = particulate matter less than 10 microns.
[2] As = Arsenic, Cu = Copper, Cd = Cadmium, Pb = Lead, Zn = Zinc.
[3] $PM_{2.5}$ = particulate matter less than 2.5 microns.
[4] Sigma Theta = Standard Deviation of Horizontal Wind Direction.
Source: DEQ 2015a.

monitoring or additional monitoring were warranted. The DEQ may require continued air monitoring to track long-term impacts of emissions for the project or require additional ambient air monitoring or analyses if any changes took place regarding quality and/or quantity of emissions or the area of impact from the emissions.

2.4.5.5 Revegetation

MMC would complete soil tests to determine the appropriate fertilizer mix required for successful reclamation. The fertilizer mix and rate would be approved by the lead agencies before being used. Interim reclamation activities would provide opportunities to evaluate the most effective use of fertilizers for final reclamation. The vegetation cover, species composition, and tree planting success would be evaluated during the first year following reseeding or replanting. In addition to a general evaluation, MMC would conduct vegetation monitoring every 2 years during operations at sites representative of various types of disturbance. Control sites in areas unaffected by the project would be established to provide information on site conditions. Reports summarizing survey data would be submitted to the lead agencies. MMC would develop reclamation bond release criteria as part of the overall reclamation plan reviewed and approved by the lead agencies. Part of the release criteria would involve specific, qualitative measurement of revegetation success.

At the end of mine operations, MMC would conduct similar vegetation monitoring every year at sites representative of various types of disturbance. The following characteristics would be evaluated:

- Plant species responses (germination, growth, competition)
- Total and vegetation cover
- Plant species and plant diversity (including weeds)
- Procedures to reclaim steep rocky slopes
- Soil redistribution depth
- Soil rock fragment content
- Effects of fertilizer rates
- Tree planting techniques
- Tree stocking rates
- Viability of bareroot versus containerized stock

MMC would request bond release in phases as specific tasks were completed. The following criteria for revegetation success and bond release would apply to areas where revegetation is the primary reclamation objective:

- Cover – Total cover was least 80 percent of the control site total cover, or the site met a total cover of 70 percent with at least 60 percent of that cover being a live plant community
- Diversity – Dominance by no more than three acceptable plant species, either in the seed mixture or the local native plant community
- Noxious Weeds – No more than 10 percent noxious weeds
- Rills and Gullies – No rills and gullies greater than 6 inches deep and/or wide

Success criteria must be met for 3 years to meet reclamation objectives. If success criteria were not met, MMC would modify seed types and reclamation techniques as appropriate and conduct a second seeding. If the site were stable but still did not meet vegetation release criteria, MMC may modify the plan and reseed again, and would request bond release by the lead agencies.

MMC would regrade and revegetate areas where rills and gullies exceeded the release criteria. If rills and gullies persisted, MMC would review run-on conditions and regrade and/or install sediment control features as appropriate. If site stability were still not achieved, MMC would consider armoring the rills and gullies with riprap, rock lining, or other similar materials to provide a stable drainage pathway. Once the site exhibited stability for 3 years, MMC would request bond release by the lead agencies.

Vegetation monitoring also would assess noxious weeds. Measures outlined in MMC's Weed Control Plan approved by the Lincoln County Weed Control District would be followed during operations and reclamation to minimize the spread of weeds to reclaimed areas. If weed content were above 10 percent, MMC would implement additional weed control methods and apply weed control treatment for 2 years. If after 3 years, the percent of weeds at the reclaimed site were 50 percent of the control site's weed population, MMC would request bond release.

2.4.5.6 Cultural Resources

All remaining un-inventoried potentially affected areas would be intensively inventoried for prehistoric and historic resources. If previously undiscovered cultural resources were encountered, work in the immediate area would stop, and the KNF and the State Historic Preservation Office would be notified. MMC would meet with KNF personnel to determine potential resource value and implement recordation and/or excavation as required. Site documentation would be provided to the KNF. No additional disturbance would proceed until the lead agencies gave approval.

2.4.6 Mitigation Plans

2.4.6.1 Wetlands and Waters of the U.S.

MMC developed a conceptual mitigation plan designed to replace wetland functions and services lost as a result of the project. MMC would replace the existing forested and herbaceous wetlands affected by the project on a 2:1 basis. For example, 10 acres of forested or herbaceous wetlands would be created for every 5 acres of forested or herbaceous wetlands disturbed. Herbaceous/ shrub wetlands would be mitigated with wetlands at a 1:1 ratio. MMC identified 44.6 acres of possible wetland mitigation areas. MMC believes the identified mitigation would be more than the required mitigation acres and should provide flexibility in selecting mitigation by the lead agencies and the Corps.

In all alternatives, the Corps would develop final mitigation requirements for jurisdictional wetlands and other waters of the U.S. In 2008, the Corps and the EPA issued regulations (33 CFR 332 and 40 CFR 230 Subpart J) regarding compensatory mitigation requirements for losses of aquatic resources, such as wetlands. These regulations require in cases where appropriate functional or condition assessment methods or other suitable metrics are available, these methods should be used where practicable to determine how much compensatory mitigation is required. If a functional or condition assessment or other suitable metric is not used, a minimum one-to-one acreage or linear foot compensation ratio must be used. Before issuance of the 2008 regulations, the Corps in Montana used ratios for various mitigation types in determining compensation requirements (Corps 2005a). The Corps developed a stream mitigation procedure for projects adversely affected streams in 2010 and revised it in 2013 (Corps 2013a). MMC's plan is conceptual and would be refined during the 404 permitting process. MMC did not update its mitigation plan for Alternative 2 to reflect the new regulations and stream mitigation procedure but instead developed a mitigation plan for Alternative 3 (see section 2.5.7.1, *Jurisdictional Wetlands and Other Waters of the U.S.*

The following sections discuss on-site and off-site mitigation. According to the compensatory mitigation regulations, on-site means an area located on the same parcel of land as the impact site, or on a parcel of land contiguous to the impact site. Off-site means an area that is neither located on the same parcel of land as the impact site, nor on a parcel of land contiguous to the parcel containing the impact site. Most of the wetland effects in all alternatives would occur on National Forest System lands, with some effect in Alternatives 2 and 4 occurring on land owned by MMC. In the following sections, mitigation is considered on-site if it occurs within a proposed facility permit area and off-site if it occurs outside of a permit area. The Corps is responsible for determining if a mitigation site is considered on-site or off-site.

MMC would create or expand existing wetlands at the following locations (Figure 20):

On-Site

- Little Cherry Creek–2.2 acres
- Little Cherry Creek Diversion–1.6 acres
- Unspecified Little Cherry Creek Site–5 acres

Off-Site

- North Poorman–3.4 acres
- South Poorman–9.7 acres
- Poorman Weather Station–14 acres
- Libby Creek Recreational Gold Panning Area–2 acres
- Ramsey Creek–6.7 acres

2.4.6.1.1 On-Site Wetland Mitigation

On-site wetland mitigation would consist of 8.8 acres within the permit area boundaries. The Diversion Channel around the tailings impoundment would be designed to provide hydrologic functions and values similar to those provided by the conifer-dominated wetlands in riparian areas. MMC anticipates 1.6 acres of wetlands would be created in the Diversion Channel.

Two mitigation sites are proposed in the Little Cherry Creek drainage downstream of the tailings impoundment. One site, not specifically identified, would use groundwater collected from beneath the tailings impoundment to create and maintain wetlands. Flows are expected in the range of 30 gpm and would be directed down low-gradient channels constructed to allow water to flow between and collect in a series of depressions. A complex of herbaceous/shrub wetlands of 5 acres would be created by directing these flows. The wetlands are anticipated to replace functions and values provided by existing herbaceous/shrub wetlands.

The other wetland mitigation site in Little Cherry Creek is along the northern side of the proposed tailings impoundment on land owned by MMC. This area contains a small existing wetland complex. MMC would increase the size of the existing wetlands through small excavations and dams that would retain water longer. MMC may use groundwater collected from beneath the tailings impoundment, if needed. An estimated 2.2 acres of additional shrub-dominated wetlands might be developed at this site.

2.4.6.1.2 Off-Site Wetland Mitigation

About 35.8 acres of potential wetland mitigation sites were identified near the project area but are outside the permit area boundaries: three sites in the Poorman Creek area, one site within the Libby Creek Recreational Gold Panning area, and one site along Ramsey Creek near the LAD Areas. The Poorman Creek sites include South Poorman, North Poorman, and Poorman Weather Station sites.

The proposed South Poorman site is adjacent to an existing 5.9-acre wetland. It could consist of 1.4 acres of new wetlands on the northern side of the existing wetland, and 8.3 acres immediately south of the existing wetland. The North Poorman site is adjacent to and north of a small existing wetland. About 3.4 acres of additional wetlands could be developed at this site. About 14 acres of new wetlands could be developed at this site.

All three Poorman sites have soils and terrain similar to that of the proposed Little Cherry Creek Impoundment Site. Wetlands would be developed through excavation of shallow depressions in locations where surface water would collect and be retained. Artesian wells would be developed to supply water if natural runoff were insufficient to maintain hydrophytic vegetation.

Two acres of newly constructed wetlands could be developed at the Libby Creek Recreational Gold Panning Area. Portions of the existing coarse placer piles would be removed, recontoured to expose groundwater, and revegetated. These new wetlands would be shrub and forb dominated initially, but would eventually become conifer dominated. The Ramsey Creek site is located near the proposed LAD Areas 1 and 2. It is part of an existing human-made wetland area, and would be expanded by spreading out streamflow that feeds the site. MMC estimates this site could be expanded by an additional 6.7 acres.

2.4.6.1.3 Monitoring

To determine the success of the wetland mitigation, monitoring would be initiated after construction of wetlands to assess vegetation growth, hydrological conditions, wildlife use, and integrity of constructed wetlands. Vegetation growth would be monitored in June and August following the first growing season. Monitoring would continue until the Corps had determined that wetland plant communities predominate and the mitigation wetland was self-sustaining, or for a period of 5 years, whichever was greater. Less intensive monitoring would then take place every 2 years thereafter until the end of operations. Species composition and canopy coverage would be recorded for constructed wetland plant communities. Growth of seeded and non-seeded (volunteer) species would be recorded. If seeded species did not become established, supplemental seedings and transplanting would be undertaken. If noxious weeds invaded wetland areas, they would be removed by mechanical methods or other methods approved by the Corps.

The hydrological status of wetlands would be monitored during spring and fall. Surface water depth would be recorded. If no surface water were present, test holes would be excavated to determine the depth of free water and saturated soil. Wildlife use would be monitored in the spring and late summer. Integrity of constructed wetlands would be monitored.

MMC would monitor any effects on existing wetlands downstream of the tailings impoundment. Monitoring of the downstream wetland areas would be completed annually for the first 5 years of mine operation. If functions and values of downstream wetlands were adversely affected, MMC, in cooperation with the lead agencies and the Corps, would develop additional wetland mitigation.

2.4.6.2 Fisheries

MMC proposed the fisheries mitigation developed collaboratively in 1993 by the KNF, FWP, Corps, and EPA to mitigate the fisheries impacts associated with the Little Cherry Creek diversion and the riprapped tailings impoundment overflow channel to Bear Creek. These impacts were the loss of recreational fishing opportunity, the loss of fisheries production in Little Cherry Creek, and loss of functions and values in Little Cherry Creek. MMC would implement one or more projects to mitigate for all identified impacts and would use the following principals in selecting and implementing projects:

- Emphasize mitigation for species of concern (sensitive species) where appropriate
- Strive to create isolated populations of genetically-pure fish. (bull trout, redband or westslope cutthroat)
- Protect, mitigate, and enhance biological production in the affected waters
- Mitigate off-site only when full mitigation of natural production is not possible within the affected waters
- Emphasize natural fish production and habitat when feasible
- Use artificial propagation of fish to enhance populations and provide recreational opportunities only when natural production is not possible

Before any other mitigation work was attempted, and immediately before closure of the Little Cherry Creek Diversion Dam, MMC would collect all fish in the existing stream section and move the fish to the newly constructed Diversion Channel. An intermediate holding pond or tank may be needed when relocating Little Cherry Creek fish. MMC would design the Little Cherry Creek Diversion Channel, to the extent practicable, for fish habitat and passage. MMC's survey of Drainage 10 that would receive diverted water shows that most of the drainage would develop habitat comparable to Little Cherry Creek (Kline Environmental Research 2005a).

Other components of MMC's fisheries mitigation would include one or more of the following:

- Libby Creek Watershed — Conduct fish investigations to determine the genetics, distribution, and abundance of fishes of concern.
- Howard Lake — Construct paved access trails and three fishing platforms for physically challenged recreationists near existing facilities. Restrooms and other facilities would be modified to improve accessibility. Rehabilitate up to 100 feet of the lake outlet to provide spawning and rearing habitat, using pool-riffle control structures, overhead cover, clean gravels, and proper flow-depth controls.

- Ramsey Lake/Creek — Survey the upper reach of Ramsey Creek and Ramsey Lake for suitability as a trout species of concern fishery, implement habitat and barrier work as necessary, and stock with suitable type and number of fish. Construct a vehicle pullout, small parking area near the mill site accessible to motorized public, and a trail around the Ramsey Plant Site that leads to upper Ramsey Creek or Ramsey Lake.
- Libby Creek — Rehabilitate habitat upstream from the mouth of Howard Creek through creation of pool and hiding cover habitat, stabilization of old mining spoils, and channel narrowing; enhance habitat values in stream reach immediately downstream of the Libby Adit Site. Rehabilitation would be based on stream survey results.
- Libby Creek Watershed — Conduct a sediment-source inventory in the watershed, and stabilize, recontour, and revegetate priority source areas, which are typically roadcuts in Libby, Hoodoo, Poorman, Midas, and Crazyman creeks.
- Standard Creek — Survey upper reaches for rehabilitation opportunities. Implement habitat work to mitigate limiting factors. Stock with a trout species of concern. Construct an artificial fish barrier protection if needed.
- Snowshoe Creek — Survey upper reach for channel stabilization and habitat rehabilitation needs. Implement habitat and streambank work as needed to mitigate limiting factors. Stock with a trout species of concern. Liming of watershed to speedup recovery of an aquatic ecosystem may be required.
- Kilbrennan Lake—Rehabilitate the fish population in the watershed to create a self-sustaining wild trout population. Implement habitat rehabilitation work as needed based on a survey.

MMC would be responsible for maintenance of all fisheries mitigation projects until mitigation of fisheries losses were complete and accepted by the lead agencies. MMC would submit project surveys and designs for consultation and agencies’ approval before implementation of any fisheries mitigation project. Five years of monitoring data indicating stable or increasing mitigation success would be required.

2.4.6.3 Grizzly Bear

The Montanore Project would affect existing grizzly bear habitat. The KNF’s 1993 ROD revised the grizzly bear mitigation outlined in the 1992 Final EIS, and adopted the USFWS recommendation of a “reasonable and prudent” alternative identified in a 1993 Biological Opinion for the project. The USFWS’ reasonable and prudent alternative is the basis for MMC’s grizzly bear mitigation plan. The plan consists of habitat protection, measures to reduce mortality risks, and mitigation plan management.

2.4.6.3.1 Habitat Protection

Habitat protection would consist of three parts: road management, habitat acquisition, and management of patented mill claims. Each part is discussed briefly below. As part of its mitigation, MMC would request that the KNF implement access changes on two roads. NFS road #4784 (upper Bear Creek Road) would be closed year-long for the life of the project. The change would be at the location of the existing seasonal gate, which is 2.1 miles from the end of the road. NFS road #4784 was proposed for an access change by the Rock Creek Project, and is no longer available for Montanore mitigation. If Alternative 2B was selected in the KNF’s ROD, and if the

Rock Creek Project had not yet implemented the closure on the Upper Bear Creek Road #4784 before MMC wanted to begin the Evaluation Phase, MMC would implement or fund the decommissioning or placement into intermittent stored service and barrier NFS road #4784 prior to Forest Serve approval to initiate the Evaluation Phase. MMC would maintain and monitor the effectiveness of this barrier until Rock Creek Project initiated activity. The closure would remain in place for the life of either mine. NFS road #4724 (South Fork Miller Creek) would be closed on a seasonal basis (April 1 to June 30) for the life of the project. The change (6.6 miles) would be at the junction of the main Miller Creek NFS road #385.

MMC would purchase 2,826 acres to mitigate for habitat losses not offset by KNF's road access changes. MMC would complete all acquisitions within a 6-year period, beginning at the time of construction, with at least 50 percent completed within the first 3 years. Acquired lands would be approved by the KNF, in consultation with the USFWS and FWP. The location of acquired lands would be within the Cabinet portion of the Cabinet-Yaak Ecosystem (CYE). Preference would be given for lands within the affected Bear Management Units and lands along the eastern side of the Cabinet Mountains. For biological reasons, and because of the potentially limited amount of lands that may be available for acquisition within this area, lands within other portions of the Cabinet Mountain area of the CYE may be considered. Any of the following could occur with the acquired parcels, including mill site or mining claims that MMC might patent as a result of the Montanore Project:

1. MMC may purchase the private parcels directly, and then transfer title to the KNF or other state or federal resource management lead agencies. If the KNF acquired these lands, they would be managed as Management Situation 1 grizzly bear habitat.
2. MMC may purchase the private parcels directly, and then transfer title to a private conservation organization, along with an acceptable conservation easement directed at protecting the land for use by grizzly bears.
3. MMC may purchase private lands directly, and then retain title to the lands, along with an acceptable conservation easement directed at protecting the land for use by grizzly bears.
4. In some instances, MMC may purchase a conservation easement with fee title remaining with the private party. Conservation easements generally would be established in perpetuity.

The KNF may, on a case-to-case basis and in cooperation with the USFWS and the FWP, accept conservation easements established for a fixed period of time extending throughout the life of the impacts. KNF would be given a chance to purchase the land before offering fee title of acquired lands to third parties. The KNF would seek a mineral withdrawal on any acquired lands to prevent future mineral entry. Under certain conditions, MMC might also be able to enter into a land exchange with the KNF, and in return receive lands outside of grizzly bear habitat. After the KNF, in counsel with the USFWS and the FWP, determines that project impacts have ended, the acquired lands could be used by others seeking mitigation for effects on grizzly bears, providing that acceptable conservation easements or other conditions are satisfied to protect these lands for use by grizzly bears.

Prior to construction activities, MMC would provide a $6,217,200 bond (based on $2,000 per acre) to the Forest Service to ensure adequate funding would be available for the required land acquisition. The bond would take into account any lands that MMC might have purchased before construction, providing that the Forest Service, in counsel with USFWS and the FWP, accepted such lands for mitigation. In the event that MMC forfeited the surety bond, MMC would be responsible for all legal fees incurred by the Forest Service. Completion of the acquisition would be a provision of project approval and failure to comply could result in project shutdown. The bond would be reviewed annually to determine if the bond amount should be adjusted.

2.4.6.3.2 Measures to Reduce Mortality Risks

MMC would fund two new full-time wildlife positions, a law enforcement officer, and an information and education specialist, with duties aimed directly at minimizing effects on grizzly bears. The estimated total cost would be about $3.1 million over the life of the project. MMC would fund both positions on an annual basis and coordinate with the employing agency to establish a collection agreement. In the future, if additional mines were developed in the CYE, funding for both positions may be shared by other mining companies.

Duties of the law enforcement officer would be established by the KNF in counsel with the USFWS and FWP, and would be focused toward those enforcement activities needed to: (1) deter illegal killing of bears; (2) investigate reported/suspected bear deaths and help prosecute illegal actions; (3) minimize/eliminate mortality due to mistaken identity during black bear hunting seasons; (4) enforce applicable federal and state laws, regulations, and policy/guidelines regarding proper sanitation practices and elimination of bear attractants; and (5) enforce road access changes and help prosecute violations of road access changes and vandalism. Similarly, the duties of the information and education specialist would focus on: (1) education of school-age children regarding grizzly bear conservation; (2) development of educational materials and programs oriented toward mine employees; (3) implementation of informational/educational materials and programs oriented toward the general public and local community; and (4) integrating with the actions and programs of the Interagency Grizzly Bear Committee and its Subcommittees.

MMC would take additional measures to reduce mortality risk, including the following:

- Request the KNF restrict public motorized travel in upper Ramsey Creek
- Report road-killed animals to FWP as soon as road-killed animals were observed; FWP would either remove road-killed animals or direct MMC how to dispose of them
- Prohibit MMC employees from carrying firearms into permit areas
- Bear-proof all garbage containers
- Prohibit the feeding of bears and leaving of food or other bear attractants in the field

2.4.6.3.3 Plan Management

The KNF would prioritize and direct the land acquisition of the grizzly bear habitat preservation program. MMC would be responsible for carrying out the acquisition, either directly or through contract with a third party. The KNF's duties in overseeing the mitigation plan would be as follows:

- Prioritize and direct the land acquisition and grizzly bear habitat preservation program
- Evaluate proposals and approve specific habitat enhancement projects for acquired lands

- Review MMC's annual progress reports on the status of the mitigation
- Direct the Information and Education program, and determine if the program were needed after 5 years or if the program's funds should be redirected to other mitigation needs
- Evaluate the effectiveness of reclamation and determine if and when access changes on roads as part of the mitigation could be reversed, and the specific timing for releasing acquired lands
- The Forest Service, in counsel with the USFWS and the FWP, would be responsible for approval of each acquisition before purchase and approval of conservation easements

2.4.6.4 Hard Rock Mining Impact Plan

Lincoln County approved an updated Hard Rock Mining Impact Plan for the Montanore Project in 2007. The plan describes how the Montanore Project would affect local government services, facilities, costs, and revenues. The plan specifies the measures MMC would undertake to mitigate adverse fiscal impacts on local governments. MMC would prepay about $180,000 in taxes before construction to offset the net negative fiscal impact on the county budget during the first year. Because the Montanore Project as currently proposed would change employment projections, MMC submitted a petition for an amendment for consideration by the Hard Rock Mining Impact Board (Klepfer Mining Service 2008b). The Board approved the petition for amendment in 2008.

2.5 Alternative 3—Agency Mitigated Poorman Impoundment Alternative

2.5.1 Issues Addressed

Alternative 3 would incorporate modifications and mitigating measures proposed by the agencies to reduce or eliminate adverse environmental impacts. These measures are in addition to or instead of the mitigations proposed by MMC. Proposed modifications were developed in response to the issues identified during the scoping process (ERO Resources Corp. 2006a).

In Alternative 3, three major mine facilities would be located in alternate locations. MMC would develop the Poorman Tailings Impoundment Site north of Poorman Creek for tailings disposal, use the Libby Plant Site between Libby and Ramsey creeks, and construct two additional adits in upper Libby Creek (Figure 22). The LAD Areas would not be used in Alternative 3. Any excess water would be treated at the Water Treatment Plant at the Libby Adit Site and discharged at existing permitted outfalls. The issues addressed by the modifications and mitigation measures are summarized in Table 18.

Table 18. Response of Alternative 3 Modifications and Mitigations to Issues.

Key Issue	Mine Plan	Tailings Storage	Water Use and Manage-ment	Reclamation	Monitoring and Mitigation Plans
Issue 1-Acid Rock Drainage and Metal Leaching	✓		✓	✓	✓
Issue 2-Water Quality and Quantity	✓	✓	✓	✓	✓
Issue 3-Aquatic Life	✓	✓	✓		✓
Issue 4-Visual Resources	✓	✓		✓	
Issue 5-Threatened or Endangered Wildlife Species	✓	✓		✓	✓
Issue 6-Wildlife	✓	✓		✓	✓
Issue 7-Wetlands and Streams	✓	✓	✓	✓	✓

The lead agencies completed an alternatives analysis and evaluated numerous tailings impoundment sites. The sites the agencies considered for an impoundment are described in the section 2.13.5, *Tailings Impoundment Location Options*. The Poorman Impoundment Site was retained for detailed analysis because it would avoid the diversion of a perennial stream (Issue 2), and the loss of aquatic habitat (Issue 3), and would minimize wetland effects (Issue 7). Additional site comparisons between Alternatives 2 and 3 tailings facilities are presented in section 3.14.3.3, *Little Cherry Creek (Alternatives 2 and 4) and Poorman (Alternative 3) Tailings Site Comparison*.

Similarly, the lead agencies considered numerous sites for locating the plant site (see section 2.13.6, *Plant Site and Adit Location Options*). MMC's proposed plant site in the upper Ramsey Creek drainage would affect RHCAs (Issue 3), core grizzly bear habitat (Issue 5), and Inventoried Roadless Areas (IRAs). An alternative plant site on a ridge separating Libby and Ramsey creeks was retained for detailed analysis to address these issues. Preliminary evaluation indicates the Libby Plant Site could be built of fill material from the large cut on the west side of the plant site. The cut and fill materials would be balanced, and waste rock would not be used in plant site construction. Avoiding the use of waste rock in plant site construction would address (acid rock drainage and metal leaching (Issue 1). To avoid disturbance in the upper Ramsey Creek drainage, the adits in Alternative 3 would be in the upper Libby Creek drainage. This modification would address the same issues as the alternate plant site (Issues 3 and 5).

The lead agencies modified the proposed water management plan to address the uncertainties about quality of the mine and adit inflows, the effectiveness of LAD for primary treatment, quantity of water that the LAD Areas would be capable of receiving, and the effect on surface water and groundwater quality. In Alternative 3, MMC would use the Libby Adit Water Treatment Plant to treat water before discharge. MMC would divert water from Libby Creek near the impoundment site during high flows (April through July) to provide adequate make-up water for mill operations. MMC would cease diversions from Libby Creek and discharge treated water to

Libby Creek from the Water Treatment Plant during low flows to avoid adversely affecting senior water rights. Discharges to Ramsey Creek from the Water Treatment Plant at low flows also may be needed for the same reason. These modifications would address Issue 2, water quality and quantity.

The modifications and proposed mitigations that comprise Alternative 3 are described in the following sections. All other aspects of MMC's mine proposal would remain as described in Alternative 2. Chapter 3 contains a more detailed discussion of how the modifications and mitigating measures would reduce or eliminate environmental impacts. Many of the modifications and mitigations also would be incorporated into Alternative 4. All plans, mitigation measures, and monitoring requirements must be submitted and approved by the KNF as sequenced and outlined in this alternative prior to the Forest Service approving MMC to proceed with those actions affecting National Forest System lands. MMC would submit amended Plan of Operations consistent with the alternative after final design, including all monitoring and mitigation plans, to the KNF for approval. MMC would submit an amended application to amend Hard Rock Operating Permit #00150 consistent with the alternative after final design, including all monitoring and mitigation plans, to the DEQ for approval. All disturbances related to the operation would be fully bonded for reclamation prior to commencement of the surface disturbing activity (see section 1.6.3, *Financial Assurance*).

2.5.2 Evaluation Phase

2.5.2.1 Objectives

As described in Chapter 1, MMI acquired the DEQ Operating Permit #00150, private land at the Libby Adit Site and in the Little Cherry Creek drainage, and water rights previously held by NMC (now Montanore Minerals Corporation). In 2006, MMI proposed and received approval from the DEQ for two revisions to DEQ Operating Permit #00150. The revisions involved reopening the Libby Adit and re-initiating the evaluation drilling program that NMC began in 1989. The DEQ approved a revision in 2009 (MR08-001) to MMC's operating permit that involved the relocation of fuel and oil storage areas at the Libby Adit and the addition of more fuel storage capacity. A description of DEQ Operating Permit #00150 is provided in Chapter 1. The KNF determined the activities associated with the Libby Adit evaluation drilling were a new Plan of Operations under the Federal Locatable Minerals Regulations (36 CFR 228 Subpart A), and MMC needed KNF approval before dewatering and continuing excavation, drilling, and development work at the Libby Adit. Under the authority of Minor Revision 06-002 of the DEQ operating permit, MMC installed a Water Treatment Plant and is treating water from the adit.

In 2006, the KNF initiated a NEPA analysis that included public scoping for the proposed road use and evaluation drilling at the Libby Adit Site. In 2008, the KNF decided the best approach for disclosing the environmental effects of the Libby Adit evaluation program was to consider this activity as the initial phase of the overall Montanore Project in this EIS. The Libby Adit evaluation program would be the first phase of the Montanore Project in Alternatives 3 and 4. The objectives of the evaluation program would be to:

- Expand the knowledge of the mineralized zones of the deposit
- Assess and define the mineralized zone within established valid existing rights

- Collect, provide, and analyze additional geotechnical, hydrological, and other information required to finalize a mine plan and to confirm and support the analysis for the Construction and Operation Phases of the mine

2.5.2.2 Proposed Activities

The evaluation drilling program is designed to delineate the first 5 years of planned production. An estimated 35,000 feet of primary drilling and 12,800 feet of infill drilling are planned. The drill core would be used to support resource modeling, mine planning, metallurgical testing, preliminary hydrology assessment, and rock mechanic studies for the full Montanore Project. Supporting surface facilities are located on private lands at the Libby Adit Site and include an office, shop, generators, waste rock stockpile, and other ancillary facilities.

If adit closure and site reclamation were necessary after completion of the evaluation drilling program, MMC would install a concrete-reinforced hydraulic plug in bedrock, reconstruct the original adit plug, remove all surface facilities, and regrade and revegetate the disturbed areas. Additional information about the evaluation drilling program and site operations and reclamation can be found in MMC's *Notification to Resume Suspended Exploration and Drilling Activities for the Montanore Project, Revision 2* (MMC 2006), on file with the lead agencies.

In Alternatives 3 and 4, MMC would use Tier 4 generators, if available, or Tier 3 generators for all Evaluation Phase activities. MMC would use Tier 4 engines, if available, or Tier 3 engines on underground mobile equipment and use ultra-low sulfur diesel fuel in generator and underground mobile equipment engines during the Evaluation Phase.

MMC would dewater the full extent of the existing Libby Adit, extend the adit 3,300 feet to beneath the ore zones, and develop an additional 7,100 feet of drifts and 16 drill stations under the currently defined ore zones. Because drill stations would be located under the deposit, the majority of the drillholes would be drilled upward; a few holes would be drilled below the drill station to test mineralization at depth.

During the Evaluation Phase, MMC would drill ahead of the drifts and keep all drill stations 300 feet from the Rock Lake Fault and 1,000 feet from Rock Lake. During the dewatering of the Libby Adit, an array of small diameter boreholes would be installed from within the Libby Adit, and instrumented with continuous recording pressure transducers. Because the intent of the underground piezometers would be to obtain pre-mining pressure data and to track drawdown as the mine void was dewatered, the piezometers would be drilled out in front of the existing working face. At each station, the two inclined piezometers would be drilled from a cutout as close to the working face as possible without causing risk to the piezometers during subsequent blasting. The piezometers would be equipped with pressure recording devices before the drift or adit was advanced. Additional description of the Pre-Evaluation and Evaluation Phase monitoring is presented in Appendix C.

MMC holds two 1902 surface water rights on Libby Creek, one for mining near the Libby Adit site in Section 15, Township 27N, Range 31W (with a maximum diversion of 44.9 gpm between April 1 and December 19, and maximum volume of 50.97 acre-feet), and one for domestic use in the same section (15 gpm year-round, and a maximum volume of 1.5 acre-feet). MMC also holds a 1989 groundwater right near the Libby Adit site in Section 15, Township 27N, Range 31W (with a total diversion of 40 gpm year-round). MMC would use either its groundwater right with a year-round diversion or its surface water right with a diversion between April 1 and December

19. MMC would not appropriate any mine or adit water for beneficial use during any phase of the mining operations, including the Evaluation Phase. (Water use and management during operations is discussed in section 2.5.4.3, *Water Use and Management*.) MMC would install a DNRC-approved water use measuring device at both point of diversion locations. Water must not be diverted until the required measuring device is in place and operational. On a form provided by the DNRC, MMC would keep a written monthly record of the flow rate and volume of all water diverted including the period of time. Records would be submitted to the KNF, DEQ, and DNRC by January 31 of each year and upon request at other times during the year. MMC would maintain the measuring device so it always operated properly and measured flow rate and volume accurately.

Section 1.3.1, *Mineral Rights* discusses the history pertaining to the two mining claims (HR-133 and HR-134) that contain the copper and silver mineralization proposed for mining. The two claims, shown on Figure 11, were patented in 2001. The apex provision of the General Mining Law entitles the owner of a mining claim a right to mineralization extending in a downward course beyond the sidelines, but within the endlines of the claims. This entitlement is referred to as extralateral rights. MMC's extralateral rights are defined by the west endline of HR 133 and the east endline of HR 134. In MMC's Minor Revision 06-002 to its Hard Rock Mine Operating Permit #00150 (MMC 2006), MMC proposed areas of exploration outside of its extralateral rights. In Alternatives 3 and 4, MMC would not explore or mine for any ore outside of its extralateral rights. MMC would notify the KNF within 48 hours when ore was encountered during either the extension of the Libby Adit, development of any drifts, or exploration drilling. MMC would isolate underground any ore encountered outside of its extralateral rights from waste rock in case a future authority provides for the disposal of those valuable minerals.

An estimated 545,300 tons (256,000 cubic yards) of waste rock would be generated and stored on private land at the Libby Adit Site. The waste rock storage areas would be lined to collect runoff from the area and seepage through the waste rock. The DEQ's approval of Minor Revision 06-002 (the Libby Adit evaluation program) contained two conditions regarding testing of waste rock: analysis of water that infiltrated and ran off of the waste rock stockpile and nitrate column leaching tests. MMC completed both testing requirements. In 2008, MMC excavated 66,000 tons of rock for sumps in the Libby Adit was placed onto a lined area. A sump was constructed that collected runoff and seepage from the waste rock stockpile. Collected water was pumped to the Water Treatment Plant and discharged in the MPDES permitted outfall. Runoff and seepage from the waste rock pile was analyzed for metals, nutrients and other parameters. Data from water in the sump at the Libby Adit waste rock stockpile (Appendix K-10) were used to represent changes in water quality related to waste rock to be used at the impoundment site. The available results of metal and nutrient release testing on the Prichard Formation as waste rock, particularly for arsenic, copper, lead, antimony and nitrate, confirm that additional monitoring would be required (see geochemistry sampling and analysis plan in Appendix C.9). As part of the nitrate column leaching test, MMC completed three blasts of waste rock and collected the blasted rock for column leach testing for nitrogen compounds. Nitrate concentrations ranged from 5.5 mg/L to 25.5 mg/L and ammonia concentrations ranged from 2.8 mg/L to 14.1 mg/L. Nitrogen values decreased with each shot, which may reflect a refinement of the loading or explosive handling technique (MMC 2015a, Apex Engineering, PLLC and Morrison-Maierle, Inc. 2008b).

The Libby Adit would be dewatered and water would be treated before discharging to one of three permitted outfalls. MMC's MPDES permit MT0030279 regulates wastewater discharges from the Libby Adit, and sets effluent limits for both surface water and groundwater. Treated water would be discharged to a percolation pond located at the Libby Adit Site. Some of the downstream surface water quality monitoring stations used in assessing effects of the discharges would be located on the National Forest System lands or MMC's private land.

The underground evaluation is anticipated to last 18 to 24 months. MMC would employ 30 to 35 people at the Libby Site and would work two 10-hour shifts 7 days per week. The hours of operation would fluctuate based on daily requirements, but would operate 7 days per week.

During all phases of the project, MMC would maintain the structures, equipment, and other facilities in a safe, neat, and workmanlike manner. Hazardous sites or conditions resulting from operations would be marked by signs, fenced, or otherwise identified to protect the public in accordance with federal and state laws and regulations. MMC also would comply with all applicable federal and state fire laws and regulations, take all reasonable measures to prevent and suppress fires on the area of operations, and require employees, contractors, and subcontractors to do likewise within the permit area boundary.

2.5.2.3 Transportation and Access

2.5.2.3.1 Development of Plans

MMC would develop a Transportation Plan for life of the mine to be approved by the agencies before the Evaluation Phase. The plan would be incorporated into an amended Plan of Operations for the Evaluation Phase. The plan's objectives would be to minimize mine-related vehicular traffic traveling between US 2 and the plant site, and minimize parking at the plant site. Busing employees to the plant site, requiring managers to car pool to the extent practicable, and establishing a supply staging area in Libby to consolidate shipments to the mine site would be a part of the plan. The bus hub would be located in a convenient location in Libby, Montana, most likely the Kootenai Business Park. The plan would specify that exceptions to staging and consolidation of supplies would include full load shipments, expedited shipments to repair equipment and other emergencies as specified in the plan. Deliveries of supplies would be scheduled for day shift, Monday through Friday only.

INFS standard RF-2 requires the development and implementation of a Road Management Plan. MMC would develop for the lead agencies' approval a final Road Management Plan before the Evaluation Phase that would address roads used during the Evaluation Phase (NFS road #231 and #2316) and other roads affected by the Evaluation Phase of the project, including roads with access changes required to be implemented for wildlife mitigation. The plan would describe:

- Criteria that govern road operation, maintenance, and management
- Requirements for pre-, during-, and post-storm inspections and maintenance
- Regulation of traffic during wet periods to minimize erosion and sediment delivery and accomplish other objectives
- Implementation and effectiveness monitoring plans for road stability, drainage, and erosion control
- Mitigation plans for road failures
- Analysis of any new road constructed in a RHCA, documenting it is the minimum necessary for the approved mineral activity

The plan would describe management of road surface materials during plowing, such as snow and ice. Sidecasting of snow mixed with soil would be avoided. Sidecasting of road material would be prohibited on road segments within or abutting RHCAs in priority bull trout watersheds. MMC would install or fund the installation of signage where sidecasting would be avoided.

2.5.2.3.2 Road Use and Improvements

MMC would use Libby Creek Road (NFS road #231), and Upper Libby Creek Road (NFS road #2316) as the primary year around access to the surface facilities at the Libby Adit Site during the Evaluation Phase. These roads would continue to be snowplowed to allow access during winter. MMC installed a gate on the Libby Creek Road. Unless as directed by the KNF or the Oversight Committee discussed in the grizzly bear mitigation plan, MMC would continue to maintain the gate and the KNF would continue to seasonally restrict access on the two roads as long as MMC used and snowplowed the two roads during the Evaluation Phase.

MMC would implement prior to the Evaluation Phase and maintain during the Evaluation Phase the BMPs shown in Table 19, such as installing, replacing, or upgrading culverts, to bring the Evaluation Phase access roads (NFS roads #231 and #2316) up to INFS standards and guidelines and Forest Service guidance (USDA Forest Service 2008a, 2015b). All ditches on NFS roads #231 and #2316 would be cleaned out to enhance drainage and reduce sedimentation. MMC would implement and maintain BMPs on roads required to be closed or stabilized for wildlife mitigation.

Some of the BMPs listed in Table 19 may require a 404 permit from the Corps. Any activity that may result in any discharge into waters of the U.S. cannot proceed until MMC provides the KNF a 401 certification from the DEQ, unless the DEQ waives its issuance. MMC would implement

Table 19. Proposed Road Improvements on NFS roads #231 and #2316.

Milepost from Junction with NFS Road #4778	Required Activity
MP 0.05	Install 24-inch ditch-relief culvert
MP 0.10	Replace existing 18-inch corrugated metal pipe (CMP) with 24-inch CMP
MP 0.13	Install 24-inch CMP; scoured channel enters ditch; no pipe present to allow water to cross road
MP 0.30	Install surface drainage; drain to the east side of road
MP 0.40	Surface drainage needed; drain to the east
MP 0.50	Lower existing 18-inch CMP and replace if necessary
MP 0.60	Clean out existing CMP
MP 0.70	Replace CMP and armor outlet
MP 0.84	Replace existing CMP with a 24-inch CMP
MP 0.90	Provide surface drainage needed; drain to south
MP 0.91	Repair or replace existing 18-inch CMP inlet
MP 1.03	Provide road surface drainage; drain to the south
MP 1.20	Provide road surface drainage; drain to the south
MP 1.30	Armor inlet of existing 24-inch CMP inlet
MP 1.41	Install 24-inch CMP; install a drainage ditch on private property
MP 1.43	Provide road surface drainage; drain to the south

the mitigation described for culvert removals on grizzly bear mitigation lands in section 2.5.7.1.2, *Jurisdictional Waters (Streams)*, p. 186.

2.5.2.4 Noise Mitigation

Beginning in the Evaluation Phase and continuing throughout the project's life, MMC would operate all surface and mill equipment so that sound levels would not exceed 55 dBA, measured 250 feet from the mill for continuous periods exceeding an hour. Backup beepers may exceed 55 dBA 250 feet from the mill. MMC would install silencers on intake and exhaust ventilation fans in the three Libby Adits so that they generate sounds less than 85 dBA measured 3 feet downwind of the portal. MMC also would locate all fans a minimum of 500 feet from the portals during operations unless alternative locations would not increase noise levels in the CMW from the Libby Adit Site by 5 decibels or more. Changes smaller than 5 dB would be considered insignificant (EPA 1978). The following mitigation would apply to the project during all phases:

- Minimize nighttime construction, operation and reclamation activities that occur outside, as well as surface blasting
- Install high-grade mufflers on all diesel-powered equipment
- Install critical silencers on emergency generators (Cummins Power Generation, Inc. 2007)
- Combine noise-generating operations to occur for short durations simultaneously during the same time period whenever possible.
- Implement a semi-annual maintenance and lubrication schedule to ensure that equipment is operating properly.
- Use an exterior warning signal prior to blasting at or near the surface, per MSHA requirements.
- Keep noise-generating sources from approaching animals on a directed course where possible
- Provide safe cover near noise-generating on-site sources where possible

2.5.2.5 Reclamation

MMC would reclaim facilities associated with the Evaluation Phase in the following manner if the full project were not approved, or if MMC decided not to proceed with the project. MMC may retain the dewatering pumps and operation of the Water Treatment Plant beyond the Evaluation Phase. Dewatering and water treatment would continue until a bedrock portal plug was installed. As part of permanent closure and site reclamation, a portal plug would be installed in bedrock near the bedrock/colluvial contact point 800 feet from the portal opening. To ensure long-term stability, waste material would be backfilled into the adit from the bedrock plug out to the surface opening where another plug would be re-installed as originally designed. Once this surface plug was installed, excavated material would be placed back over the portal plug and general opening and regraded to match the surrounding topography. Other surface features, such as the waste rock stockpiles and the percolation pond would be regraded. All surface facilities, buildings, power supply, and equipment would be removed. The stockpiled 18 inches of soil would be placed over the regraded and scarified areas. The disturbed sites would be reseeded.

2.5.2.6 Final Design Process

This section describes the agencies' requirements during final design. The final design process and surveys would be completed during the Evaluation Phase before construction would begin. MMC would collect the necessary data for final design and develop final facility design, monitoring, and mitigation plans. Once approved by the KNF, the final designs and plans would be a component of the Amended Plan of Operations. The KNF would conduct additional NEPA analysis if significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts, as described by 40 CFR 1502.9(c)(1)(ii), were identified during final design. If MMC submitted final designs that were not materially different from the conceptual designs of Alternative 3, the DEQ would approve the final designs. If the analysis of the data collected during the Evaluation Phase caused MMC to submit final designs that are materially different from the conceptual designs of Alternative 3, the DEQ would require MMC to submit an application to modify its operating permit. The DEQ would conduct the appropriate level of MEPA review on the application.

2.5.2.6.1 Pre-construction Surveys

Before any ground-disturbing activities occurred and receiving agency approval to implement the Construction Phase in Alternatives 3 and 4, MMC would complete an intensive cultural resources inventory and a jurisdictional wetland delineation on all areas where such surveys have not been completed and that would be disturbed by the alternative. Similarly, MMC would update surveys for threatened, endangered, and Forest and state sensitive plant species on National Forest System lands for any areas that would be disturbed by the alternative where such surveys have not been completed or for any species listed as threatened, endangered, or Forest Service or state sensitive since 2005. Survey reports would be submitted to the agencies for approval. If wetlands or species of concern were identified and adverse effects could not be avoided, MMC would develop appropriate mitigation plans for the agencies' approval. MMC would implement the mitigation plan and receive agency concurrence of mitigation implementation before any ground-disturbing activities. The plan, once approved, would become a component of the amended Plan of Operations.

An intensive cultural resource inventory of the APE would meet the requirements of the 36 CFR 800, the guidelines in the 2009 KNF Site Inventory Strategy, and Montana SHPO. An intensive cultural resource inventory is a pedestrian survey with transects no more than 100 feet apart that covers the entire APE. The adequacy of past intensive cultural resource inventories would be decided by the KNF in consultation with the Montana SHPO. Following completion of a cultural resources survey, MMC would follow the requirements of a Programmatic Agreement between the KNF and the Montana SHPO. MMC would submit to the KNF an inventory report meeting Montana SHPO requirements. The report would include eligibility for listing on the National Register of Historic Places recommendations for all identified historic properties. When an adverse effect to an eligible historic property was anticipated, MMC may choose to redesign the project to avoid the property. If avoidance is not feasible, MMC would undertake actions to mitigate any adverse effect following the requirements of 36 CFR 800.6. A mitigation plan would be developed by MMC, reviewed by the KNF, reviewed by culturally affiliated tribes, and submitted to the SHPO and the Advisory Council on Historic Preservation for approval. Upon the conclusion of the consultation with the SHPO, the documentation needed to formalize the conclusion would be determined by the KNF, in consultation with the SHPO and the Corps. MMC would implement the mitigation plan and receive KNF concurrence of mitigation implementation before any ground-disturbing activities.

MMC also would complete a detailed Order I soil survey for all areas that have not been intensively surveyed and from which soils would be salvaged. During final design and after all areas were intensively surveyed, MMC would submit a final Soil Salvage and Handling Plan to the lead agencies for approval before any ground-disturbing activities (see next section).

2.5.2.6.2 Plan Development, Updates and Implementation

Mitigation Plans

The lead agencies developed specific design features and mitigation for Alternatives 3 and 4, with a majority of the measures common to both Alternative 3 and Alternative 4. The agencies' mitigation plans are summarized in section 2.5.7, *Mitigation Plans*. Each plan describes the timing of implementation. For example, the grizzly bear mitigation plan specifies the timing of required land acquisition, some of which must be acquired before the Evaluation Phase commenced. In all cases, the mitigation would be in place before the effect for which the mitigation applied occurred. MMC would submit final designs and mitigation plans specific for the alternative as part of it amended Plan of Operations, Operating Permit, and other permits or approvals.

Monitoring Plans

The agencies' conceptual monitoring plans are summarized in Appendix C. Each plan describes the timing of implementation. In all cases, the monitoring would begin before or concurrently with the effect for which the monitoring applied occurred. MMC would submit final monitoring plans as part of its amended Plan of Operations, Operating Permit, and other permits or approvals.

Road-Related Plans

Prior to the Evaluation Phase, MMC would submit for lead agencies' approval a Road Management Plan for the two roads (NFS road #231 and #2316) and other roads affected by the Evaluation Phase of the project including access changes required to be implemented for wildlife mitigation. The Road Management Plan would become part of the amended Plan of Operations for the Evaluation Phase. Before initiating the Construction Phase, MMC would update the plan for the lead agencies' approval to address all access management changes and all new and reconstructed roads affected by the Construction and Operations Phases of the mine and transmission line. The plan's elements would include BMPs to minimize sediment delivery to area streams and would be the same as described in the Stormwater Pollution Prevention Plan. The plan would include the timing and level of management for each road depending upon the determined purpose for that road. The plan would incorporate safety signing such as "Caution Truck Traffic" signs at several locations on both Libby Creek and Bear Creek roads between US 2 and the mine facilities (Poorman Tailings Impoundment Site, Libby Adit sites, and Libby Plant Site). MMC would post warning signs for speed limits and other important road conditions and require all mine-related vehicles to follow all traffic control restrictions, such as speed. Other appropriate wording may be used as approved in the Road Management Plan. MMC also would continue to implement the Transportation Plan described for the Evaluation Phase.

Before initiating the Construction Phase, MMC would submit a traffic impact study report to the agencies and MDT that address the requirements of MDT's System Impact Action Process (Montana Department of Transportation 2007). The purpose of the traffic impact study would be to:

- Identify the traffic loads (*i.e.*, traffic impacts) that the project would contribute to the roadway system
- Provide a credible basis for estimating site access requirements and off-site roadway improvements that are attributable to the project
- Assess whether on-site functions would compromise off-site operations
- Assess compatibility with State and local transportation plans

The report would describe anticipated traffic generated by the project, anticipated impacts on capacity and level of service and traffic safety, and recommendations for improvements. Final decisions regarding necessary road improvements would be made by the road owner (MDT, County, and Forest Service). MMC would fund all road improvements required by the project.

Soil Salvage and Handling Plan

During final design and after all areas were intensively surveyed, MMC would submit a final Soil Salvage and Handling Plan to the lead agencies for approval. The plan would include means to ensure that the necessary amount of suitable soil would be salvaged in disturbed areas, that soils would be stockpiled and redistributed properly, and that losses from handling and erosion on stockpiles and in reclaimed areas would be minimized. Also, the timing and sequencing of stockpile use (for respreading) would be detailed to ensure that visual impacts would be mitigated, and that direct-haul methods would be maximized.

Stormwater Pollution Prevention Plan

In accordance with the draft renewal MPDES permit, MMC would submit a final Stormwater Pollution Prevention Plan (SWPPP) for the agencies' approval no later than the 28th of the following month 60 days after the effective date of the MPDES permit. The SWPPP would describe the facility, BMPs, control measures, and monitoring procedures that will ensure compliance with the terms and conditions of their MPDES permit. The SWPPP would address stormwater runoff from mine-related facilities including topsoil stockpiles, access/haul roads, adit pads, and parking lots. The plan also would address stormwater runoff from transmission-related facilities. The plan would include, at a minimum, the components described in the final MPDES permit:

- Storm Water Pollution Prevention Team and SWPPP Administrator
- Site description
- Site map
- Summary of any potential pollutant sources
- Description of control measures and BMPs
- Any schedules and/or standard operating procedures
- SWPPP modifications and updates
- Corrective actions
- Employee training

The final SWPPP would be approved by the KNF and the DEQ. The BPA would develop a SWPPP for construction of the Sedlak Park Substation and loop line.

Vegetation Removal and Disposition Plan

As part of final design and submittal of an amended Plan of Operations and permit application before the Construction Phase, MMC would prepare a Vegetation Removal and Disposition Plan for the agencies' approval. The plan would evaluate the opportunities to minimize tree and other vegetation clearing, particularly in RHCAs, and consider potential uses of vegetation removed from disturbed areas, and describe disposition and storage plans during mine life. The plan would apply to all National Forest System lands covered by the Plan of Operations and all private lands covered by the operating permit and transmission line certificate. It would not apply to private or State lands along the mine access road. Vegetation removal and disposition on private lands along the access road would be governed by the easement between the Forest Service and the private land owner. It also would address vegetation removal along the transmission line (see transmission line Alternatives C-R, D-R, and E-R).

Weed Control Plan

MMC has a Weed Control Plan approved by Lincoln County Weed Control District. The plan would be modified as described under *Noxious Weed Mitigation Measures* (p. 144) and submitted to the lead agencies during final design for their approval. Following KNF's and DEQ's approval of the final Weed Control Plan, MMC would submit it to the Lincoln County Weed Control District for approval. Weed control measures would be applied to all areas disturbed by the project activities including the mine permit areas. Weed control measures along the transmission line are described in the agencies' Environmental Specifications (Appendix D).

2.5.2.6.3 Final Tailings Impoundment Design Process

The design developed for project facilities in Alternatives 3 and 4, such as the Poorman tailings impoundment site, is conceptual and is based on the available geotechnical investigations. Additional site information is needed to complete a final design. The design process would include a preliminary design phase and a final design phase. Site information would be collected during geotechnical field studies during final design. MMC would submit a tailings impoundment site geotechnical field study plan to the agencies for their approval before commencing activities. Once approved, the Site Exploration Plan would become a component of the amended Plan of Operations. A preliminary site program would be completed to confirm the geotechnical suitability of the Poorman Tailings Impoundment Site. A similar process would be used for the Libby Plant Site. The field studies would include a site reconnaissance and a drilling and sampling program to evaluate:

- Site geology and foundation conditions
- Groundwater conditions and water quality
- Borrow material availability
- Geotechnical characteristics of foundation and borrow materials

Site data to be collected would include an assessment of artesian pressures and their potential influence on impoundment stability, an assessment of a subsurface bedrock ridge between Little Cherry Creek and the effect it may have on pumpback well performance, aquifer pumping tests to refine the impoundment groundwater model and update the pumpback well design, and site geology to identify conditions such as preferential pathways that may influence the seepage collection system, the pumpback well system, or impoundment stability. Based on these data, a preliminary design of the facility sites would be completed to confirm the site layout and design/operation feasibility. Field studies would be completed to collect data and material samples necessary for the final design.

With the exception of tailings density at initial deposition, design criteria proposed for the Poorman tailings impoundment (Klohn Crippen 2005) would be used unless alternative criteria are approved by the agencies. In Alternatives 3 and 4, MMC would, during final impoundment design:

- Update the seismic stability analysis using the most recent attenuation relationships that are based on instrumental records of attenuation collected in the United States and internationally (*e.g.,* Spudich *et al*. 1999, Boore and Atkinson 2007, or Petersen *et al*. 2008)
- Complete circular failure and block failure assessments through various critical dam sections, and through the foundation
- Update the pumpback well design and analysis using geologic and hydrologic data collected as part of geotechnical field studies, with a focus on minimizing drawdown north of impoundment
- Avoid or minimize, to the extent practicable, filling wetlands and streams, such as described in Glasgow Engineering Group, Inc. (2010)
- Avoid or minimize, to the extent practicable, locating facilities, such as the Seepage Collection Pond, in a floodplain
- Submit final design to the agencies for approval
- Fund an independent technical review of the final design as determined by the lead agencies

The functionality of the Alternative 3 tailings impoundment would depend on determination and design of the water removal system (such as deep tank or high compression thickeners) and the strict control of final slurry parameters such as moisture content, deposition sequences, and impoundment water management. During final design, MMC would determine the proper thickener and distribution system and deposition plan for the tailings (see section 2.5.4.2.2, *Tailings Deposition* for a discussion of target tailings density). MMC would develop an optimum filling plan and operation and monitoring manual that addressed plant operations, tailings thickening parameter tolerances, contingencies for tailings density not meeting specifications, monitoring of the thickening process, and reporting to the lead agencies. Similar monitoring and reporting for the tailings impoundment as proposed in Alternative 2 would be implemented for Alternative 3 (see Appendix C).

MMC would develop a general operating plan for the tailings impoundment site including a final Fugitive Dust Control Plan to control wind erosion from the tailings impoundment site. Before commencing operations, MMC would submit to the agencies for approval a general operation plan for the tailings impoundment site including a Fugitive Dust Control Plan. The plan would include, at a minimum, the embankment and cell (if any) configurations, a general sprinkler arrangement, and a narrative description of the operation, including tonnage rates, initial area, and timing of future enlargement. Should these measures not be adequate to control wind erosion from the impoundment, MMC would submit a revised plan to the agencies for approval, incorporating alternative measures, such as a temporary vegetation cover

As part of final design, MMC would submit an Operations, Maintenance, and Surveillance Manual for the Libby Plant and tailings impoundment. The manual would identify maintenance requirements and operation guidelines to reduce risks of system upsets, describe the leak detection system for tailings and reclaim water lines, and outline spill response procedures. MMC also would submit and implement a comprehensive Environmental Health and Safety Plan.

Technical review of the final tailings facility design would be made by a technical advisory group (TAG) established by the lead agencies. The tailings TAG would be comprised of agency experts in geotechnical, geochemical, and water quality issues related to current practices in the construction, operations, and closure of tailings facilities. The tailings TAG's review would encompass the technical aspects of tailings design including impoundment groundwater model, the pumpback well system, and the short- and long-term stability of the tailings storage facility.

The TAG would advise on the development of the quality assurance/quality control protocols for the tailings facility. The tailings TAG would also advise the lead agencies as to whether the environmental impacts associated with final design remained within the scope of those impacts identified in the Final EIS. The lead agencies would review and approve the final design before construction.

The KNF and the DEQ would guide, organize, and chair the tailings TAG meetings, and consolidate and document the consensus review recommendations. The lead agencies may also retain the services of a third-party tailings consultant if they determined additional technical expertise was required. MMC would fund any required third-party services. During the review process, MMC may be asked to provide additional information or clarification to the tailings TAG on certain aspects of the plan, as determined by the KNF and the DEQ. Possible members of the TAG include the KNF, the DEQ, the EPA, U.S. Army Corps of Engineers, Confederated Salish Kootenai Tribe, and Lincoln County.

The lead agencies may form additional TAGs if they determine a need. As explained previously, the KNF and the DEQ may also consider retaining the services of third-party consultants with expertise on specific issues. The third-party services would be funded by MMC. The lead agencies would determine whether a TAG would be formed and which approach would be used with a particular issue on a case-by-case basis. The lead agencies would decide this based on where the most expert review would best be obtained for the specific issue being considered, and the complexity and significance of that issue.

2.5.2.6.4 Final Underground Mine Design Process

MMC would submit a detailed final mine plan, including final plans for underground geotechnical monitoring, for agencies' approval before any underground development began in the Construction Phase. The mine plan would:

- Include the physical setting of the ore body (for each ore zone, the elevation of the floor or back, thickness, depth below surface) and the planned extent of mining.
- Use a variety of pillar strength estimation approaches such as Obert and Duvall (1967), Wilson Abel (1972), Hedley and Grant (1972), Hardy and Agapito (1975), Bieniawski (1981), Stacey and Page (1986), Abel (1988), and Esterhuizen *et al.* (2008) to calculate pillar strength and corresponding factor of safety. This would allow the agencies to better evaluate the MMC design in relation to other standard approaches.

- Use a minimum 0.8 pillar width to height ratio as a preliminary numeric criterion (Agapito Associates, Inc. 2014a). Pillars with less than a 0.8 width to height ratio would require justification by MMC as to their stability.
- Explicitly assess sill pillar stability during all mine planning phases.
- Identify two barrier pillars 20 feet wide across the width of the ore body that would be left in place (except for openings needed for access) until additional refinement of the hydrologic model was completed and the need for barrier pillars was evaluated. The purpose of the barrier pillars would be to minimize post-mining changes in East Fork Rock Creek and East Fork Bull River streamflow and water quality. The evaluation of the barrier pillars is discussed in more detail in section 2.5.4.1, *Mining* (p. 162) and in the Groundwater Hydrology section under Mitigation (p. 612).
- Maintain at least a 1,000-foot buffer from Rock Lake and a 300-foot buffer from the Rock Lake Fault. MMC also would maintain during mining a 100-foot buffer from faults identified on Figure 61. MMC would keep the size and number of drives through the faults identified on Figure 61 to the minimum necessary to achieve safe and efficient access across the fault. Any request to modify the buffers would require review and approval by the lead agencies.
- Include an Explosive Handling and Blasting Plan that describes measures to minimize pillar size reduction from overblasting.
- Explicitly state that no secondary mining (reduction in pillar width or length, or increase in pillar height from designed final dimensions) would be allowed.
- Exclude the mining of ore outside MMC's extralateral rights defined by the west endline of HR 133 and the east endline of HR 134.

In addition to MMC's proposed underground geotechnical monitoring discussed on page 88, MMC would implement the following measures to reduce the risk of subsidence:

- Perform a pre-mining baseline topographic survey over the ore body using aerial methods (LiDAR, InSAR, or equivalent) approved by the agencies. Surveys using the chosen method would be repeated periodically before production mining to (a) establish the variability of the monitoring method employed (with respect to its technical limitations and outside factors such as snow and vegetation cover, natural rockfalls, landslides, etc.), and (b) as a reference point for measuring any suspected mining-related subsidence.
- Complete and provide to the agencies a detailed surficial geologic survey of lands overlying the mine area to identify structures that could affect subsidence potential and implement the Evaluation Phase activities described in the Rock Mechanics Monitoring Plan (Appendix C).
- Reference the Troy Mine experience in its pillar designs, and highlight how the designs account for and differ from failed designs at the Troy Mine. As pillar designs were refined, numerical modeling would be undertaken to further evaluate expected underground mine design performance, including the potential for shear failure at the pillar/roof or pillar/floor interface.

- Increase the understanding of the structural setting, including faulting, jointing, bedding, and the horizontal stress regime, which will improve the geotechnical design. The description of one Troy Mine pillar collapse indicates that adverse pillar orientation with regard to bedding dip may have played a role, and the Troy Mine sinkhole events appear to be related to faulting. Hydrologic effects could be exacerbated by reactivation of fault zones, such as the Rock Lake Fault or any sympathetic and/or undocumented faulting that may exist. A better understanding of the structural environment at Montanore would benefit the mine design effort and improve the understanding of potential impacts that may arise. These data would be obtained through lineament analysis of surface features, joint mapping and statistical analysis of joint frequency and attitude, strain-relief overcoring to measure the horizontal stress field, and further exploratory drilling.
- Use the best science to study the interaction of workings. Initial numerical modeling for the Montanore Project in 1989 studied the issue of pillar columnization and sill pillar stability between the two ore zones. More sophisticated and powerful modeling approaches have become available since that time. Such approaches would be used, along with current design assumptions, to further study candidate designs for the two ore zones, as interaction of workings may be crucial to overall pillar/sill stability.
- Complete a roof support analysis to finalize the support plan and mining span.
- Retain the services of an independent third party technical advisor. This advisor would be similar to third-party consultants retained by the lead agencies for review of the tailings impoundment. MMC would fund this independent technical advisor to assist the agencies in review of the final subsidence monitoring plan, underground rock mechanics data collection, and mine plan. The technical advisor also would assist the agencies with underground mine quality assurance and quality control oversight during construction and operations. The technical advisor would be selected and directed by the agencies through an agreement with MMC. MMC would provide the agencies and their representatives access to the underground workings to observe data collection and mine development. MMC would provide mine access, logistical support, and all information required by the technical advisor to complete a review of underground rock mechanics data and MMC's mine plan. The advisor would review monitoring reports submitted by MMC and may engage in monitoring independent of that required under MMC's monitoring program. Assessments of the underground workings by the technical advisor may occur as frequently as quarterly, with the results of the inspections compiled into an annual assessment report. This annual report from the technical advisor would incorporate data collected as part of the ongoing monitoring program, and would be in addition to the annual report prepared by MMC. The technical advisor would have no financial interest in the Montanore Project.

2.5.2.6.5 Final Groundwater Model Development Process

MMC developed separate 3D groundwater models for the mine area and the Poorman Impoundment Site. Before the Construction Phase started, MMC would update both models, incorporating the hydrologic and geologic information collected during the Evaluation Phase. The tailings impoundment groundwater model would consider the seasonal withdrawal of Libby Creek alluvial groundwater in its development. The required monitoring of the underground mine and at the tailings impoundment site during the Evaluation Phase is described in Appendix C. Required characterization data at the tailings impoundment site during the Evaluation Phase is described in section 2.5.2.6.3, *Final Tailings Impoundment Design Process.* The agencies anticipate the mine area model's uncertainty for predicting inflows and water resource impacts may be reduced based on the empirical data obtained from underground testing. Effects on surface resources would be re-evaluated based on the updated mine and tailings impoundment modeling. The agencies would modify the monitoring requirements, such as the Groundwater Dependent Ecosystem (GDE) inventory and monitoring, described in Appendix C for the Construction and Operations phases if necessary to incorporate the revised model results. Similarly, the agencies would use adaptive mitigation to modify the mitigation plans described in Section 2.5.7, *Mitigation Plans,* if necessary to incorporate the revised model results.

2.5.2.6.6 Final Road Design Process

The following sections describe the agencies' design requirements for US 2 and National Forest System roads proposed for use in Alternative 3. During final design, MMC would complete a preliminary and final road design using these specifications for KNF approval. MMC would use appropriate road design and construction techniques and standards to minimize the amount of disturbance within the road prism on National Forest System lands, and private lands where the Forest Service holds a right-of-way easement.

Design Requirements for US 2 Improvements

The Bear Creek Road is a public approach to US 2. MMC would evaluate the approach for the largest design vehicle and modify the intersection if the approach did not meet the design requirements for that vehicle. The approach would be designed to maintain the transportation system level of service and safety along US 2. This mitigation also would apply to the intersection of US 2 and Kootenai Business Park access road to the Libby Loadout. All US 2 improvements would be identified in the traffic impact study report to be submitted to the agencies and MDT.

Design Requirements for Bear Creek Road Reconstruction

About 14 miles of the Bear Creek Road (NFS road #278), from US 2 to the junction of a new road proposed to be constructed in the Poorman Tailings Impoundment Site, would be widened to two 12-foot wide travel lanes and two shoulders of 1 foot, for a total width of 26 feet. The KNF may decide during final design that a narrower width would be sufficient to provide for safe and efficient use. Additional widening would be necessary on curves and short segments of new road would be needed. The disturbed area, including ditches and cut-and-fill slopes, may be up to 100 feet wide. The existing Bear Creek bridge, which currently is 14 feet wide, also would be replaced and widened to a width compatible with a 26-foot wide Bear Creek Road. The roadway would be paved with hot mix asphalt, and the asphalt road surface would then be chip-sealed.

As in Alternative 2, a buried 34.5-kV transmission line along Bear Creek Road and the Libby Plant Access Road may be installed if it was needed and MMC acquired easements for its construction across private land on the Bear Creek Road. Telephone and data communications would be via new, buried utilities along the Bear Creek Road and the Libby Plant Access Road from Libby if MMC acquired easements for its construction across private land on the Bear Creek Road. Flathead Electrical Cooperative would provide power for the 34.5-kV line and MMC would become a Cooperative member. Flathead Electrical Cooperative provides power to private owners along the Bear Creek Road via above- and underground electric lines. MMC would upgrade the existing line to 34.5 kV and then extend the line if all necessary easements were acquired. Under Flathead Electrical Cooperative policies, an existing member cannot unreasonably withhold approval to extend the powerline to other members.

A travel lane on the Bear Creek Road would be maintained to allow continued motorized public access during Bear Creek Road reconstruction. If road closures were necessary during bridge replacement, closure would be restricted to Monday through Friday. MMC would develop signage on US 2 notifying road users of construction conditions, possible delays, or necessary detours. Signage on US 2 would be posted north of the Libby Creek Road intersection, and north and south of the Bear Creek Road intersection. Detour information would include alternative route directions.

MMC would hold a field review with KNF after completion of preliminary road and utility corridor design. Individual property owners would be invited to attend the preliminary design field review in the event the reconstructed road would exceed the current right-of-way width. The design would include a plan for accommodating continued access by local landowners and recreational forest users during road reconstruction. If preliminary design indicates the reconstructed road would exceed the current right-of-way width, MMC would make a reasonable effort during the Evaluation Phase to secure all necessary easements to accommodate the needed road right-of-way width. A “reasonable effort” is one in which MMC offers the current property owner a fair market offer for a right-of-way no wider than the minimum necessary to accommodate the needed road width.

MMC would be responsible for all costs, including legal fees, associated with the acquisition of easements. Any easement obtained by MMC for additional right-of-way would be established until final bond release, would be conveyed to the Forest Service, and would be consistent with the Forest Service’s standard right-of-way easement language. MMC would submit all proposed easements to the KNF for approval before purchase. In cases where a landowner was unwilling to grant an easement to MMC but was willing to grant an easement directly to the Forest Service, MMC would still be responsible for all costs associated with acquisition of the easement. MMC also would make a reasonable effort during the Evaluation Phase to reconcile areas where the access road was outside existing right-of-way easements. MMC would be responsible for all costs associated with easement reconciliation.

In those areas where MMC cannot obtain additional right-of-way width or achieve easement reconciliation after a reasonable effort has been made, MMC would submit written documentation of MMC’s reasonable efforts. MMC would concurrently submit for KNF approval design changes for a road that could be constructed with the existing right-of-way. The necessary specifications that could be implemented without obtaining additional right-of-way would be incorporated into the design.

Design Requirements for Main Haul Road

MMC would use segments of NFS roads #2317, #4781, #6210, and #2316 as the main haul road between the Libby Adit Site and the Poorman Impoundment Site. The roads used to haul waste rock from the Libby Adit and the Upper Libby Adit to the Poorman Tailings Impoundment Area are shown on Figure 29. Except for a segment of the Upper Libby Creek Road (NFS road #2316) and the Poorman Creek Road (NFS road #2317) south of the impoundment, mine haul roads would be restricted to mine traffic only. These two segments would require joint public and mine traffic. During final design, MMC and the KNF would determine the most appropriate method to accommodate joint traffic. The Mine Safety and Health Administration (Mine Safety and Health

Administration 1999) recommends a road width of 56 feet wide when using a 16-foot haul truck to accommodate joint-use traffic safely. For the Poorman Creek Road (NFS road #2317), joint traffic could be segregated by building a new road parallel to the existing road. A parallel road may have less effect than a 56-foot wide road.

South of Little Cherry Creek, MMC would build 0.7 miles of new road west of and parallel to the Bear Creek Road that would connect Bear Creek Road with Ramsey Creek Road (NFS road #4781) (Figure 29). MMC would construct a new bridge crossing Poorman Creek just upstream and adjacent to the existing crossing. The road would have a chip-seal surface and be constructed to a width to accommodate haul traffic. Mine traffic would use the Libby Plant Access Road and the public would use the existing Bear Creek Road. The crossing of the new mine access road across Poorman Creek and Ramsey Creek would be built to accommodate the 100-year flow event and be constructed in compliance with INFS standards and guidelines and Forest Service guidance (USDA Forest Service 2008a, 2015b). The crossing width would be consistent with the roadway width.

MMC would use the same roads (NFS road #4781, NFS road #6210 between Ramsey Creek and Libby Creek, and NFS road #2316) for access to the Libby Adit Site and Libby Plant Site (Figure 29). Modifications to these roads also would be the same as Alternative 2, except for a segment of NFS road #2316 west of NFS road #6210. MMC would use a segment of NFS road #2316 west of the Libby Adit Site for access to the Upper Libby Adit Site. MMC would install a gate on NFS road #2316 west of the Libby Adit Site and maintain the existing hiking trail beyond the Upper Libby Adit Site. For the segment on the Upper Libby Creek Road (NFS road #2316) that would have joint use, the agencies anticipate low public traffic use. An alternative to a 56-foot wide road at this location would be the development of administrative procedures either to eliminate or accommodate through traffic control mine hauling when public use occurred.

MMC would develop a small (4 to 5 vehicle) graveled recreational parking area at the gate on the Poorman Creek Road (NFS road #2317). The parking area would facilitate non-motorized access to the Poorman Creek drainage via the Poorman Creek Road. MMC also would develop a new hiking trail between Poorman and Ramsey creeks to provide non-motorized access to upper Ramsey Creek.

The Bear Creek Road from the junction of the new Libby Plant Access Road to the Libby Creek Road would be surfaced with 6 inches gravel at its existing width (a minimum of 16 feet) (Figure 29). A segment of the Bear Creek Road north and west of Libby Creek is on private property. The Forest Service has an easement with the property owner that allows the Forest Service to maintain the road. The easement is 100 feet wide from the western boundary of the northernmost private parcel (Raven Placer) and is 50 feet wide on either side of the Bear Creek Road in most locations in the parcel north of the junction with the Libby Creek Road. This surfacing would ensure the safe transition from the improved section north of the new Libby Plant Access Road and the unimproved section to the Libby Creek Road.

2.5.3 Construction Phase

The Construction Phase would begin after MMC analyzed the data from the Evaluation Phase, collected the necessary data for final design, submitted final design plans to the agencies for their approval, and received agency approval to implement the Construction Phase. Possible additional NEPA and MEPA analysis is described in section 2.5.2.6, *Final Design Process.*

2.5.3.1 Permit and Disturbance Areas

Disturbance area boundaries around the plant site and tailings impoundment site would be marked in the field with fenceposts or fenced and signed to limit potential disturbance outside permitted disturbance areas. Fences, if used, would be designed and built to avoid debris jams at stream crossings. The operating permit area would total 2,157 acres and the disturbance area would total 1,565 acres (Table 20). During the Construction Phase, MMC would reconstruct portions of the Bear Creek Road (NFS road #278). These activities are described in section 2.5.2.6.6, *Final Road Design Process*.

2.5.3.2 Vegetation Clearing and Soil Salvage and Handling

2.5.3.2.1 Vegetation Removal and Disposition

MMC would implement the approved Vegetation Removal and Disposition Plan during the Construction Phase and continue to implement the plan whenever vegetation was cleared or removed.

To minimize metal leaching problems and low pH seepage from soil stockpiles containing large amounts of coniferous vegetation, the coniferous forest debris would be removed before soil removal to the extent feasible. Merchantable timber would be measured, purchased from the

Table 20. Mine Surface Area Disturbance and Operating Permit Areas, Alternative 3.

Facility	Disturbance Area† (acres)	Permit Area (acres)
Existing Libby Adit	18	219
Upper Libby Adit	1	1
Rock Lake Ventilation Adit	1	1
Libby Plant Site and Adits	76	172
Poorman Tailings Impoundment Site and Surrounding Area	1,272	1,506
Poorman Tailings Impoundment and Seepage Collection Pond	608	
Borrow areas outside impoundment footprint	92	
Soil stockpiles	48	
Other potential disturbance (roads, storage areas, ditches, etc.)	524	
Access and Other Roads†		
Bear Creek Road (NFS road #278 from US 2 to Tailings Impoundment permit area)	90	0
Tailings Impoundment permit area to Libby Plant Site (NFS roads #278, #2317, #4781, #6210 and new road)	66	214
Libby Plant Site to Libby Adit Site and Upper Libby Adit Site (NFS roads #6210 and #2316)	41	44
Total	1,565	2,157

†Disturbance area shown for roads excludes 33 feet of existing disturbance along roads.

KNF, and then cleared before soil removal. Non-merchantable trees, coniferous forest debris, and slash from vegetation clearing in the mine disturbance areas and along the transmission line would be managed in accordance with Montana law regarding reduction of slash (76-13-407, MCA) and, on National Forest System lands, KNF objectives regarding fuels reduction. Except where used in wildlife or fisheries mitigation, excess slash would be removed or burned in all timber clearing areas and within 0.5 mile of any residence. Slash management on Plum Creek and other private lands not owned by MMC would be in accordance with Montana law and the landowner/MMC easement agreement. Non-merchantable trees and coniferous forest debris would be removed using a brush blade or excavator to minimize soil accumulation. MMC would comply with DNRC open burning requirements. Where possible, slash of non-coniferous forest debris or dead coniferous forest snags would be salvaged and chipped to be sold, used as mulch, or used as an additive to stored soil. All mulching materials would be certified noxious weed-seed free.

2.5.3.2.2 Soil Salvage

MMC would implement the approved Soils Salvage and Handling Plan during the Construction Phase and continue to implement the plan whenever soil was removed, stockpiled, or replaced. MMC would salvage soils in all disturbed areas, with the exception of slopes exceeding 50 percent and soil stockpiles. Suitability of soils proposed for reclamation was determined from physical and chemical data collected during the baseline soils survey. Soils would be salvaged in two lifts in the tailings impoundment site, borrow areas, and Libby Plant Site. The first lift would include the relatively organic-rich surface layers (topsoil), and the second lift would include the subsoil immediately below the topsoil to a depth based on need and suitability. At road disturbances, soils would be salvaged in one lift. Soils with more than 50 percent rock fragment generally would not be salvaged. Soils with rock fragment contents up to 60 percent by volume would be salvaged in some areas to provide erosion protection on the tailings impoundment embankments.

Not all soils within the impoundment area would be salvaged during the Construction Phase. Disturbances from which soils would be salvaged from within the impoundment site during the Construction Phase include Starter Dam, Seepage Collection Pond, Borrow Areas, roads, and wetlands within the impoundment footprint. Other soils within the impoundment footprint would be salvaged incrementally during operations.

2.5.3.2.3 Soil Stockpiles

The two-lift soil salvage would segregate soils according to erodibility (*i.e.*, rock fragment content) and first lift versus second lift. For example, glaciolacustrine soils, having the greatest erodibility and few rock fragments, would be stockpiled separately from first lift materials that contain a large amount of rock fragments, and second-lift glaciolacustrine clay-rich soils would be stockpiled separately from other second-lift soils. The stockpiles would be signed, based on the use in the post-mining landscape. Soil stockpiles would be constructed with 40 percent side slopes and 33 percent sloping ramps, where possible. In the tailings impoundment area, stockpiles would be located in the soil stockpile area shown on Figure 25, within the borrow areas area after borrow materials had been removed, temporarily within the impoundment footprint or within the disturbance area provided they were more than 250 feet from a wetland. Any stockpile within the impoundment footprint would eventually be moved to a borrow area until final reclamation.

Soil stockpiles would have organic matter and fertilizer added to help retain soil quality and promote successful revegetation. Noxious weeds on stockpiles would be controlled throughout the stockpile life, and sprayed before soil redistribution.

In Alternative 2, MMC proposes to stabilize soil stockpiles when they reach their design capacity and seed during the first appropriate season following stockpiling. In Alternatives 3 and 4, MMC would incrementally stabilize soil stockpiles (rather than waiting until the design capacity was reached) to reduce erosion and maintain soil biological activity in the surface. Seeding should be done as soon after disturbance as possible rather than waiting until the next appropriate season. Immediate seeding of road cuts-and-fills would reduce erosion on Forest Service roads regardless of planting time. To the extent possible, MMC would stockpile soils in clearings or recent timber harvest areas that were immediately adjacent to new roads, which would be operational for mine life, rather than stockpiling along the entire road corridor.

MMC would report soil stockpile volumes and disturbance acres in each annual report to the lead agencies. MMC would prepare an annual soil reconciliation report to document that the soils in stockpiles were sufficient to reclaim the current disturbed acres. If a shortfall existed, MMC would submit a plan to make up for the soil shortfall in the following year (see section 2.5.5.2.3, *Soil Replacement and Handling* regarding replaced soil thickness).

2.5.3.2.4 Direct Haul and Temporary Storage of Soil

Direct haul soil salvage and replacement would be required for use whenever, and as much as possible, to enhance revegetation success of native unseeded species (Prodgers and Keck 1996). Direct haul would be done primarily at the tailings impoundment.

Areas such as road cut-and-fill slopes, transmission line structure locations, access roads, and other disturbances that would remain post-mine should be reclaimed as soon as final grades were achieved with direct haul soil or soil that had been stockpiled for less than 1 year. This would increase the chances of direct transplantation and propagation of many of the local ecotypes on the reclaimed surface (Prodgers and Keck 1996).

2.5.3.2.5 Noxious Weed Mitigation Measures

MMC would implement all weed BMPs identified in Appendix A of the KNF Invasive Plant Management Final EIS (KNF 2007a) for all weed-control measures. MMC would focus mitigation on prevention as the most effective and least expensive weed management strategy, and early detection and eradication as the best alternative once a new species had been introduced. For established invaders, treatment and containment of noxious weeds species would be the main objective. MMC would include integrated noxious weed management in the environmental training.

MMC would comply with state and local laws and agencies' guidelines for all noxious weed-control activities. All herbicides used in the project area would be approved for use in the KNF, and would be applied according to the labeled rates and recommendations to ensure the protection of surface water, ecological integrity, and public health and safety. Herbicide selection and application timing would be based on target species on the site, site factors (such as soil types and distance to water), and with the objective to minimize impacts on non-target species. MMC would coordinate with the KNF Weed Specialist for use of biocontrol agents as they become available.

To the extent possible, MMC would survey all proposed ground disturbance areas for noxious weeds before initiating disturbance. Where noxious weeds were found, MMC would treat infestation the season before the activity was planned. For example, if timber clearing were planned to be in the spring or early summer, the survey and control would be implemented the previous fall. Areas surveyed would include roads, borrow areas, tailings impoundment, transmission line, and any other areas designated for timber removal. MMC would describe in final design plans the extent of which surveys and pretreatment would not be feasible. The proposed survey and treatment approach would be a part of the final Weed Control Plan, to be reviewed and approved by the lead agencies.

MMC would include road-related weed mitigation in any road access that was approved for the project (including access routes to the transmission line). MMC would treat noxious weeds along all haul and access roads yearly with the appropriate herbicide mix for the target species. MMC would broadcast treat every other year and spot treat the alternate years.

MMC would minimize soil disturbance and mineral soil exposure during ground-disturbing activities. Ground disturbance should be no more than needed to meet project objectives. MMC would prevent road maintenance machinery from blading or brushing through known populations of new invading noxious weed species. In areas where noxious weeds were established and activities require blading, MMC would brush and blade areas with uninfested segments of road systems to areas with noxious-weed infested areas. MMC would limit brushing and mowing to the minimum distance and height necessary to meet safety objectives in areas of heavy weed infestations.

MMC would pressure wash all off-road equipment including equipment for mining, vegetation clearing, road construction and maintenance, and reclamation before entering the project area to help prevent the introduction of new invader noxious weed species to the area.

MMC would continue to monitor/survey the project area for existing and new invader weed species and populations annually. MMC would monitor weed population levels with particular emphasis on haul routes, access routes, borrow areas, soil stockpiles, and the transmission line corridor. MMC would treat weed infestations as needed.

In areas where timber was to be removed, MMC would consider winter vegetation clearing to reduce mineral soil exposure and the chance of spreading existing noxious weeds.

MMC would develop and implement site-specific guidelines to be followed for weed treatments within or adjacent to known sensitive plant populations. MMC would evaluate all future treatment sites for sensitive plant habitat suitability; suitable habitats would be surveyed as necessary before treatment.

MMC would submit an annual report to the lead agencies describing weed control efforts. The report would provide a map showing areas of weed infestation that were treated in the preceding year. It also would provide a qualitative evaluation of the weed control efforts.

2.5.3.2.6 Stormwater Control and Discharges

Discharges

In 2010, MMC applied to the DEQ to renew the MPDES permit and requested the inclusion under the permit of five new stormwater outfalls needed for Alternative 3 for the next 5 years.

MMC submitted supplemental information in support of the renewal application in 2011 (Geomatrix 2011b). In 2011, the DEQ determined the renewal application was complete and administratively extended the permit (ARM 17.30.1313(1)) until MMC receives the renewed permit. The DEQ issued a draft MPDES permit in July 2015 and held a public hearing on the draft permit in August 2015. The DEQ will issue a final MPDES permit with its ROD. MMC also held MPDES permit MTR104874 for stormwater discharges from the Libby Adit Site. These discharges were incorporated into the draft renewal MPDES permit. This section discusses stormwater control and discharges during the Construction Phase; discharges of water during the Operations Phase are discussed under the Operations Phase. The five outfalls in the draft renewal permit are:

- Outfall 004—stormwater-only outfall for runoff from the Upper Libby Adit pad and access road discharging into Libby Creek
- Outfall 005—stormwater-only runoff from a 3.8-acre road segment between the Libby Adit Pad and the Libby Plant Site discharging into Libby Creek
- Outfall 006—stormwater-only runoff from a 6.2-acre road segment north of the Libby Plant Site discharging into Ramsey Creek
- Outfall 007—stormwater-only runoff from a 2.8-acre road segment south of the Poorman Tailings Impoundment Site discharging into Poorman Creek; this outfall is unlikely to be used because the access road alignment changed after MMC submitted its MPDES renewal permit application
- Outfall 008—stormwater-only runoff from a 2.9-acre road segment south of the Poorman Tailings Impoundment Site discharging into Poorman Creek

The draft renewal MPDES permit contains the following requirements or restrictions regarding stormwater discharges from outfalls 004 through 008:

- The Upper Libby Adit pad and portal will be constructed such that any waste rock produced and/or any mine drainage encountered will be directed to the existing Libby Adit for removal and treatment. The discharge of any process wastewater or any water resulting from mine dewatering activities at Outfall 004 is prohibited.
- Outfalls 005-008 are stormwater only outfalls for runoff from access roads and haul roads that are not part of the active mine area. The discharge of any process wastewater or any water resulting from mine dewatering activities at Outfalls 005-008 is prohibited.
- All stormwater ditches and sediment ponds associated with Outfalls 004 through 008 will be sized to contain the 10-year/24-hour storm event.
- Oil and grease cannot exceed 10 mg/L daily and pH must be within the range of 6.5 and 8.5 at all times.
- MMC will implement an approved SWPPP described in 2.5.2.6.2, *Stormwater Pollution Prevention Plan.*
- MMC will install and maintain site-specific BMPs that are an effective method for controlling the discharge of stormwater and that will minimize or eliminate any potential short-term stormwater impacts associated with the discharge of stormwater.

- MMC will conduct stormwater discharge monitoring summarized in Appendix C and described in detail in the draft renewal permit, including the requirement to collect grab samples within 30 minutes of discharge and flow-weighted samples over the course of the discharge.
- Effluent limits for metals and whole effluent toxicity testing on the discharge from Outfalls 004 through 008 is not required due to the expected nature and constituents (runoff driven sediment) of any discharges from these outfalls.

In its supplemental information in support of the renewal permit application in 2011 (Geomatrix 2011b), MMC indicated that it "proposes to renew or amend its existing MPDES permit to maintain the existing three outfalls, add new stormwater outfalls. These changes would suffice for the next 5-year period covering the Evaluation Phase (years 1-2) and Construction Phase (years 3-5) of the Montanore Project." The agencies anticipate MMC would require additional outfalls during the Construction Phase for the following reasons. A "stormwater discharge associated with construction activity," as defined in ARM 17.30.1102(28), requires permit coverage. Construction activity that results in the disturbance of equal to or greater than 1 acre of total land area would need to obtain permit coverage. Construction activity includes the disturbance of less than 1 acre of total land area that is part of a "larger common plan of development or sale" if the larger common plan will ultimately disturb 1 acre or more. MMC has not applied for and is not authorized to discharge stormwater from any areas other than those described for Outfalls 001 through 008. Before the KNF and DEQ would allow MMC to start construction, MMC would have to obtain a permit to discharge stormwater from other disturbances associated with the project. MMC could either amend its MPDES permit or obtain coverage under Montana's General Permit for Storm Water Discharges Associated with Construction Activity if the project was eligible for coverage under the General Permit. The disturbances from which the agencies anticipate MMC would require authorization to discharge stormwater may include, but not necessarily be limited to:

- Libby Plant Site during construction
- Poorman Impoundment Site during construction
- Soil stockpiles during construction and operations
- Access roads, such as NFS road #278, and all other access roads used for the mine or transmission line
- Libby Loadout during construction if loadout construction was considered construction activity

In addition to the disturbances described above from which the agencies anticipate MMC would require authorization to discharge stormwater, MMC may need to obtain authorization to discharge stormwater that came in contact with waste rock. Waste rock excavated extending the Upper Libby Adit and the new Libby Adit would be hauled to a temporary waste rock stockpile within the Poorman Tailings Impoundment footprint, the location of which would be determined during final design. Before the KNF or the DEQ would allow MMC to create a temporary waste rock stockpile within the Poorman Tailings Impoundment footprint, MMC would submit data regarding the concentrations of potential pollutants in runoff and seepage from waste rock to the DEQ. The DEQ would use a reasonable potential analysis to determine whether a discharge, alone or in combination with other sources of pollutants to a water body, could lead to an excursion above an applicable water quality standard. The DEQ would establish effluent limits during the MPDES permitting process if runoff from the waste rock stockpile was not sent to the Water Treatment Plant (Outfalls 001 through 003) for treatment.

Best Management Practices

Sediment and runoff from all disturbed areas would be minimized through the use of BMPs developed in accordance with the Forest Service's *National Best Management Practices for Water Quality Management on National Forest System Lands* (USDA Forest Service 2012a) and the BMP requirements in the MPDES permit. All BMPs would be monitored throughout the project (see Appendix C) and remain in place until the DEQ approved MMC's Notice of Termination. MMC could submit a Notice of Termination when the disturbance associated with the construction activity had achieved final stabilization. Final stabilization means the time at which all soil-disturbing activities at a site have been completed and a vegetative cover has been established with a density of at least 70 percent of the pre-disturbance levels, or equivalent permanent, physical erosion reduction methods have been employed. Final stabilization using vegetation must be accomplished using seeding mixtures or forbs, grasses, and shrubs that are adapted to the conditions of the site. Establishment of a vegetative cover capable of providing erosion control equivalent to pre-existing conditions at the site would be considered final stabilization.

The KNF completed an analysis of BMPs that would be required for the Bear Creek Road that would be used for mine access during all phases except the Evaluation Phase and the first year of Construction. The analysis focused on the segment of the Bear Creek Road from US 2 to Little Cherry Creek because most stormwater discharges within the mine permit area boundary south of Little Cherry Creek are covered by Outfalls 005 through 008 in the draft renewal MPDES permit. The analysis considered stream crossings along the Bear Creek Road as well as some of the open roads that would be closed for grizzly bear mitigation. The analysis also evaluated stream crossings on the Libby Creek Road that would be used for mine access during the Evaluation Phase and the first year of Construction.

The agencies used the Forest Service interface for the Water Erosion Prediction Project computer model (WEPP) (USDA Forest Service 1999a, USDA Forest Service 2015e) to quantitatively evaluate erosion and sediment delivery from forest roads that would be used for the mine alternatives. The modeling assumed the Bear Creek Road would be entirely paved and widened to 26 feet. On the Libby Creek Road, the agencies would require that the road length contributing sediment would be no longer than 150 feet. During final design, BMPs other than paving at stream crossings on the Bear Creek Road where WEPP predicted paving would increase sediment would be evaluated. Appropriate BMPs would be determined on a site-specific basis and would be monitored to determine their effectiveness. Appropriate BMPs (Burroughs and King 1989, Furniss *et al*. 1991, Kennedy 1997, Riedel *et al*. 2007) may include:

- Locating outlets for road drain dips, surface water deflectors and open top box culverts in non-erosive buffer areas
- Stabilizing disturbed areas with vegetative cover
- Erosion control treatment on fillslopes and cutslopes such as erosion control mats, rocks, hydromulching, and sodding
- Placement of filter windrows (such as logging slash) on or just below fillslopes
- Capture of road runoff in settling ponds
- Prevention of ruts in roadways that channel runoff

- Regular road maintenance
- Addition of at least 6 inches of good aggregate to roads (if not paving)
- Dust control on roads
- Prevention of erosion from roadside ditches using riprap, mats or paving
- Aligning culverts with the natural course and gradient of a stream
- Controlling scouring at culvert outlets
- Replacing buried or damaged culverts
- Replacing culverts or bridges with larger structure to prevent road flooding and channel and bank scouring
- Monitoring and maintaining culverts to prevent clogging and flooding of roads

The proposed stream mitigation in Alternatives 3 and 4 includes instream activity in Swamp Creek near US 2, Little Cherry Creek, Poorman Creek and at 21 stream crossings on land acquired for grizzly bear mitigation. The proposed mitigation is section 2.5.7.1.2, *Jurisdictional Waters (Streams).* Appropriate BMPs would be determined on a site-specific basis and would be monitored to determine their effectiveness. Placing straw bales in the stream below the construction area would significantly reduce sediment concentrations in the stream below the bales (Foltz *et al*. 2008). An effective way to prevent brief turbidity and sediment concentration increases, if practicable, would be to route stream water around the construction area until completion (Wegner 1999).

2.5.3.3 Libby Plant Site and Adits

Pre-production development would be similar to Alternative 2, but the Libby Plant Site would be located on a ridge separating Libby and Ramsey creeks (Figure 24). The same facilities proposed for the Ramsey Plant Site (Figure 5) would be built at the Libby Plant Site. Access to the plant site would be via NFS roads #4781 and #6210. A permanent bridge would be constructed across Ramsey Creek to provide access to NFS road #6210 from the Ramsey Creek Road. The bridge would be built in compliance with the INFS standards and guidelines and Forest Service guidance (USDA Forest Service 2008a, 2015b). Soil from the Libby Plant Site would be salvaged and stored in a stockpile at the Plant Site.

In Alternative 3, four adits would be required for the project, similar to Alternative 2. The two Ramsey Adits would be relocated into the Libby Creek drainage area (Figure 24). The ventilation adit located near Rock Lake proposed in Alternative 2 would remain the same (Figure 4) and the existing Libby Adit would be enlarged. The Rock Lake ventilation adit would be used only as an air intake adit and any pollutant emissions from the adit would be prohibited. The relocation of the Ramsey adits would not significantly alter the targeted access points into the deposit (crusher area, etc.) as proposed in Alternative 2.

The existing Libby Adit would be enlarged to about 30 feet wide by 30 feet high. An additional adit would be constructed on MMC’s private land near the existing Libby portal and would be 17,000 to 18,000 feet long and decline to the ore body at 5 percent grade, depending on the portal location selected. These two adits would serve the same function as the two Ramsey Adits with one adit containing the underground conveyor and the other used for personnel access and material delivery into the mine. The exact location of the second adit on private land has not been determined. Two options for this adit portal were identified.

A third adit (Upper Libby Adit) would be west of the Libby Adit Site and would provide ventilation and emergency access. This adit would be 13,700 feet long, parallel the existing Libby Adit (Figure 22), decline to the ore body at about a 7 percent grade, and terminate at the proposed mine void. The Upper Libby Adit would be constructed from underground, and waste rock would be hauled out and stored the Libby Adit Site, and not the Upper Libby Adit site. The adit portal pad would be constructed of on-site soil and rock materials with no waste rock used. Ditches and a sediment pond also would be constructed at this site, with excess stormwater from the pad surface being discharged to a permitted stormwater outfall at Libby Creek (Geomatrix 2011b).

Geotechnical investigations of the Libby Plant Site have not been completed. If the depth to bedrock at the site were similar to the Libby Adit Site, preliminary evaluation indicates the Libby Plant Site could be built out of fill material from the large cut on the west side of the plant site. The cut and fill materials would be balanced, and waste rock would not be used in plant site construction.

Electrical power for the Construction Phase would be supplied by two diesel, Tier 4 generators, if available, or Tier 3 generators at the Libby Adit. The combined total maximum rated design capacity of the diesel engine/generators would not exceed 1,500 brake horsepower. A buried 34.5-kV transmission line along Bear Creek Road and the Libby Plant Access Road may be installed to replace the generators before the installation of the main transmission line. If the buried 34.5-kV line were installed, the generators would be used as standby power during construction. If constructed, the 34.5-kV line along Bear Creek Road and the Libby Plant Access Road would connect to a substation at the Libby Plant Site. MMC also would use Tier 4 engines, if available, or Tier 3 engines on underground mobile equipment and use ultra-low sulfur diesel fuel in those engines during the Construction Phase and throughout the remaining project life.

MMC would design, construct, own, operate, maintain, and reclaim the mill site substation. Peak demand is expected to be 50 megawatts; a transformer of the same size would be needed. A 50-MW transformer may weigh 50 tons, which would necessitate reinforcing bridges and culverts on stream crossings on the Bear Creek Road and other access roads. The method and requirements of transporting the substation transformer and other mining equipment on access roads would be identified during final road design.

Power would be distributed from the substation to equipment in various locations at the Libby Plant Site, the Libby Adit Site, the Poorman Tailings Impoundment site, and within the underground mine. Once the power was available from a transmission line (either the buried 34.5-kV line or the overhead 230-kV line), the generators at the Libby Adit Site would be moved to the Libby Plant Site and used as a backup power source. The backup generators at the mill after power was available from a transmission line would not be used more than 16 hours during any rolling 12-month time period.

2.5.3.4 Waste Rock Management

The estimated schedule for waste rock management in Alternatives 3 and 4 is shown in Table 21. Waste rock excavated during the Construction Phase by extending the Upper Libby Adit and the new Libby Adit would be hauled to a waste rock stockpile within the Poorman Tailings Impoundment footprint, the location of which would be determined during final design. MMC would submit data regarding the concentrations of potential pollutants in runoff and seepage from waste rock to the DEQ. The DEQ would use a reasonable potential analysis to determine whether a discharge, alone or in combination with other sources of pollutants to a water body, could lead

Table 21. Estimated Schedule for Waste Rock Production and Disposal, Alternatives 3 and 4.

Phase	Prichard, Burke, and Revett Waste Rock (tons)		Revett Barren Lead Waste Rock (tons)	Total Waste Rock (tons)	Ore (tons)
Current	424,400	0	0	424,400	0
Evaluation	545,300	0	0	545,300	0
Construction	0	2,115,900	134,900	2,250,800	333,000
Operations (Years 1-5)	0	85,000	245,000	330,000	0
Operations (Years 6+)	0	121,400	231,300	352,700	0
Total	0	3,292,000	611,200	3,903,200	0
Proposed Placement Pending Analysis	Temporary lined Libby Adit stockpile; then to tailings impoundment	Tailings impoundment construction	Underground		Temporary unlined storage pile near the Libby Adit portal, then to mill

Conversion from bank cubic yards presented in MMC 2009 based on a density of 12.18 cubic feet/ton
Source: Table C-3 in Appendix C, MMC 2009.

to an excursion above an applicable water quality standard. The DEQ would establish effluent limits during the MPDES permitting process if runoff from the waste rock stockpile was not sent to the Water Treatment Plant (Outfalls 001 through 003) for treatment. If the DEQ determined treatment would be necessary, the waste rock stockpile would be lined with clay or a geomembrane to achieve a permeability of less than or equal to 10^{-6} cm/sec. MMC would provide a stability analysis if the area were lined. If treatment were necessary, collected water would be pumped to the Water Treatment Plant at the Libby Adit site. If the water treatment would not be necessary, a retention pond sized to store runoff from a 10-year/24-hour storm would retain runoff. The Seepage Collection Pond or the Starter Dam may serve this purpose if they were constructed before waste rock generation.

In Alternative 2, MMC proposed to temporarily store 333,000 tons of ore excavated during the Construction Phase at the LAD Area 1 before mill began operations. In Alternative 3, MMC would store the ore at the Libby Adit Site. MMC would cover the stockpile with an impermeable material to minimize infiltration from precipitation and stormwater runoff.

Limited pre-mining access to subsurface portions of the Montanore deposit makes additional sampling of waste and ore during the Evaluation Phase necessary. Further sampling and analysis also would be conducted during mine construction and operation. Together with baseline information, these data would be used to confirm and/or refine MMC's plans for operational waste rock sampling nand selective handling and management of mined rock and tailings (Geomatrix 2007a). During the Evaluation Phase, MMC would:

- Collect representative samples from previously unexposed zones of waste rock. Specifically, these zones should include any unsampled, altered waste zones within the Revett, Burke and Wallace formations, as well as portions of the Prichard Formation to be exposed during construction of new adits. Samples would be analyzed using acid base accounting (ABA), multi-element whole rock analyses, and petrography to determine (1) conformity of new sample populations with previously analyzed samples and described field-scale geochemical analogs; (2) overall adequacy of sampling; and (3) relative need for additional metal mobility and/or kinetic testing. The number of samples required to be collected during the Evaluation Phase and an approach to assessing sample adequacy are described in Appendix C.
- Collect representative samples of ore within the portion of the Revett Formation to be exposed in the evaluation adit, for additional evaluation of metal release potential. The number of required ore samples is also estimated in Appendix C.
- Collect a bulk ore sample for metallurgical test work, to obtain representative tailings for additional geochemical analysis using ABA, whole rock, synthetic precipitation leaching procedure (SPLP), and mineralogy methods. The primary goal of these analyses is to refine estimates of metal release potential for tailings. Five tailings samples are estimated in Appendix C, but the number required would be contingent upon the metallurgical test design.
- Re-evaluate predicted water quality using Evaluation Phase kinetic and metal mobility test results. Kinetic test methods would reflect the geochemical environment of proposed rock management facilities (*e.g.*, saturated or unsaturated, aerobic or anaerobic conditions). In particular, MMC would use geochemistry data to further refine the predicted volume and quality of groundwater flow post-closure and assess potential for solute attenuation downgradient of the tailings impoundment.
- If appropriate, update operational sampling and analysis plans based on all available data.
- Identify operationally achievable handling criteria for waste management.
- Re-evaluate proposed methods of managing exposed underground workings (*e.g.*, grouting, barrier pillars), backfilling waste rock, and managing impounded tailings using data obtained during the Evaluation Phase.

Until water quality predictions, operational geochemistry, and rock management plans are finalized using Evaluation Phase data, MMC would:

- Isolate and place waste rock on a liner as described in section 2.5.2, *Evaluation Phase*
- Continue to treat water from the adit and waste rock stockpiles at the Water Treatment Plant

RC Resources, Inc. (RCR) is the proposed operator of the Rock Creek Project, a proposed mine on the west side of the Cabinet Mountains. RCR funded the development of a geochemical database that contains all data relating to ore, waste rock, and tailings of the formations likely encountered by the Montanore Project and the Rock Creek Project, such as the Revett, Prichard, and Burke formations. The database is part of the Montanore and Rock Creek project record. MMC would fund the maintenance and updating of the database. Should RC Resources continue the development of the Rock Creek Project, funding for the maintenance and updating of the database could be shared equally by MMC and RCR.

2.5.3.5 Tailings Management

The agencies developed a conceptual layout of a tailings impoundment at the Poorman Tailings Impoundment Site as an alternative because it would avoid the diversion of Little Cherry Creek, reduce the loss of aquatic habitat, and minimize wetland effects. The Poorman Tailings Impoundment Site would not provide sufficient capacity for 120 million tons of tailings without a substantial increase in the starter dam crest elevation if tailings were deposited at a density proposed in Alternative 2. The tailings thickener requirements to achieve higher tailings slurry density (and hence higher average in-place tailings density) are uncertain without additional testing of simulated tailings materials. Such testing would be completed during the Evaluation Phase. These issues and the development of the Poorman Impoundment Site for tailings disposal are discussed in the following sections. Additional site comparisons between Alternatives 2 and 3 tailings facilities are presented in section 3.14.3.3, *Little Cherry Creek (Alternatives 2 and 4) and Poorman (Alternative 3) Tailings Site Comparison.*

2.5.3.5.1 Impoundment Site Location

The Poorman Tailings Impoundment Site, which would be between Little Cherry and Poorman creeks in an unnamed watershed tributary to Libby Creek, could be developed to hold 120 million tons of tailings and support facilities (Figure 25). The site would be entirely on National Forest System lands. Private property not owned by MMC is located 300 feet east of the southern two-thirds of where the tailings dam alignment would be located. The Poorman site is in Sections 24 and 25, Township 28N, Range 31 West. Tailings would be transported to the site from a mill as a slurry, the same as proposed by MMC in Alternative 2. At the site, the tailings would be sent to a thickener plant and deposited in the impoundment as high-density tailings.

The Poorman Tailings Impoundment Site is a broad, east-facing slope about 0.25 mile west of Libby Creek. Like the Little Cherry Creek site, groundwater beneath the site exhibits artesian pressures in the base of the slopes above Libby Creek (Morrison-Knudsen Engineers, Inc. 1989a). The geology and near surface soils of the site are similar to the materials found in the Little Cherry Creek tailings site (Alternative 2) except that soft weak clays do not appear to be present in the soil strata (Morrison-Knudsen Engineers, Inc. 1989a).

2.5.3.5.2 General Proposed Facilities

In Alternative 3, the cyclone overflow (the fine tailings fraction after the sand is removed to build the sand dam), would be deposited as high-density tailings slurry with an average slurry density of 70 percent. The ability to achieve these densities is discussed in section 3.14.3.3, *Little Cherry Creek (Alternatives 2 and 4) and Poorman (Alternative 3) Tailings Site Comparison*. The agencies assumed thickening to an 80 percent density for the Rock Creek Project, which is proposing the mine in the same formation as the Montanore Project (see section 3.9.4, *Environmental Geochemistry* for a discussion of the geologic similarities between the Rock Creek and Montanore deposits). At a 70 percent slurry density, the average settled density of the tailings over the life of the project is estimated to be 85 pounds per cubic foot (pcf). As excess water drains from the fine tailings mass and the mass consolidates under long-term conditions, the average mass density could exceed 90 pcf. The time frame for such consolidation and the final average tailings density would depend upon the characteristics of the tailings and deposition patterns around the impoundment. The tailings slope is estimated to be 5 percent and the tailings shear strength sufficient to remain stable. During final design, laboratory tests would be run to confirm the slurry densification and shear strength characteristics, and seepage-induced consolidated tests would be performed on representative tailings samples to determine the appropriate slurry density, slope at deposition, and expected consolidation behavior of the tailings. During impoundment construction and operations, MMC would fund a third party technical advisor to assist the agencies with tailings impoundment quality assurance and quality control oversight.

Site development would include site stripping and foundation preparations followed by construction of a Starter Dam built from waste rock and borrow materials (as in Alternative 2), a Rock Toe Berm from waste rock and borrow materials under the toe of the Main Dam for stability, a drainage system within the impoundment area (as in Alternative 2), a Seepage Collection Pond (as in Alternative 2) and associated pumpback well system, a Saddle Dam on the north side of the impoundment, a tailings thickening plant, a waste rock stockpile, topsoil and subsoil stockpile areas, and relocation of NFS road #278.

The tailings dam would consist of three sections, the Starter Dam along the upstream toe of the Main Dam section, a Rock Toe Berm to buttress/support the sand dam along the Main Dam section, and a Main Dam section consisting of the sand fraction cycloned from the tailings (Figure 25 and Figure 26). The dam would have a final crest length of 10,300 feet at an elevation of 3,664 feet. The dam would have a vertical height of 230 feet above the Rock Toe Berm and 360 feet including the Rock Toe Berm. The dam layout is designed to maximize the height of the dam section based on estimated quantities available from the cyclone operations and to minimize fill requirements to balance the fill volume required for the total dam. Based on initial evaluation, the layout is considered feasible, but would be revised in final design, if possible, to reduce total fill quantities.

An impoundment with a Main Dam crest of 3,664 feet would contain almost all of the thickened tailings. With an average in-place density of 85 pcf at completion of tailings deposition (91.4 million tons), about 1 foot of additional dam crest would be required for complete storage of the tailings at a level surface. Assuming a level tailings surface, the impoundment capacity at the estimated dam crest elevation in the final years of operation would not allow for water storage within the impoundment area nor account for lost capacity due to the slope of the tailings surface. The dam maximum crest would be set at about 3,664 feet based on the Starter Dam and Rock Toe Berm layouts and the volume of cyclone sand available for construction of the Main Dam. Perimeter tailings deposition from an elevated position along the back slope of the impoundment would be required to store all of the tailings and allow for water storage within the impoundment during the final years of operation as discussed in subsequent sections. The cross-section shown in Figure 26 shows the estimated height and slope of the tailings surface with deposition from the perimeter slopes.

Foundation Preparations

Foundation preparations would be as described in Alternative 2. Additional field exploration would be required to assess foundation conditions at the Poorman site. This field work would be completed during the Evaluation Phase. Based on available data, deposits of low strength, highly compressible glaciolacustrine clay may underlie the Poorman site. No unsuitable foundation conditions relative to dam stability are anticipated in the Poorman Site. The extent of the glaciolacustrine clay and its strength would be assessed during final design to assess the need for shear keys. In the event unsuitable materials were identified in subsequent design studies, or otherwise encountered in the site, such material would be excavated and stored in a stockpile. The material would be used for cover material in closure of the tailings facility or backfilled into borrow areas.

Rock Toe Berm

A Rock Toe Berm constructed as a compacted rock fill structure in the toe area of the Main Dam is currently part of the conceptual design. The Rock Toe Berm is designed to reduce the volume of cyclone sand required to construct the dam to the design height, and limit the height of the sand dam to allow a steeper downstream face to reduce the required sand volume. The Rock Toe Berm would be a free draining structure to prevent buildup of a water surface in the toe of the Main Dam. The Rock Toe Berm would have a 30-foot wide crest at an elevation of 3,440 feet with a 2.5H:1V downstream slope and a 3H:1V upstream slope. The upstream face of the Rock Toe Berm would be of screened material to create a surface that is filter compatible with the tailings sand to prevent the tailings sand from migrating into the Rock Toe Berm. The crest length is 4,400 feet and the vertical height at the maximum section is 140 feet. The total estimated volume of the Rock Toe Berm is 2.7 million cubic yards. About 1.2 to 1.5 million cubic yards of waste rock would be available from initial mine development and early mine operations. The balance of material would be obtained from either a rock borrow quarry developed in the upper elevations of the site where soil cover is minimal (Figure 25) or from suitable sand and gravel lenses noted in the glacial deposits located at the site (Morrison-Knudsen Engineers, Inc. 1989a).

Starter and Saddle Dams

The Starter Dam would be a compacted earthfill embankment with a 70-foot wide crest at an elevation of 3,480 feet (Figure 25). Upstream and downstream slopes would be 2.5H:1V. The wide crest was selected to reduce sand requirements in the Main Dam. The estimated crest length is 6,000 feet and the maximum section about 100 feet high. The Starter Dam would be constructed with waste rock and borrow material excavated from surface and near surface glacial deposits within or adjacent to the impoundment (Figure 25). The conceptual layout volume of the Starter Dam is estimated to be 1.7 million cubic yards. The fill would be placed in maximum uncompacted lifts of 1 foot or less and compacted with suitable equipment. All boulders larger than 8 inches diameter would be removed from the fill. A Saddle Dam of similar construction would be required in the north perimeter of the impoundment area. The Saddle Dam volume is estimated to be 730,000 cubic yards. The estimated volume of available borrow within the impoundment area is in excess of 5 million cubic yards; an estimated 1.2 million cubic yards of waste rock also would be available (Table 21). A HDPE geomembrane liner would be placed beneath a portion of the tailings impoundment and keyed into the low permeability zone of the dam (Figure 25 and Figure 26). During Starter Dam construction, a temporary water reclaim/storage pond would be constructed upstream from the Starter Dam to hold water until the Starter Dam was complete.

After the Starter and Saddle Dams were constructed, the impoundment footprint would be prepared for tailings deposition after operations began. Any soft, unsuitable materials would be either excavated and transported as backfill for the borrow areas, or filled with suitable material, such as general fill from borrow areas. An average of 24 inches of surface soils and 12 inches of subsoils at all wetlands would be excavated and used at isolated wetland mitigation sites (see section 2.5.7.2, *Isolated Wetlands*). Final design for management of wetland soils would be submitted to the agencies for approval. No tailings would be deposited directly into waters of the U.S. because other materials would first be placed in these areas before depositing the tailings.

Borrow Materials

The primary source for borrow materials for the starter and Saddle Dams would be local borrow materials from within the impoundment footprint (Figure 25). The borrow source for the Rock Toe Berm would be waste rock from the mine stockpiled at the site supplemented by local borrow within or adjacent to the impoundment area. Borrow for the Rock Toe Berm from within the impoundment site would consist of sands and gravels obtained for lenses in the underlying glacial alluvial material or bedrock obtained from a quarry site that could possibly be developed in the higher elevations where soil cover appears to be shallow compared to most of the impoundment area.

Drain materials would be obtained from on-site crushing and screening of suitable borrow (such as the sand and gravel lenses referenced in the glacial alluvial deposits) or obtained from a commercial source. Table 22 is a summary of anticipated material and volumes based on the conceptual layouts for Alternative 3.

Table 22. Estimated Tailings Impoundment Facility Volumes, Alternative 3.

Facility	Volume (million cubic yards)
Starter Dam	1.7
Rock Toe Berm	2.7
Cyclone Sand Dam	22.2
Saddle Dam	0.7
Seepage Collection Pond Fill	<0.1

2.5.3.5.3 Seepage Collection

In Alternative 3, a seepage collection system similar to that proposed in Alternative 2 would be used. A system of trunk drains and smaller lateral drains over the impoundment floor and beneath the tailings dam would convey seepage to the toe of the dam (Figure 25). Smaller secondary drains would convey water laterally into the trunk drains. Because the proposed underdrain system of the Little Cherry Creek and Poorman Impoundment as well as the hydrogeologic setting of the two sites were similar, the agencies assumed tailings seepage would be equal to the flow rates estimated for Alternative 2. For example, the estimated seepage flow rate into the foundation below the impoundment is 25 gpm and the seepage water from tailings consolidation is based on 75 percent of consolidation water migrating downward and 25 percent moving upward into the surface pond. MMC requested a groundwater mixing zone beneath and downgradient of the Poorman Impoundment for changes in water quality (NewFields 2015). Requested boundaries of the groundwater mixing zone beneath and downgradient of the Poorman Impoundment are 5,000 feet in length (east-west) downgradient of the west upper edge of the tailings impoundment; and 7,000 feet in width extending north-south. A mixing zone a limited area of a surface water body or a portion of an aquifer, where initial dilution of a discharge takes place and where water quality changes may occur and where certain water quality standards may be exceeded (ARM 17.30.502(6)). The DEQ would determine if a mixing zone beneath and downgradient of the impoundment would be authorized in accordance with ARM 17.30.518 and, if so, would determine its size, configuration, and location. If DEQ authorized a mixing zone, water quality changes might occur, but BHES Order limits could not be exceeded outside the mixing zone, and for other water quality parameters, exceedance of nonsignificance criteria could not occur outside the mixing zone unless authorized by DEQ.

Artesian conditions are present along the toe area of the dam footprint. A drainage collection system would be designed (similar to Alternative 2) and installed under the Rock Toe Berm and extend upstream under the Main and Starter dam footprints as necessary to collect and control groundwater. The Rock Toe Berm would be designed as a separate facility, but with its base layer compatible with the underlying drain system. Design of the groundwater drain system in the toe area of the dam would be separate from the tailings impoundment seepage collection system to enable separate monitoring of the two systems before flowing into the Seepage Collection Pond. Final design of the groundwater drain system would consider the need and benefit of a seepage collection trench along the toe of the dam upstream of the private property (Figure 25).

Drain designs (both gravity and pressure relief drains) would be similar to those used in Alternative 2. Drains within the impoundment would be installed in trenches into the native ground and covered with a permeable protective layer to prevent erosion and plugging of the drains during initial placement of the tailings (Figure 25). During construction of the seepage collection and drain system, any wetlands uphill of the Main Dam would be filled. All drains would be placed in a geomembrane-lined trench and consist of a core of highly pervious 1- to 4-inch rock wrapped in geotextile and surrounded by sand and gravel filter material. Locally available sand and gravel alluvial material would be used to cover the drains to prevent the fine tailings from piping into the drain materials during operations. Seepage collection drains through and under the dam footprint would be designed as integral parts of the dam foundation and compatible with each of the overlying dam sections. MMC would install pumpback recovery wells to collect tailings seepage not intercepted by the Seepage Collection System. The pumpback recovery wells would be located beyond the dam toe, and would be designed to collect seepage not collected by the drain system.

A Seepage Collection Pond and return facility would be 500 feet west of Libby Creek and 500 feet downstream of the impoundment. The facility design would include collection of water from the impoundment seepage collection drains, the groundwater relief drains, and runoff from the downstream slope and toe area of the tailings dam facility. The pond would have a crest elevation of 3,240 feet and be lined with HDPE (or equivalent). The outside compacted fill slopes would consist of material excavated from the pond area and graded to have 2.5H:1V slopes. The perimeter crest would be 30 feet wide for maintenance purposes. The design criteria for the pond would be to contain up to 30 days of drain flow plus runoff from the 6-hour PMP storm event. (The Seepage Collection Pond in Alternative 2 was designed to accommodate the smaller 100-year/24-hour storm.) The capacity of the Seepage Collection Pond shown in Figure 25 is 153 acre-feet (50 million gallons).

A pump station would be located on the west side of the Seepage Collection Pond (Figure 25). The return water pipelines would plumb either into the return water lines in the thickener plant, or into the tailings facility where the water would combine with the tailings water and then would be recovered through the tailings impoundment return water system. The pumps would be rated at 125 percent of the estimated maximum flow into the ponds.

2.5.3.6 Transportation and Access

The following sections describe road use and public access along the main access road (Bear Creek Road (NFS road #278), Libby Creek Road (NFS road #231), and within the proposed permit areas during the Construction, Operations, and Closure Phases. With the exception of the Bear Creek Road, all open roads in the impoundment site permit area would be gated and restricted to mine traffic only. Non-motorized public access would be restricted within each permit area by signage at the permit area boundary. Table 23 lists those roads with a change in road status in Alternative 3; these roads are shown on Figure 29. MMC would be responsible for maintaining all existing or new roads and stream crossings used by the operation.

2.5.3.6.1 US 2 Improvements

MMC would fund and implement roadway improvements to US 2 and intersections with US 2 required by MDT.

2.5.3.6.2 Bear Creek Road Reconstruction

In Alternative 3, MMC would use the Bear Creek Road as in Alternative 2 for main access during operations. As discussed previously, the agencies incorporated the Libby Adit evaluation program into Alternatives 3 and 4. MMC would continue to plow and use the Libby Creek Road (NFS road #231) and the Upper Libby Creek Road (NFS road #2316) year-round during the 2-year evaluation program and the 1-year period during reconstruction of the Bear Creek Road. MMC would install and maintain a gate on the Libby Creek Road and the KNF would seasonally restrict access on the Libby Creek Road (NFS road #231) and the Upper Libby Creek Road (NFS road #2316) as long as MMC used and snowplowed the two roads, or as directed by the KNF or the Oversight Committee. Any work in a RHCA along an access road would be completed in compliance with INFS standards and guidelines and Forest Service guidance (USDA Forest Service 2008a, 2015b).

MMC would reconstruct the Bear Creek Road in accordance with the road design developed during the final design process. MMC would implement the plan for maintaining continued access by local landowners and recreational forest users during the Bear Creek Road reconstruction.

South of Little Cherry Creek, MMC would build 0.7 miles of new road west of and parallel to the Bear Creek Road that would connect Bear Creek Road with Ramsey Creek Road (NFS road #4781) (Figure 29). Once oversized haul vehicles were no longer needed between the tailings impoundment and Libby Plant Site, the mine and public traffic would both use the new alignment. When the road was used jointly, the primary road use would be mine traffic (vendors, concentrate haulage, deliveries, and personnel) similar to the use patterns on the lower segment of Bear Creek Road. The segment of the Bear Creek Road parallel to the new access road would be decommissioned, and the culvert crossing Poorman Creek would be removed. Decommissioned roads are discussed in 2.9.4.2, *Access Road Construction and Use*.

Similar to Alternative 2, MMC would use open and closed roads in Alternative 3. Some currently open roads would be gated. The agencies' wildlife mitigation includes access changes, either with gates or barriers. MMC would be responsible for installing and maintaining each closure. MMC would check the status of the closures twice-a-year (spring and fall), and repair any gate or barrier that is allowing access. The gates would have dual-locking devices to allow the KNF fire or administrative access. When accessing areas regulated by the Mine Safety and Health Administration, KNF personnel would check in at the mine office before entering regulated areas.

Table 23. Proposed Change in Road Status for Roads used during Construction, Operations, and Closure in Alternative 3.

Road #	Road Name	Location	Existing Status	Length (miles)	Proposed Status
1408	Libby Creek Bottom	Tailings Impoundment	Open	0.8	Gated, mine traffic only
2316	Upper Libby Creek	Libby Adit Site	Open	2.2	Mixed mine haul and public traffic
2316	Upper Libby Creek	Libby Adit Site	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.3	Gated, mine traffic only
2316	Upper Libby Creek	Libby Adit Site	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.7	Trail
2317	Poorman Creek	Up Poorman Creek	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	1.8	Trail
2317	Poorman Creek	Up Poorman Creek	Open	0.3	Mixed mine haul and public traffic
2317B	Poorman Creek B	Up Poorman Creek	Impassable, open to snow vehicles 12/1-4/30	0.5	Trail
4781	Ramsey Creek	Up Ramsey Creek	Open	0.7	Gated, mine traffic only
4781	Ramsey Creek	Up Ramsey Creek	Open	0.5	Decommission
4781	Ramsey Creek	Up Ramsey Creek	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	2.2	Trail
5181	L Cherry Loop H Cowpath	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.5	Gated, mine traffic only
5181A	L Cherry Loop H Cowpath A	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.2	Gated, mine traffic only
5184	Bear-Little Cherry	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.2	Gated, mine traffic only
5184A	Bear-Little Cherry A	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.2	Gated, mine traffic only
5185	S Bear-Little Cherry	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.9	Gated, mine traffic only
5185A	S Bear-Little Cherry A	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.3	Gated, mine traffic only
5187	L Cherry Loop L Clearing	Tailings Impoundment	Barriered year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.2	Gated, mine traffic only
6201	Cherry Ridge	Tailings Impoundment	Barriered year-long to motor vehicles, open to snow vehicles 12/1-4/30	1.2	Gated, mine traffic only
6201A	Cherry Ridge A	Tailings Impoundment	Barriered year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.6	Gated, mine traffic only

Road #	Road Name	Location	Existing Status	Length (miles)	Proposed Status
6210	Libby Ramsey	Libby Adit Access Road	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	2.95	Gated, mine traffic only
6210	Libby Ramsey	Libby Adit Access Road	Open	0.4	Gated, mine traffic only
6212	Little Cherry Loop	Tailings Impoundment	Open	2.1	Bridge across Poorman Creek removed during construction; road south of Poorman Creek decommissioned; Gated, mine traffic only
6212H	Little Cherry Loop H	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.6	Gated, mine traffic only
6212L	Little Cherry Loop L	Tailings Impoundment	Barriered year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.4	Gated, mine traffic only
6212M	Little Cherry Loop M	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	1.1	Gated, mine traffic only
6212P	Poorman Pit	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.3	Gated, mine traffic only
8749	Noranda Mine	Libby Adit Site	Private, gated	0.5	Gated, mine traffic only
8749A	Noranda Mine A	Libby Adit Site	Private, gated	0.2	Gated, mine traffic only
14403	Lower Ramsey	Libby Plant Site	Barriered year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.4	Gated, mine traffic only
14404	Bare Road	Tailings Impoundment	Barriered year-long to motor and snow vehicles	0.6	Gated, mine traffic only

Public access would be eliminated on the Little Cherry Loop Road (NFS road #6212) during the Construction, Operations, and Closure Phases and used exclusively for mine traffic (Figure 29). The bridge on NFS road #6212 across Poorman Creek would be removed during construction and the road south of Poorman Creek to the intersection of NFS road #278 would be decommissioned. A gate on the road would be installed near the tailings impoundment permit area boundary on the north end. Depending on timing of project construction, the KNF may need administrative access to NFS road #6212P to allow access to a gravel pit at the road’s terminus. The following closed National Forest System roads within the impoundment area would be used in Alternative 3: #1408 to the private land in the NW¼, Section 25, Township 28N, Range 31 West, #5181, #5181A, #5185, #5185A, #5187, #6212H, #6212L, #6212M, and #6212P (Figure 29).

Access and road use on NFS road #4781 up Ramsey Creek and NFS road #6701 would change from gated to barriered to provide grizzly bear mitigation. A short segment of the Ramsey Creek Road would be placed in intermittent stored service (Figure 29).

2.5.3.7 Other Modifications

2.5.3.7.1 Updated Closure Plan

MMC would update the closure plan, including a long-term monitoring plan, during the Construction Phase in sufficient detail to allow development of a reclamation bond for the Closure Phase. A final closure and post-closure plan, including a long-term monitoring plan, would be submitted 3 to 4 years before mine closure.

2.5.3.7.2 Scenery and Recreation

MMC would design and construct a scenic overlook with information and interpretive signs on NFS road #231 (Libby Creek Road) downstream of the Midas Creek crossing with views of the tailings impoundment. MMC would develop two interpretative signs, one on the mining operation and another one on the mineral resource and geology of the Cabinet Mountains. Parking would be developed in cooperation with the KNF.

MMC would gate certain roads currently open in the mine permit areas beginning during the Construction Phase for the life of the project (Table 23). These roads would be different in Alternative 4. The KNF would change the access to other roads for wildlife mitigation (see section 2.5.7.4, *Wildlife*). In Alternatives 3 and 4, MMC would check the status of the closures twice-a-year (spring and fall), and repair any gate or barrier that was allowing access.

MMC would pay the reimbursement funding for a volunteer campground host from Memorial Day through Labor Day at Howard Lake Campground using an Volunteer Services Agreement for Natural Resources Agencies (Optional Form 301a), during the Construction and Operations Phases of the mine. MMC would shield or baffle night lighting at all facilities.

MMC would complete vegetation clearing operations under the supervision of an agency representative with experience in landscape architecture and revegetation. Where practicable, MMC would create clearing edges with shapes directly related to topography, existing vegetation community densities and ages, surface drainage patterns, existing forest species diversity, and view characteristics from Key Observation Points (KOPs). MMC would avoid straight line or right-angle clearing area edges. MMC would not create symmetrically-shaped clearing areas.

MMC would transition forested clearing area edges into existing treeless areas by varying the density of the cleared edge under the supervision of an agency representative. MMC would mark only trees to be removed with water-based paint, and not mark any trees to remain. MMC would cut all tree trunks at 6 inches or less above the existing grade in clearing areas located in sensitive foreground areas such as within 1,000 feet of residences, roads, and recreation areas. These locations would be determined and identified by an agency representative before clearing operations.

MMC would submit plans and specifications to the agencies to locate above-ground facilities, to the greatest extent practicable, without the facilities being visible above the skyline as viewed from the KOPs.

2.5.3.7.3 Reporting

MMC would submit as part of its annual report to the lead agencies a discussion of its compliance with all the monitoring and mitigation requirements specified in the DEQ Operating Permit and the KNF's approved Plan of Operations. Each monitoring and mitigation requirement of the selected alternative would be listed in the report.

2.5.4 Operations Phase

2.5.4.1 Mining

The agencies made seven changes to the mine plan: ore conveyance, mining outside MMC's extralateral rights, changes in buffer thicknesses, the use of barrier pillars, underground monitoring and inspection, sound levels and limitations on air emissions.

Ore would be conveyed via an above-ground covered conveyor from the Libby Adit Site 6,000 or 7,500 feet (depending on the adit location) to the covered coarse ore stockpile at the Libby Plant Site. The conveyor would parallel NFS roads #2316 and #6210. The agencies identified two options for the conveyor: one would be about 10 feet wide and 10 feet high, and the other would be lower (8 feet), but wider (16 feet) (Figure 23). The conveyor and three transfer points would be fully enclosed to minimize emissions, contact with precipitation and loss of ore. Any spillage would be promptly cleaned up to avoid contact with precipitation.

In MMC's Minor Revision 06-002 to its Hard Rock Mine Operating Permit #00150 (MMC 2006), MMC proposed areas of exploration outside of its extralateral rights. In Alternatives 3 and 4, MMC would not explore or mine for any ore outside of its extralateral rights.

In Alternative 3, MMC would be required to maintain at least a 1,000-foot buffer from Rock Lake and a 300-foot buffer from the Rock Lake Fault. MMC also would maintain during mining a 100-foot buffer from faults identified on Figure 61. MMC would keep the size and number of drives through the faults identified on Figure 61 to the minimum necessary to achieve safe and efficient access across the fault. During the Evaluation Phase, MMC would conduct hydrologic and geotechnical studies and update the hydrologic model, as described in Appendix C, to determine if the buffer dimensions should be changed. The results would be reviewed by the lead agencies and approval would be required before MMC could mine within a smaller buffer area.

For the purpose of analyzing the effects of possible mitigations to minimize effects on surface water from mine dewatering, MMC simulated two options in its 3D groundwater model: grouting, during Operations Phase, of the sides of the three uppermost mine blocks and corresponding access ramps, as well as installing two 20-foot thick concrete pressure grouted wall bulkheads with a hydraulic conductivity of 1×10^{-9} cm/sec in two mining blocks in the mine at Closure. The agencies' evaluation of the constructed bulkheads, discussed in more detail in the *Groundwater Hydrology* section under Mitigation (p. 612), concluded that man-made concrete bulkheads would unlikely provide the necessary mitigation over the long-term, assuming the hydrologic modeling was representative of underground conditions. The agencies also concluded that leaving a "pillar" of unmined ore with characteristics similar to the constructed bulkheads simulated in the modeling would likely provide the necessary mitigation over the long-term, again assuming the hydrologic modeling was representative of underground conditions. Consequently, by the fifth year of operations, MMC would assess the need for barrier pillars to minimize post-mining changes in East Fork Rock Creek and East Fork Bull River streamflow and water quality. If needed, MMC would submit a revised mine plan with one or more barrier pillars with constructed bulkheads at access openings to the agencies for approval. One or more barriers would be maintained underground, if necessary based on the hydrologic monitoring, after the plan's approval. The underground barriers are described in section 2.5.2.2, *Proposed Activities* in the discussion of the Evaluation Phase.

To ensure MMC only mined ore within its valid existing rights and that the underground mine development adhered to required buffer zone boundaries, the Plan of Operations and DEQ operating permit would include requirements for underground monitoring. MMC would fund and facilitate biannual surveys of the underground workings that would be completed by an independent qualified mine surveyor. The surveyor would be selected and directed by the agencies through an agreement with MMC. The surveyor would have no financial interest in the Montanore Project. The agencies may also require more frequent surveys and/or as-built drawings if discrepancies arose. MMC would provide mine access, logistical support, and all information required by the surveyor to complete independent inspections and resulting documentation for the identified tasks. This would include all company-conducted mine surveys of the underground workings. After completing the monitoring survey, the independent surveyor would submit maps of the workings to the agencies and would report any underground disturbances that crossed the established extralateral rights boundary, entered into designated buffer zones, or deviated from agency approved mine design.

MMC would fund a third party technical advisor to assist the agencies with underground mine quality assurance and quality control oversight during operations. The technical advisor would assist the agencies in evaluating underground mine stability and adherence to the approved mine plan. MMC would provide mine access, logistical support, and all information required by the technical advisor to complete a review of underground rock mechanics data and MMC's mine plan. Assessments of the underground workings by the technical advisor may occur as frequently as quarterly, with the results of the inspections compiled into an annual assessment report. This annual report from the technical advisor would incorporate data collected as part of the ongoing monitoring program, and would be in addition to the annual report prepared by MMC. The technical advisor is described in section 2.5.2.6.4, *Final Underground Mine Design Process*.

MMC would compile the results from its surface and underground monitoring programs as developed during the final design process, and provide the results to the agencies in an annual report.

MMC would operate all surface and mill equipment so that sound levels would not exceed 55 dBA, measured 250 feet from the mill for continuous periods exceeding an hour. Backup beepers may exceed 55 dBA 250 feet from the mill. MMC's proposal in Alternative 2 to install silencers on intake and exhaust ventilation fans in the Ramsey Adits so that they generate sounds less than 85 dBA measured 3 feet downwind of the portal would apply to the three Libby Adits. As in Alternative 2, MMC also would locate all fans a minimum of 500 feet from the portals during operations unless alternative locations would not increase noise levels in the CMW from the Libby Adit Site by 5 decibels or more. Changes smaller than 5 dB would be considered insignificant (EPA 1978).

MMC would adhere to all emission limitations in the final air quality permit. The DEQ's Supplemental Preliminary Determination on MMC's air quality permit (DEQ 2015a) contains a number of limitations on air emissions, including:

- The maximum ore production (measured as throughput at the primary crusher) would be limited to 20,000 tons during any 24-hour rolling period and to 7,000,000 tons during any rolling 12-month time period.

- The maximum diesel fuel consumption by underground equipment would be limited to 3,576 gallons during any rolling 24-hour time period and to 1,305,279 gallons during any rolling 12-month time period.
- The maximum diesel fuel consumption by surface equipment would be limited to 3,769 gallons during any rolling 24-hour time period and to 1,375,712 gallons during any rolling 12-month time period.
- The maximum propane consumption by the propane fired heaters would be limited to 488,448 gallons during any rolling 12-month time period.
- The maximum RU Emulsion explosive use would be limited to 4,770.5 tons during any rolling 12-month time period.
- The stack height of the diesel engine/generator would be a minimum of 10 feet above ground level.
- The emissions from the Libby #1 Exhaust Ventilation Adit would be limited to 8.74 tpy of particulate matter with an aerodynamic diameter of 10 microns or less (PM10); 2.03 tpy of particulate matter with an aerodynamic diameter of 2.5 microns or less (PM2.5); 23.22 tpy of oxides of nitrogen (NOx); and 1.91 tpy of oxides of sulfur (SOX).
- The Libby #1 and Libby #2 Exhaust Ventilation Adits would not exhaust more than 350,000 cubic feet per minute (cfm) of air.
- Emissions from the baghouses used to control emissions from the surface ore handling activities at the SAG mill and at the Libby Load-Out facility would be limited to 0.05 grams per dry standard cubic meter (g/dscm) or 0.020 grains/dscm.
- Emissions from the wet venturi scrubber used to control emissions from the coarse ore stockpile transfer to the apron feeders would be limited to 0.05 g/dscm or 0.020 grains/dscm.
- MMC would not cause or authorize to be discharged into the atmosphere stack emissions that exhibit 7% opacity or greater averaged over 6 consecutive minutes from the baghouse.
- MMC would not cause or authorize to be discharged into the atmosphere any fugitive emissions from process equipment that exhibit 10% opacity or greater averaged over 6 consecutive minutes.

2.5.4.2 Tailings Management

2.5.4.2.1 Main Dam

The Main Dam would be a compacted cyclone sand dam constructed by the centerline method to an elevation of 3,664 feet (Figure 25 and Figure 26). A crest width of 70 feet was used to account for the upstream slope of the sand deposition and working crest area for the proposed cyclone towers. The downstream slope was set at 2.75H:1V and would be buttressed by a Rock Toe Berm described above. Based on the height and position of the Rock Toe Berm, the vertical height of the Main Dam would be 230 feet above the Rock Toe Berm crest (Figure 25 and Figure 26). The final crest length would be 10,300 feet, and the main north-south axis would be 5,000 feet long. The left and right abutment sections would be both angled back at about 75 degrees from the main section centerline and tie into the existing ground at the crest elevation (Figure 25). The dam would be raised with cyclone underflow sand hydraulically placed and compacted in cells as described for Alternative 2. The cyclone overflow (fine tailings fraction) would be routed to the tailings thickener plant and combined with the primary thickener underflow and thickened to a target slurry density of 70 percent. The density would be determined during final design.

2.5.4.2.2 Tailings Deposition

In Alternative 3, tailings would be thickened to a target density of 70 percent at a thickener plant at the impoundment site. Density can vary between deposition methods depending on the physical and geotechnical characteristics of site-specific tailings. Deposition of tailings slurries at thicker densities can offer several advantages over tailings slurries at 55 percent or less, including increasing water recovery; reducing requirements for make-up water and water storage; providing greater impoundment stability; and under certain conditions, potentially depositing tailings higher than the level surface of the tailings. The Poorman Impoundment Site is amenable to thickened tailings deposition from the upstream perimeter slopes, whereas the Little Cherry Creek site has limited capacity for thickened tailings deposition from slopes upstream of the impoundment. In Alternatives 2 and 4, thickened tailings deposition would only increase impoundment storage capacity if the drainage area above the diversion dam on Little Cherry Creek were used.

Tailings Pipelines

Tailings slurry would be pumped in buried double-walled HDPE or HDPE/steel combination pipelines from the mill at the Libby Plant Site to a thickener facility west of the impoundment. In Alternative 3, the pipeline corridor would parallel the road except where the road curved (Figure 22, Figure 23). Tailings pipelines would be double-walled to reduce the risk of leaks; one type of pipeline used successfully at the Stillwater Mine complex consists of a HDPE pipe inside a steel pipe. The leak detection system proposed by MMC would be used. In the event that the leak detection system monitored a leak, the mill operator would change flows to the second tailings line and flush the other line of all solid material. The investigation of the leak would then commence.

MMC would bury tailings pipelines adjacent to the proposed access road between the Libby Plant Site and the Poorman Impoundment Site in most locations. Unless it was impracticable, pipelines would be buried at least 3 feet deep adjacent to the access road. The pipelines would not be buried at the Ramsey Creek and Poorman Creek crossings, but would set in a lined, covered trestle adjacent to the bridge. The creek crossings would have secondary containment built into the crossings besides the double-walled pipe. The containment would be covered and drain toward a designed sump or tank system. Valves would be installed on either side of the crossings to minimize the quantity of tailings that would reach the creek. The ditch proposed by MMC in Alternative 2 would not be constructed. MMC would prepare an as-built drawing showing pipeline depths. Burying the pipelines would provide better protection from vandalism, eliminate the visible presence of the pipelines, and facilitate concurrent reclamation in the pipeline corridor along most of the route between the mill and the tailings thickener plant. In addition to the pump station at the Poorman Creek crossing proposed in Alternative 2, another pump station, similar to the Poorman Creek pump station, would be needed at the Ramsey Creek crossing. These pump stations would be outside of the 100-year floodplain to comply with INFS requirements (Figure 23). Once the pipelines were no longer needed, they would be flushed out into the tailings impoundment. They would be removed from all stream crossings and anywhere they were less than 3 feet below the surface. For other segments of the pipelines, the pipelines would be left in place. They would be cut at 0.5-mile intervals, and capped.

Thickener Facility

The thickener facility would remove water, or dewater, the tailings to a target density of 70 percent solids and deposited to achieve an average in-place tailings density of 85 pcf or greater. Water removed from the tailings would be sent to the water storage pond on the north end of the Poorman Tailings Impoundment (Figure 25). It is anticipated that either a high compression thickener or a deep tank thickener system would be required. A high compression thickener is basically a high rate thickener with higher sidewalls so that a higher mud level is maintained in the thickener. This produces a higher percent solids underflow, referred to as high-density slurry. The deep tank thickener has a high sidewall so that the aspect ratio of diameter to height is about 1:1. A higher mud level and residence time results in higher percent solids than the high compression thickener. The appropriate selection would be based on a series of rheology tests (test to evaluate the physical relationship between the slurry density and size/material type of the pipe to determine the “pumpability” of the slurry) using representative tailings samples. The number of thickeners would depend on the test results coupled with the production rate. The plant would be expanded in stages to accommodate the increasing tailings production rate over time (from 12,500 to 20,000 tons of tailings per day). The water removed from the tailings slurry would be routed to the storage pond in the impoundment and then returned to the mill as make-up water.

The area required for the facility would depend on final design and arrangement of the thickeners. An area up to 300 feet by 200 feet would be located above the impoundment area. The main building and any exterior thickeners/facilities would be painted to help reduce visual impacts. Vegetation surrounding the thickener plant would be retained or planted to help visually blend the plant site with adjacent hillsides. The thickener plant would be designed to receive, dewater, and pump up to 20,000 tons of tailings per day.

Pumping and Deposition

The selection of pumping equipment would depend largely on the type of thickener selected, the pumping pressures required, and rheology of the tailings. Either centrifugal pumps or positive displacement pumps likely would be required for this alternative. The selection would be determined as part of final design studies.

Initially, the high-density slurry would be applied to the ground surface from the crest of the Starter Dam and initial raises of the Main Dam, and retained by a Starter Dam and subsequent Main Dam similar to Alternative 2. Deposition from the dam crest would continue through about Year 5 of operation to establish a back slope for the upstream side of the sand dam and a contact with the tailings slurry. After about Year 5, the thickened tailings would be deposited to the ground from multiple points upslope of the tailings impoundment area to form several mounds of tailings. As tailings deposition continues, the slope of the mounded tailings would overlap and migrate down into the impoundment area. The thickened tailings would form a surface at about a 3 to 5 percent gradient to create a slope of tailings graded down into the impoundment area (Figure 27). The mass of tailings deposited to form the slope would be balanced with the tailings volume within the impoundment area so as not to exceed the height of the Main Dam and provide adequate solution and stormwater management capacity within the impoundment area. The last year or two of operations, tailings would be deposited to facilitate final closure of the facility with surface water drainage reporting to the northern corner of the impoundment. Distribution pipelines around the impoundment would be surface mounted for maintenance and operation purposes.

Dust Control at Impoundment

The DEQ's Supplement Preliminary Determination (DEQ 2015a) has specific requirements for tailings dust management. Spigots distributing wet tailings material and water would cover about one-half of the total tailings at any time. The spigots would be moved regularly and would cause wetting of all non-submerged portions of the tailings impoundment to occur each day. This wetting would be supplemented by sprinklers as necessary when weather conditions could exist to cause fugitive dust. MMC would implement the Fugitive Dust Control Plan throughout operations. At closure, MMC would maintain wind erosion control during the interim period after the end of active tailings deposition and before final reclamation of the site. Any revisions to these requirements in the final air quality permit would be implemented.

2.5.4.3 Water Use and Management

2.5.4.3.1 Project Water Requirements

The water balance in Alternative 3 (Table 24) would differ from the water balance in Alternative 2 in four aspects: the Water Treatment Plant at the Libby Adit Site would be used instead of land application water treatment (see section 2.5.4.3.3, *Wastewater Discharges and Water Treatment*), all mine and adit inflows would be treated and discharged from Libby Adit Water Treatment Plant; additional water would be discharged from the Libby Adit Water Treatment Plant during Operations, Closure and Post-Closure Phases whenever flow in Libby Creek at LB-2000 was less than 40 cfs, and make-up water for ore processing would be diverted from an infiltration gallery adjacent to Libby Creek. The Alternative 3 water balance is based on the same assumptions regarding mine and adit inflows, precipitation, and evaporation used in Alternative 2. MMC would maintain a detailed water balance that would be used to monitor water use. Actual volumes for water balance variables (*e.g.*, mine and adit inflows, precipitation and evaporation, and dust suppression) would vary seasonally and annually from the volumes shown in Table 24.

Mine and adit water would not be used beneficially in any phase, and would be treated and discharged from the Water Treatment Plant during all phases. In all phases except the Evaluation Phase when water was used beneficially, water would be discharged whenever flow in Libby Creek at LB-2000 was less than 40 cfs. The capacity of the existing Water Treatment Plant would be expanded to accommodate operational discharges (see section 2.5.4.3.3, *Wastewater Discharges and Water Treatment*). Diversions from Libby Creek would be necessary to provide adequate water for project use. Section 2.5.4.3.2, *Water Rights* discusses appropriations and discharges associated with water rights.

Using thickened tailings may affect the ability to use the impoundment as a reservoir to maintain a water balance. In final design, MMC would re-evaluate the water balance and the tailings deposition plan. Several options for water storage would be available. One option would use the drainage in the northern end of the impoundment area as a dedicated water storage area and readjust the dam alignment and deposition plan. If chosen, during the final few years of operations, the dedicated water storage area could be infilled if needed as part of final tailings deposition and contouring for reclamation. Preliminary evaluation of this option indicates that this may be possible with only minor changes to the Alternative 3 layout and site development. A second option would be to use the Seepage Collection Pond for excess water storage. A third option would be to use one or more borrow areas for storage. The Alternative 3 water balance assumes that all collected water would be returned to the impoundment and no water storage would occur in the Seepage Collection Pond.

Table 24. Average Water Balance, Alternative 3.

Phase—>	Evaluation Phase 2 Years		Construction Phase 3 Years			Operations Phase 1st 5 Years	Operations Phase 2nd 5 Years	Operations Phase 3rd 5 Years	Closure Phase 1st 5 Years	Post-Closure Phase 2nd 5 Years
Project Year—>	**Project Year 1**	**Project Year 2**	**Project Year 3**	**Project Year 4**	**Project Year 5**	**Project Years 6-10**	**Project Years 11-15**	**Project Years 16-24**	**Project Years 25-29**	**Project Years 30-35**
Production Rate—>	**0 tpd**	**0 tpd**	**0 tpd**	**0 tpd**	**0 tpd**	**12,500 tpd**	**17,000 tpd**	**20,000 tpd**	**0 tpd**	**0 tpd**
Component	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**
Mine and Adit Flow										
Adit inflow	230	230	340	395	450	270	270	200	135	0
Mine inflow	30	30	30	30	30	110	110	170	0	0
Total flow	**260**	**260**	**370**	**425**	**480**	**380**	**380**	**370**	**135**	**0**
Water Treatment Plant										
Inflows - mine and adit flows	260	260	370	425	480	380	380	370	135	0
Runoff from Libby Adit waste rock stockpile	3	3	0	0	0	0	0	0	0	0
Water from tailings impound-ment seepage/runoff collection	0	0	98	75	20	0	0	0	405	270
Mitigation water from impoundment during low flow (August-March) ‡								**395**		
Water treatment plant discharge †	**263**	**263**	**468**	**500**	**500**	**380**	**380**	**765**	**540**	**270**
Mill Inflow										
Flows from mine/adit	0	0	0	0	0	0	0	0	0	0
Water from tailings impoundment seepage/runoff collection	0	0	0	0	0	498	815	1,044	0	0
Make-up water from Libby Creek alluvium stored in tailings impoundment‡	0	0	0	0	0	380	380	370	0	0
Subtotal	**0**	**0**	**0**	**0**	**0**	**878**	**1,195**	**1,414**	**0**	**0**
Mill Outflow										
Water transported with tailings at deposition	0	0	0	0	0	872	1,186	1,405	0	0
Water in concentrate	0	0	0	0	0	6	9	9	0	0
Subtotal	**0**	**0**	**0**	**0**	**0**	**878**	**1,195**	**1,414**	**0**	**0**

Phase—>	Evaluation Phase 2 Years		Construction Phase 3 Years			Operations Phase 1st 5 Years	Operations Phase 2nd 5 Years	Operations Phase 3rd 5 Years	Closure Phase 1st 5 Years	Post-Closure Phase 2nd 5 Years
Project Year—>	**Project Year 1**	**Project Year 2**	**Project Year 3**	**Project Year 4**	**Project Year 5**	**Project Years 6-10**	**Project Years 11-15**	**Project Years 16-24**	**Project Years 25-29**	**Project Years 30-35**
Production Rate—>	**0 tpd**	**0 tpd**	**0 tpd**	**0 tpd**	**0 tpd**	**12,500 tpd**	**17,000 tpd**	**20,000 tpd**	**0 tpd**	**0 tpd**
Component	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**
Tailings Impoundment Inflow[*]										
Precipitation on stored water pond	0	0	2	33	33	181	357	323	67	9
Seepage collection pond net precipitation	0	0	84	165	165	139	139	139	32	5
Runoff captured from impoundment dam/ beach/catchment area	0	0	18	24	24	212	138	162	44	0
Runoff from waste rock stockpile within impoundment	0	0	4	4	4	3	10	0	0	0
Water transported with tailings at deposition	0	0	0	0	0	872	1,186	1,405	0	0
Water released from fine tailings consolidation	0	0	0	0	0	28	101	137	102	20
Water released from sand tailings consolidation (dams)	0	0	0	0	0	133	181	214	0	0
Groundwater interception/ seepage collection	0	0	0	0	0	221	221	221	221	221
Make-up water from Libby Creek alluvium[‡]								765		
Subtotal	**0**	**0**	**108**	**226**	**226**	**1,789**	**2,333**	**3,366**	**466**	**255**
Tailings Impoundment Outflow[*]										
Dust control	0	0	5	6	6	12	24	24	6	0
Evaporation	0	0	8	45	45	216	444	423	81	10
Water retained by tailings voids	0	0	0	0	0	710	965	1,143	0	0
Water recycled to mill (to Water Treatment Plant in pre/post operations)[‡§]	0	0	72	75	20	498	815	1,414	405	270
Seepage to groundwater	0	0	0	0	0	15	25	25	25	25
To Water Treatment Plant during August-March[‡]								395		
Change in water stored in impoundment	0	0	23	100	155	338	59	(59)	(51)	(50)
Subtotal	**0**	**0**	**108**	**226**	**226**	**1,789**	**2,333**	**3,366**	**466**	**255**

gpm = gallons per minute

[†]Water Treatment Plant discharge rates are based on current plant capacity, which would be increased in Alternatives 3 and 4.

[‡]Rates of water to the impoundment and from the impoundment to Water Treatment Plant for water rights mitigation discussed in section 2.5.4.3.2, *Water Rights* were calculated for full operations.

[§]Rates of water to Water Treatment Plant during Closure and Post-Closure Phases are based on current plant capacity, which would be increased in Alternatives 3 and 4; see section 2.5.4.3.3, *Water Treatment*.

2.5.4.3.2 Water Rights

MMC submitted four beneficial water use permit applications to the DNRC for the use of surface water and groundwater associated with the project (MMC 2012a). One application was subsequently withdrawn and two applications were modified. If permitted, the three rights would be in addition to MMC's two existing surface water rights and one groundwater right in Libby Creek. The three permit applications are summarized in Table 25.

Table 25. Summary of MMC's Beneficial Water Use Permit Applications.

Variable	Water Source		
	Groundwater	Groundwater	Surface Water
General Description	Groundwater from pumpback wells	Groundwater from Libby Creek alluvium	Precipitation captured by impoundment
Purpose	Mining	Mining	Mining
Period of Use	1/1-12/31	4/1-7/31	1/1-12/31
Point of Diversion	Poorman Impoundment Site	Libby Creek alluvial groundwater near Poorman Impoundment Site	Poorman Impoundment Site
Point of Use	Libby Plant Site and Poorman Impoundment Site	Libby Plant Site and Poorman Impoundment Site	Libby Plant Site and Poorman Impoundment Site
Average Flow Rate over Period of Use (gpm)	250	765	625
Maximum Flow Rate (gpm)	250	1,125	1,950
Maximum Volume (acre-feet/year)	403	410	1,038

The values shown for each water source is what MMC requested and may be different from those in any beneficial water use permit issued.
Source: MMC 2012a.

Any new water right for water use issued pursuant to Montana law for water use in Alternative 3 would be consistent with the terms of an approved Plan of Operations. An approved Plan of Operations consistent with Alternative 3 would contain the stipulation that any water right acquired solely for the purposes of mineral development in an approved Plan of Operations would terminate when the Plan of Operations terminated. MMC must request and obtain prior written approval from the KNF for any change in beneficial use or place of use of water allowed under an approved Plan of Operations or the water use allowed under an approved Plan of Operations would terminate.

MMC would create 7.5 acres of new wetlands in the Libby Creek drainage (see section 2.5.7.2, *Isolated Wetlands*). MMC would acquire a permit for the created wetlands if the DNRC determined water use for creating wetlands was a beneficial use. If water use for creating wetlands was not a beneficial use, MMC could use water for wetland creation without a beneficial water use permit protecting its right to do so. Water to create wetlands would come from precipitation on MMC and National Forest System lands and the legal availability of that water would not be at risk of appropriation by another user.

In Alternatives 3 and 4, MMC would acquire a parcel along US 2 through which Swamp Creek flows for wetland and stream mitigation (see section 2.5.7.1, *Wetlands*). Rehabilitation of the site to improve its functions as a wetland would not require a water right. The current owner of this parcel has a surface water right to flood irrigate 26 acres of hay meadow between May 1 and October 31, with a maximum diversion rate of 291.72 gpm, and maximum volume of 52 acre-feet per year. MMC would file for a change of use for this water right to an instream flow right. Any water right used for wetland mitigation would be conveyed to the Forest Service when the mitigation sites were conveyed.

Construction and Operations Phases Diversions and Discharges

The Forest Service has an instream water right for 40 cfs in Libby Creek at the confluence of Bear Creek with a 2007 priority date. Any new water right obtained by MMC associated with its Plan of Operations would be junior to the Forest Service right and would terminate when the Plan of Operations expired. Senior rights have an earlier priority date and claimants who hold them have a higher priority to divert water from a stream or water body than those with later, or junior rights. Consequently, MMC would divert groundwater from Libby Creek during high flows (April through July) and store it in the tailings impoundment, Seepage Collection Pond, or mine water pond at the Libby Plant Site. No appropriation would be made whenever flow at LB-2000 was less than 40 cfs. Storage of diverted water would occur during the late Construction Phase after the Starter Dam was lined and MMC began storing water for mill startup, during the Operations Phase, and during the Closure Phase until the impoundment was dewatered for reclamation.

MMC would establish a flow gaging station at LB-2000 near the upstream point-of-diversion of the Forest Service's 40-cfs right. The gaging station would consist of a staff gage and pressure transducer. The pressure transducer would be set to collect stream stage data at 1-hour intervals and transmitted electronically to the mine office. MMC would review the transducer data daily at 9 AM and if it indicates a flow below 40 cfs, MMC would cease appropriating Libby Creek water. Site-specific flow measurements would be conducted at the gaging station for a range of low, medium, and high flow measurements to establish a rating curve for the staff gage and pressure transducer data. A specific height on the staff gage would be identified that equates to a flow of 40 cfs in Libby Creek. After initial equipment setup and verification of proper operation, the staff gage would be measured monthly, and the pressure transducer data would be downloaded monthly.

In an average precipitation year, groundwater tributary to Libby Creek would be appropriated from Libby Creek alluvium between April 1 and July 31 at an average flow rate of 765 gpm and a maximum flow rate of 1,125 gpm (410 acre-feet/year maximum volume). Water would be diverted using a subsurface infiltration gallery installed in the gravels along the west side of the Libby Creek channel at the proposed point-of- diversion (Figure 25). The gallery would be connected to a pumping station that would pump water in a single pipe to the Poorman tailings impoundment. Groundwater tributary to Libby Creek also would be appropriated year-round at an average and maximum flow rate of 250 gpm (403 acre-feet/year maximum volume) from the pumpback wells. Precipitation captured by the impoundment would be appropriated year-round at an average flow rate of 625 gpm and a maximum flow rate of 1,950 gpm (1,038 acre-feet/year maximum volume). (The values shown in Table 25 are what MMC requested and may be different from those in any beneficial water use permit issued.) Diverted water would be stored in the impoundment water pond and would be pumped to the plant/mill for ore-processing make-up water.

Whenever flow in Libby Creek at LB-2000 was less than 40 cfs, stored water would be treated at the Libby Adit Water Treatment Plant, and discharged at a rate equal to all Libby Creek appropriations, including created wetlands in the Libby Creek drainage. The rates would vary, depending on actual precipitation and the total pumping rate of the pumpback wells. As part of the water balance monitoring described in Appendix C, MMC would measure precipitation and evaporation at the tailings impoundment and total pumping rate of the pumpback wells to determine the appropriate rate of discharges to avoid adversely affecting senior water rights. Any water from the tailings impoundment to be treated and discharged would be mine drainage and precipitation commingled with process water. No process water would be discharged unless one of the two exemptions in the ELGs was met (40 CFR 440.104(b)(2)).

On Ramsey Creek, a senior water right holder has a 1 cfs surface water right on Ramsey Creek between RA-200 and RA-400. When the 3D model was updated after the Evaluation Phase, MMC would re-evaluate baseflow changes in Ramsey Creek. If baseflow changes in Ramsey Creek may adversely affect this right on Ramsey Creek during any mining phase, MMC would develop a plan during final design to convey treated water from the Water Treatment Plant to a location upstream of the senior water right's point of diversion (RA-300). Discharge to Ramsey Creek would equal MMC's Ramsey Creek baseflow changes whenever the flow at RA-300 was less than 1 cfs. Discharge of treated water to Ramsey Creek would require a new outfall in the MPDES permit.

Closure and Post-Closure Phases Diversions and Discharges

During operations and at closure, the three adits would be hydraulically connected to the mine void, and without plugs, water would drain toward the mine void until the void filled to the level of the adits. During the Closure Phase, MMC would place two or more plugs in each adit. The plugs would be located to isolate the adits hydraulically from the mine void and to ensure groundwater from Libby and Ramsey creeks would not flow into the mine void. The plug locations would be determined by the agencies using the 3D groundwater model maintained and updated throughout the project. MMC would provide a plugging design and the required groundwater modeling as part of the final closure plan.

Following adit plugging, water flowing into the adits would begin to refill the adits. As long as MMC appropriated or diverted water from Libby Creek whenever flow at LB-2000 was less than 40 cfs, MMC would treat, if necessary to meet MPDES permitted effluent limits, stored adit water and discharge it to Libby Creek at a rate equal to all of MMC's Libby Creek appropriations or diversions occurring at that time. Discharges to Ramsey Creek also would be required if the modeling indicated adit inflows during the Closure Phase would adversely affect the senior water right on Ramsey Creek.

After facilities were reclaimed and precipitation was no longer intercepted, appropriations or diversions from the Libby Creek watershed would be limited to adit inflows and pumping from the pumpback well system. Inflow into the adits, during the period when Libby Creek would have a flow of 40 cfs or more at LB-2000, would begin to refill the adits. Whenever flow at LB-2000 was less than 40 cfs, MMC would set a datum at the current water level in each adit. The datum would be the location of the water level in each of the adits at the time water would be required for mitigation. Through discharges, MMC would maintain water levels in each adit at that datum as long as flow in Libby Creek at LB-2000 was less than 40 cfs. In other words, MMC would discharge from the adits so as not to increase the storage in any adit whenever mitigation was required. Discharges would cease and water levels in the adits would increase whenever flow in Libby Creek at LB-2000 was 40 cfs or more. A new datum would then be established whenever mitigation was again needed.

Before the water level in the adits reached the bedrock-colluvial interface (about 800 feet from the adit portal), MMC would place an additional plug in bedrock at the bedrock-colluvial interface and allow the adits to reach steady state hydrologic conditions. Construction of the second plug would begin when flow at LB-2000 was 40 cfs or more. A third plug would be placed at the opening of each adit. The third plug to be placed at the adit opening would be coarse rock fill intended to prevent access to the tunnel and also to prevent subsidence in the near-surface portion of the tunnel. The adit portals then would be reclaimed.

Water appropriated by the pumpback well system during the Closure and Post-Closure Phases would be treated and discharged at the Water Treatment Plant. After the second plug was placed in each adit, no further discharges to Libby Creek other than from the pumpback well system would be required to avoid adversely affecting senior water rights.

2.5.4.3.3 Wastewater Discharges and Water Treatment

MMC proposes in Alternative 2 to use the LAD Areas for primary treatment of excess mine and adit inflows. Currently, MMC is permitted by the DEQ under Operating Permit #00150, Minor Revision 06-002, to treat Libby Adit inflows through an existing Water Treatment Plant at the Libby Adit Site before discharge to MPDES permitted outfalls. In Alternative 3, the existing Water Treatment Plant would be used solely to treat any waters before discharge at the MPDES permitted outfalls. Water would not be discharged at the LAD Areas. MMC would conduct the monitoring required in the MPDES permit.

The agencies anticipate that the Water Treatment Plant would be modified to increase capacity and as necessary to treat parameters such as nutrients or metals to meet MPDES permitted effluent limits. In 2015, MMC requested that the general variance for both total nitrogen and total phosphorus be incorporated into the MPDES permit and indicated that the facility design flow is less than 1.0 million gallons per day (mgd). In the draft renewal MPDES permit, the DEQ preliminarily granted a variance for total nitrogen of 15 mg/L, and determined that a variance for total phosphorus was not necessary because the facility did not show reasonable potential to violate this nutrient standard. MMC would have to comply with the BHES Order limit of 1 mg/L total inorganic nitrogen. The final MPDES permit will contain DEQ's final determination regarding the variance.

MMC's analysis of discharges during operations indicated maximum discharges would be 1,024 gpm during an average year, and 1,178 gpm during the estimated wettest year in a 10-year period (36 inches of precipitation) (MMC 2012a). A discharge of 1,178 gpm would exceed the current design capacity of the Water Treatment Plant, estimated to be 500 gpm. During final design, MMC would estimate the maximum discharge rate during the estimated wettest year in a 20-year period using best available precipitation data and modify the Water Treatment Plant such that it would have adequate capacity to treat discharges during such a year. MMC also would evaluate the size of the percolation pond at the Libby Adit, and enlarge it, if necessary, to accommodate higher discharge rates during operations. MMC would seek authorization from the DEQ to amend its MPDES permit to discharge at a higher rate than 500 gpm considered in the draft renewal MPDES permit. The increased capacity and treatment modifications would be in place at mill startup.

If MMC's Ramsey Creek diversions may adversely affect a senior right on Ramsey Creek during any mining phase, MMC would develop a plan during final design to convey treated water from the Water Treatment Plant to a location upstream of senior water right's point of diversion. Discharge of treated water to Ramsey Creek would require a new outfall in the MPDES permit.

MMC evaluated several treatment alternatives for treating nitrogen compounds (Apex Engineering, PLLC and Morrison-Maierle, Inc. 2008a). The recommended alternative for treating nitrates and ammonia is a moving bed biofilm reactor (MBBR). In a MBBR, microorganisms grow as a biofilm on the surfaces of plastic carriers, called media, in a treatment reactor. Air is forced into the reactor, and as the media circulate through wastewater in the reactor, the microorganisms remove nitrogen compounds through biological processes. The media provide high surface area and protected interior space for growth of the microorganisms, enabling high treatment capacity in a small footprint. This system is in use currently at the Stillwater Mining Company (Stillwater) mining complex in Montana.

Organic nitrogen treatment would be achieved by removal of the particulate fraction through solids separation via ultrafiltration. Inorganic nitrogen treatment would be a two-step process. Ammonia would be removed from water through the biological process called nitrification, which converts (oxidizes) ammonia to nitrate. Nitrates are removed through another biological process called denitrification. Microorganisms convert nitrate to inert nitrogen gas that vents from the system. With addition of a carbon energy source, the biological processes are optimized and carbon dioxide is also produced and vented with the nitrogen gas. Based on Stillwater's treatment system, the agencies anticipate the MBBR technology would be capable of meeting MPDES permitted effluent limits.

At the current design flow rate of 500 gpm, the MBBR system for nitrification would consist of a concrete tank about 24 feet long, 24 feet wide, and up to 13 feet deep. The nitrification concrete tank would be filled about 50 percent with plastic media and supplied with forced air. An MBBR system for denitrification would be a concrete tank about 20 feet long, 24 feet wide and 10 feet deep (plus 2 to 3 feet of freeboard). The denitrification tank would be filled about 40 percent with plastic media. A carbon energy source would be added to the denitrification tank. Both tanks would be on the south side of the existing water treatment building.

Phosphorus treatment, if needed to meet MPDES permitted effluent limits, may involve chemical addition to wastewater with aluminum- or iron-based coagulants followed by filtration, which can reduce total phosphorus concentrations in the final effluent to low concentrations. Phosphorus reduction may also be accomplished by chemical precipitation or adsorption, biological assimilation, or enhanced biological nutrient removal.

The existing Water Treatment Plant uses ultrafiltration to remove metals sorbed onto particulates suspended in the water, thereby reducing total suspended sediments and metal concentrations. The current system has been successful in treating adit discharges to concentrations less than MPDES permitted effluent limits. MMC currently samples untreated water monthly for both total and dissolved metals. MMC would continue the monitoring described in Appendix C, and make appropriate modifications to the Water Treatment Plant if necessary to remove dissolved metals.

Treatment technologies for dissolved metals could include the addition of chemicals to promote chelation (formation of a larger, filterable compounds) followed by the existing ultrafiltration system, or reverse osmosis.

2.5.4.3.4 Stormwater Control and Discharges

MMC would continue to discharge stormwater from all permitted stormwater outfalls unless MMC submitted and the DEQ approved a Notice of Termination. Some stormwater outfalls used during the Construction Phase may be terminated while others remained in place. MMC also would continue to maintain BMPs associated with the outfalls until the DEQ approved a Notice of Termination. MMC would implement the SWPPP until the DEQ approved a Notice of Termination for all stormwater outfalls.

Poorman Impoundment Site

Stormwater from undisturbed lands above the tailings facility would be diverted around the impoundment site toward the Poorman Creek and Little Cherry Creek drainages during mine operations, unless water was needed for mill operations. Settling ponds for runoff from newly reclaimed areas along the perimeter of the tailings thickener facility would be unlined but vegetated, and would drain through a constructed drainage network to existing intermittent drainages. Stormwater from reclaimed areas that were not fully stabilized would be captured along with runoff from the tailings facility. Undisturbed portions of the facility would either drain into existing drainages or be diverted away from active areas, soil stockpiles, and the stormwater pond. All diversions would be sized to handle a 10-year/24-hour storm event. The diversions would be reclaimed and permanent drainageways established when mine operations ended when the site was fully reclaimed.

Localized sediment retention structures and BMPs would be used along the downslope perimeter of the impoundment for control, sampling, and recovery of drainage from the impoundment, sediment, and stormwater runoff. These structures and collection ditches would act as stormwater diversions to channel the water and sediment from the tailings thickener facility into stormwater ponds. The ditches would be sized to accommodate a 10-year/24-hour storm event.

The EPA considers runoff from tailings dams when constructed of tailings to be mine drainage, or, if process water if process fluids are present. MMC would design all ditches and sediment ponds that would contain process water or mine drainage for a 100-year/24-hour storm (rather than the 10-year/24-hour storm proposed in Alternative 2). In Alternative 2, MMC indicated that below the tailings impoundment ditches containing runoff would be directed, where possible, toward the Seepage Collection Pond; otherwise, appropriate BMPs would be used to handle stormwater that was not classified as mine drainage water or process water. In Alternative 3, all runoff from the tailings impoundment dam would be directed to the Seepage Collection Pond or to lined containment ponds. Water from the ponds would be returned to the impoundment and then mill for reuse. Alternative water management techniques may be identified during final design and the MPDES permitting process. Stormwater discharges from the tailings impoundment would not occur during operations.

Depending on final design, a stormwater outfall may be needed for stormwater from the soil stockpile upgradient of the tailings impoundment. Ditches and the sediment pond containing stormwater would be designed for the 10-year/24-hour storm. Infrequent discharges from the sediment pond would flow and be monitored at a MPDES permitted outfall at a Little Cherry Creek tributary, and would be required to meet applicable effluent limits.

Libby Plant Site

Surface water runoff from the Plant Site area would be directed along ditches to lined sediment ponds sized for the 10-year/24-hour storm. Water from the ponds would be pumped to the plant for makeup needs. An ore stockpile at the Plant Site would be covered so that precipitation water would not contact this material. No waste rock would be placed at the Plant Site. Stormwater discharges from the Libby Plant Site would not occur during operations.

Access Roads

The Bear Creek Road would be reconstructed during the Construction Phase and new disturbances would be revegetated after the road surface was paved. New disturbances would achieve final stabilization during the Operations Phase and permitted stormwater discharges would cease after the DEQ approved a Notice of Termination. Stormwater discharges from Outfalls 005 through 008 would likely continue during the Operation Phase.

2.5.4.3.5 Fugitive Dust Control

Fugitive dust control in Alternative 3 would be similar to Alternative 2 and would include all measures identified by the DEQ in its Supplemental Preliminary Determination on MMC’s air quality permit application (DEQ 2015a). Dust control at the tailings impoundment is discussed in section 2.5.4.2.2, *Dust Control at Impoundment*. The Supplemental Preliminary Determination identified the following emission control requirements:

- Water sprays would be used at the primary crusher.
- Water sprays would be used at the five underground coarse ore conveyor transfer points to be located along the conveyor route from the primary crusher to the Libby Adit portal.
- Water sprays would be used at the transfer of ore from the underground conveyor system to the coarse ore stockpile.
- Conveyor emissions from the Libby Adit portal to mill would be controlled by a using a fully enclosed conveyor. All three transfer points on this conveyor would also be fully enclosed.
- Coarse ore stockpile would be surrounded by a pole structure with an enclosure on the top and two sides.
- A wet scrubber would control particulate emissions from the coarse ore stockpile transfer to the apron feeders.
- The conveyor discharge to the SAG mill would occur inside the Mill Building.
- The concentrate transfer and loading of concentrate into highway trucks for shipment to the Libby Loadout facility would be entirely enclosed within the Mill Building.
- The oversize material transferred to the oversize hopper and oversize reclaim belt originate from the SAG mill, which would be a wet process. The material passes through a sump and pump to the reclaim route and would be wet material.
- A baghouse would control emissions from the oversize screen, crusher, and transfer to the SAG mill.

In Alternative 2, MMC proposes to use mine or adit water and/or chemical stabilization on unpaved mine access roads for dust suppression. Mine, adit, or tailings water may have elevated concentrations of suspended sediment, nutrients (nitrates), or metals. These compounds could enter surface water if water for dust suppression ran off of the roads. To reduce the potential for adversely affecting water quality in Alternative 3, MMC would use either a chemical stabilization that does not attract wildlife or groundwater appropriated using its existing water right to control dust on unpaved mine access roads and other work areas.

2.5.4.4 Waste Management

MMC's proposal in Alternative 2 to use buried sewage tanks adjacent to the Ramsey Plant Site for storage of sanitary wastes and then dispose of them off-site would be modified in Alternatives 3 and 4. MMC would submit plans and specifications for public water supply wells, as well as plans for construction of a sanitary waste treatment facility to the DEQ for approval. In Alternatives 3 and 4 during the Evaluation and Construction Phases, MMC would use an on-site sewage treatment and disposal system at the Libby Adit Site. The system consists of the four components: four 1,000-gallon septic tanks; a two-pod treatment unit and combination recirculation tank/drainfield dosing tank; effluent distribution system; and infiltrator trenches. Expected discharge is 585 gallons per day (Geomatrix 2010a). During Operations, MMC would use a similar system consisting of septic tanks for primary treatment, followed by discharge to the tailings impoundment for final disposal. The effluent from the septic tanks would be disinfected before pumping to the impoundment. Disinfection would be by chlorination, ozonation, or ultraviolet light. This step would disinfect the effluent to reduce the number of microorganisms and eliminate potential hazards due to human exposure of the water in the impoundment. Disinfection would be conducted as the effluent water is pumped from the septic tanks to the impoundment. Expected discharge is 6,100 gallons per day; a rate of 7,000 gallons per day was used for design purposes (Geomatrix 2010a). Sanitary waste management after the impoundment was no longer available for final disposal would be determined in the final closure plan.

In Alternative 2, MMC would occasionally bury certain wastes underground in mined-out areas. Because the mill office buildings and tailings impoundment would be on National Forest System lands and the mine would be beneath National Forest System lands, MMC would comply with Forest Service policies when disposing of demolition debris during closure in Alternatives 3 and 4. It is Forest Service policy (FSM 2130) to discourage the disposal of solid waste on National Forest System lands unless such use is the highest and best use of the land. No solid wastes other than waste rock would be buried underground in mined-out areas. Reinforced concrete foundation materials may be buried on National Forest System lands under the following conditions:

- The concrete must be free from contaminants, such as petroleum products.
- Contaminated sections of concrete would be removed and disposed of at an approved waste disposal facility off of National Forest System lands in accordance with Montana's solid and hazardous waste regulations (ARM 17-50-101 *et seq*. and ARM 17-53-101 *et seq*.).
- The concrete must be cut or broken into sections no larger than 4 feet square and buried in a manner that would not create large voids that could lead to future settling of the materials. This may involve mixing glacial borrow material with the concrete sections during backfill operations. The rebar could remain in the concrete provided it was cut flush with the individual sections.
- The concrete would be buried with a minimum of 4 feet of glacial borrow material graded in a manner that would not concentrate surface water runoff or allow water to pond.

- If new federal regulations prohibit burying of any materials at time of mine reclamation and closure, all materials would be hauled off-site.
- All other demolition materials, whether originating above or below ground, would be disposed of off National Forest System lands in an approved, off-site waste disposal facility.

2.5.5 Closure and Post-Closure Phases

Short- and long-term reclamation objectives would remain the same as for Alternative 2. These objectives would be achieved through interim and final reclamation of all disturbed sites as described for Alternative 2, with additional mitigation described below and implementing all erosion- and sediment-control measures described for Alternative 2.

2.5.5.1 Closure and Reclamation of Project Facilities

The post-mining topography of project facilities would follow the procedures outlined for Alternative 2 with the following modifications. MMC would develop final regrading plans for each facility to reduce visual impacts of reclaimed mine facilities. These plans would require the agencies' approval before implementation. At the end of operations, any waste rock not used in construction would be either placed back underground or used in regrading the tailings impoundment. Any waste rock used at the Libby Plant Site would require an MPDES permit modification to include runoff or seepage from the waste rock.

MMC would develop plans to shape slopes of the Libby Plant Site (Figure 30), mine portal areas, and Libby Adit Site to closely resemble the surrounding landscape. Final grading would involve regrading and shaping flat surfaces to blend with the adjacent landscape and have natural dendritic drainages. Additional fill would be used as necessary to create smooth transitions between human-made and natural landforms.

2.5.5.1.1 Underground Mine and Libby Adits

No solid wastes other than waste rock would be buried underground in mined-out areas. MMC would place two or more plugs in each of the three mine adits. The plugs would be located to isolate the adits hydraulically from the mine void and to ensure any groundwater tributary to Libby and Ramsey creeks would flow into the adits, and remain within the Libby Creek watershed. The plugs are described in section 2.5.4.3.2, *Water Rights*.

If necessary to minimize post-mining changes to the streamflow in East Fork Rock Creek and East Fork Bull River, MMC would construct concrete bulkheads in access openings in any barrier pillar left within the mine void. Barrier pillars are discussed in section 2.5.4.1, *Mining.*

2.5.5.1.2 Libby Plant Site

The mill building, conveyors, bridges, administration offices, substations, and other facilities associated with this area would be dismantled and removed once they are no longer required to support mine operations or closure activities. Plant Site facilities would be removed, sold, scrapped, or disposed locally off of National Forest System lands. Concrete foundations may be broken up and buried on-site in accordance with the Forest Service policy regarding solid waste disposal discussed in section 2.5.4.4, *Waste Management*.

2.5.5.1.3 Poorman Tailings Impoundment

As part of reclamation, all surface facilities would be removed from the site. Facilities at the impoundment site would be removed, sold, scrapped, or disposed locally. Concrete foundations may be broken up and buried on-site in accordance with the Forest Service policy regarding solid waste disposal discussed in section 2.5.4.4, *Waste Management*.

The tailings surface and disturbed areas would be covered as outlined Alternative 2. MMC would survey tailings settlement at closure on a 100-foot by 100-foot grid to document settlement. The area would be surveyed after borrow material used for fill was placed to create final reclamation gradients, and again after soil placement to ensure runoff gradients were achieved and soil thicknesses were met. Rocky borrow and geotextile would be needed for construction equipment to work on the tailings surface. In Alternative 2, MMC would place riprap on the dam crest and uppermost part of the dam face to minimize potential gully formation at the tailings dam crest. In Alternative 3, MMC would use rocky borrow from within the disturbance area to provide erosion protection. Borrow material volumes would be determined during final design.

Deposition of the tailings at closure would produce a final surface that would drain toward an unnamed tributary of Little Cherry Creek (Figure 31). Once all water from the tailings surface in the northern area of the impoundment had been removed (evaporated, or treated, if necessary, and discharged), and the near surface tailings had stabilized for equipment access, a channel would be excavated through the tailings and Saddle Dam abutment to route runoff from the site toward a tributary of Little Cherry Creek. The channel would be routed at no greater than 1 percent slope and along an alignment requiring the shallowest depth of tailings to be excavated down to the channel grade. The side slopes would be designed to a stable slope and covered with coarse rock to prevent erosion. As part of the final closure plan, MMC would complete a hydraulic and hydrologic (H&H) analysis of the proposed runoff channel during final design, and submit it to the lead agencies and the Corps for approval. The H&H analysis would include a channel stability analysis and a sediment transport assessment. Based on the analysis, modifications to the final channel design would be made and minor modifications to the upper reaches of the tributary of Little Cherry Creek may be needed to minimize effects on channel stability in the tributary of Little Cherry Creek and to avoid allowing water to pond on the surface of the reclaimed tailings. Other drainage alternatives for the surface of the reclaimed tailings impoundment that protect against erosion but also provide aquatic habitat may be developed with agency approval.

Water would not flow toward Little Cherry Creek as long as water was needed for water rights mitigation, described in section 2.5.4.3.2, *Water Rights.* A stormwater/sediment retention pond would be built on the impoundment surface near the North Saddle Dam that would be designed to contain the 10-year/24-hour storm, or an estimated 40 million gallons of water.

Post-operational seepage management would be the same as Alternative 2. MMC would operate the seepage collection and the pumpback well systems until groundwater adjacent to the reclaimed impoundment met BHES Order limits or applicable nondegradation criteria without additional treatment. The Seepage Collection Pond and mill pond at the Libby Plant Site also would remain in place. MMC estimates total water storage capacity at closure to be 110 million gallons. Long-term treatment may be required if BHES Order limits or nonsignificance criteria were not met. The length of time these closure activities would occur is not known, but may be decades or more. Following removal of the Seepage Collection Dam, the disturbed area would be graded to blend with the original slope. After BHES Order limits or applicable nonsignificance criteria were met, seepage from the underdrains and seepage not intercepted by the underdrains would flow to Libby Creek. Klohn Crippen (2005) estimated a steady state flow from the underdrain system after closure of 50 to 100 gpm for the Little Cherry Creek impoundment and the agencies anticipate conditions at the Poorman Impoundment Site would be similar.

MMC would develop a design to recontour faces of the tailings impoundment dams to more closely blend with the surrounding landscape than proposed in Alternative 2. Sand deposition would be varied during final cycloning and placement of sand on the dams. This design would incorporate additional rocky borrow at selected locations on the dam face and use benches in some locations. Islands of trees and shrubs would be planted in the rocky areas. The seed mixture on the dam face would vary to reduce uniformity of the revegetated dam.

2.5.5.1.4 Roads

Reclamation of the Bear Creek Road, new roads, currently open roads, and all new bridges used in Alternative 3 would be the same as Alternative 2. The existing Bear Creek Road and the new Bear Creek Road from the Poorman Tailings Impoundment Site to south of Poorman Creek would remain chip-sealed and 26 feet wide. Any segment of the existing Bear Creek Road parallel to the new road that was graveled and not disturbed by the tailings impoundment would be decommissioned. All currently gated or barriered roads used in Alternative 3 would be decommissioned by using a variety of treatment methods to achieve desired conditions for other resources.

2.5.5.1.5 Monitoring and Potable Water Supply Wells

Any monitoring well used by MMC for monitoring during any project phase would be plugged and abandoned according to ARM 36.21.810 when it was no longer needed for monitoring. Any potable water supply well on National Forest System lands would be plugged and abandoned according to ARM 36.21.810. The well casing would be removed to below the ground surface, and the well covers removed and disposed off-site. The area associated with all abandoned wells would be regraded to blend with the natural surroundings. The area would be ripped if appropriate and revegetated with in accordance with Alternative 3 revegetation plan.

2.5.5.2 Revegetation

2.5.5.2.1 Revegetation Success/Bond Release Criteria

The following criteria for all reclaimed areas, including the transmission line right-of-way and access roads, would be used to determine revegetation success and bond release. MMC and the lead agencies would establish disturbed/reclaimed control sites for the project before operations. These sites would be based on previous disturbances and be close as possible to the mine area. Minimum vegetation cover would be 80 percent of the disturbed/reclaimed control site total cover. If the required minimum cover were not obtained, MMC would implement remedial action such as reseeding with a modified seed mixture, mulching, fertilizer, or other changes to address the issue. If after two remedial attempts the particular site still did not meet the minimum vegetation cover standard but met 80 percent of the average of selected disturbed/reclaimed control sites, did not exhibit rills or gullies, and met the weed standard, the portion of the reclamation bond would be released. If the site continued to fall short of meeting the cover requirement, a third remedial effort, approved by the lead agencies, would be applied. If the standard still were not met but the site had 70 percent of the disturbed/reclaimed control cover and did not exhibit rills and gullies and met the weed standard, the portion of the reclamation bond attributed to revegetation success would be released.

MMC would develop a final Vegetation Monitoring Plan from these disturbed/reclaimed sites and collect vegetation data during the mine life. This information would be used to validate the release criteria numbers with respect to minimum cover requirements, tree/shrub density, weeds, and other provisions preliminarily set in the EIS. The intent is to provide long-term site-specific data to support the release criteria established for the project. The monitoring plan would be approved by the lead agencies and would require the report be submitted annually or as outlined in the plan or as approved by the lead agencies. Monitoring would continue for 20 years after planting or seeding to ensure revegetation requirements were met, or less if the reclamation portion of the bond were released by the lead agencies before this period expired.

Category 1, 2, and 3 noxious weed species cover would have less than or equal to the cover of noxious weed species present on agency-approved disturbed/reclaimed control sites in the area. Category 2 and 3 (new invaders and potential invaders) are described in the latest edition of the KNF Noxious Weed Handbook. A minimum of 400 trees and 200 shrubs per acre would be living after 15 years (density may be lower in some areas where no trees or shrubs were planted, such as herbaceous wetlands and meadows).

2.5.5.2.2 Seed Mixture Modifications

MMC would revise all seed mixes so that mixes would be composed of local native seed from the Forest Service Coeur d'Alene Nursery or the Kootenai Seed Mix (defined in Savage 2014). MMC would select seed mixes to be compatible with dry and moist forest conditions. On dry south-facing slopes, a seed mix with more aggressive plant species able to establish under harsh conditions would be used, while in moist areas, the aggressive species would be avoided. Native seed mixes would have the ability to be updated in conjunction with ongoing research and as more information becomes available, or as directed by the lead agencies.

The interim and permanent seed mixes proposed for Alternative 2 contain introduced species (Table 26). In the Alternative 3 and 4 seed mixes, MMC would not use the species shown in Table 26, and would replace them with native species. In the event native species were not establishing rapidly enough to control invasive plants, MMC would submit an alternative seed mixture to the lead agencies for approval. The alternative mixture could include non-native species that would meet the overall goals and objectives of the reclamation plan. MMC would conduct seeding between September 15 and October 31, or between April 1 and June 15. All areas would be seeded with the permanent seed mix; the interim seed mix proposed in Alternative 2 would not be used. Change in the seeding schedule would be approved by the lead agencies.

Table 26. Introduced Species Eliminated from MMC's Proposed Seed Mixes.

Revegetation Mixture 1	Revegetation Mixture 2
Redtop (*Agrostis gigantea*)	Redtop (*Agrostis gigantea*)
Meadow foxtail (*Alopecurus pratensis*)	Orchardgrass (*Dactylis glomerata*)
Tall fescue (*Festuca arundinacea*)	Canada bluegrass (*Poa compressa*)
Timothy (*Phleum pratense*)	White clover (*Trifolium repens*)
White clover (*Trifolium repens*)	

2.5.5.2.3 Soil Replacement and Handling

MMC would replace soils in all disturbed areas, with the exception of soil stockpiles and cut slopes in consolidated material. In Alternative 2, MMC proposed to redistribute 24 inches of soil on the embankment of the tailings impoundment in two lifts: 15 inches of rocky subsoil on the bottom followed by 9 inches of topsoil on the top. Replaced soils depths on other disturbed areas would be 18 inches including the top of the tailings impoundment. Other reclaimed sites in Montana have shown that 24 inches of replaced soil provides sufficient rooting depth (Plantenberg, pers. comm. 2006). In Alternatives 3 and 4, where redistributed soils cover non-native material, the replaced soil depth would average 24 inches using two lifts, including over the entire tailings impoundment. Soils replacement depths at other disturbances where soil is to be replaced, except road disturbances, would be 18 inches and would be applied in two lifts. If MMC demonstrated through test plots that site-specific soils would provide sufficient root zone and revegetation success with thinner soil replacement, the replaced soil thickness could be reduced with the lead agencies' concurrence.

Soils in the impoundment area would be replaced based on soil erodibility and slope steepness. For example, the least erodible colluvial/glacial soils having the greatest rock fragment content for both first lift and second lift soils, would be used on the impoundment face to minimize erosion potential. The soils with the greatest erodibility, primarily glaciolacustrine soils, would be used on slopes less than 8 percent, such as the relatively flat tailings impoundment surface. Soil salvage and redistribution would occur throughout the life of the mine operation. Soils should be handled and worked at the minimal moisture content to reduce the risk of compaction and tire rutting.

Disturbed areas, such as parking areas, roads, adit portal areas, and building sites would be ripped to 18 inches deep with dozer ripping teeth before soil replacement to reduce any root zone barriers due to compaction and to facilitate stormwater infiltration after reclamation. Any disturbed area to be seeded would be scarified to a depth of 6 to 12 inches before seeding for best seed establishment. All disturbed areas would be seeded, fertilized, and mulched as necessary. Where soil fertility may be low and tilth poor, organic matter (weed-free agencies-approved wood-based compost) would be incorporated into respread soils before planting. All permanent cut and fill slopes on roads would be seeded, fertilized, and stabilized with hydromulch, netting, or by other methods.

Mycorrhizae, which are structures in the soil important in maximizing plant establishment and productivity, especially for woody plants, are eliminated in soil stored for prolonged periods. In reclaimed areas where trees would be planted, an agencies-approved wood-based compost would be incorporated into the upper 6 inches of respread soil that had been stored for prolonged periods to promote the rebuilding of mycorrhizae in the soil (Plantenberg, pers. comm. 2006), and/or inoculated tree-planting stock with the appropriate mycorrhizal fungi would be used, or mycorrhizal fungi would be incorporated into the soil as pellets during seeding. Additional nitrogen fertilizer may be needed to compensate for wood-based mulch.

2.5.5.2.4 Planting

MMC cites recommendations for establishment of seedlings (not planting) ranging from 400 to 680 trees per acre, but plans 435 trees per acre and 200 shrubs per acre. At a success rate of 65 percent, this would yield 283 trees and 130 shrubs per acre, which would be at the low end of the densities recommended by KNF. In Alternative 3, MMC would plant sufficient trees and shrubs to achieve 400 trees and 200 shrubs per acre 15 years after planting.

To help prevent noxious weed establishment, MMC would plant trees and shrubs randomly by hand unless safety issues require machine planting. MMC would mulch around planted trees and shrubs, and control weeds adjacent to trees and shrubs, but apply native seed elsewhere. If noxious weeds colonized planting areas, and weed control with herbicides were necessary, trees would likely be lost. MMC would use an agencies-approved wood-based compost to promote fungi-based communities and tree growth rather than straw or manure based compost that promotes bacteria-based grassland communities.

2.5.5.2.5 Organic Amendments

MMC would amend the top 0 to 4 inches of soil before seeding with an agencies-approved wood-based organic amendment to raise the organic matter level in the soil to a minimum of 1 percent by volume.

2.5.6 Monitoring Plans

Numerous operational and post-operational monitoring programs proposed by MMC are described in Alternative 2. The agencies revised these plans, which are presented in Appendix C.

2.5.7 Mitigation Plans

In Alternative 3, the wetlands, fisheries, and wildlife mitigation plans would differ from that proposed in Alternative 2. The proposed plans for these resources are discussed below. The Hard Rock Mining Impact Plan would be the same as Alternative 2.

2.5.7.1 Jurisdictional Wetlands and Other Waters of the U.S.

The objective of the compensatory mitigation plan for jurisdictional wetlands and other waters of the U.S. is to offset unavoidable adverse impacts to wetlands, streams, and other aquatic resources allowed under a Clean Water Act Section 404 Permit (*i.e.*, discharge of dredged or fill material into a water of the U.S.). For impacts permitted under a 404 Permit, compensatory mitigation is not considered until after all appropriate and practicable steps have been taken to first avoid and then minimize adverse impacts to the aquatic ecosystem pursuant to 40 CFR 230 (the 404(b)(1) Guidelines). The lead agencies prepared a 404(b)(1) analysis discussing compliance with the Guidelines (Appendix M) and provided it to the Corps so that the Corps may conduct a 404(b)(1) compliance determination on MMC's 404 permit application for the Montanore Project. The analysis in Appendix M is not intended to represent the Corps' conclusions or their final 404(b)(1) determination. It is MMC's responsibility to demonstrate compliance with the Guidelines.

MMC used the mitigation sequencing required by compensatory mitigation regulations (33 CFR 332.3(b), 40 CFR 293(b)) in developing its proposed mitigation for Alternative 3. Mitigation bank credits and in-lieu fee program credits were not available. MMC submitted a draft conceptual waters of the U.S. mitigation plan to the Corps, the KNF, and the DEQ in 2011 for the agencies' preferred alternatives (Mine Alternative 3 and Transmission Line Alternative D-R) and a Preliminary Mitigation Design Report for impacts on waters of the U.S. in 2013 (Geomatrix and Kline Environmental Research 2011, NewFields Companies and Kline Environmental Research

2013). MMC submitted a revised Preliminary Mitigation Design Report in 2014 (MMC 2014a); the proposed mitigation for Alternative 3 is based on the 2014 report.

MMC is proposing permittee (MMC)-responsible mitigation. MMC would use the Swamp Creek site, which is considered an off-site mitigation site, as compensatory mitigation for all unavoidable effects on jurisdictional wetlands (Figure 34). The discussion found on page 116 regarding mitigation requirements and on-site and off-site mitigation also applies to Alternative 3. Mitigation for other waters of the U.S., such as streams, is described below. MMC would be responsible for meeting the Corps' mitigation requirements for jurisdictional wetlands and other waters of the U.S. The amount of jurisdictional and non-jurisdictional wetlands affected by the mine alternatives are listed in Table 187. The functions and services provided by each mitigation site are discussed in section 3.23, *Wetlands and Other Waters of the U.S.* The monitoring of the mitigation sites is described in section C.4 of Appendix C.

During plan development, MMC coordinated with the MDT on the plans and MDT's proposed improvements to US 2 adjacent to the Swamp Creek mitigation site. MMC would continue to coordinate with MDT as necessary as final plans were developed.

2.5.7.1.1 Jurisdictional Wetlands

The proposed Swamp Creek off-site wetland mitigation area is about 4 miles east of the project area and encompasses 67 acres along US 2 (Figure 34). The meadows cover an area of about 30 acres. In the early 1950s, a new channel of Swamp Creek was excavated across the property, enhancing surface water drainage and lowering the shallow groundwater surface. Other side ditches were excavated to channel water from several natural springs on the property. As a result of the ditching effort, productive hayfields were developed on the property.

MMC completed a wetland delineation in 2011 and the site has 20 acres of degraded wetland. MDT holds an easement on the property for a stabilization berm for reconstruction of US 2 (Figure 34). The total area rehabilitated would be 18 acres, with 15 acres attributed to wetland mitigation and 3 acres attributed to stream restoration. Wetland rehabilitation is the manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural/historic functions of degraded wetland. Rehabilitation results in a gain in wetland function but does not result in a gain in wetland acres (33 CFR 332.2, 40 CFR 230.92). Most of this degraded wetland area would be rehabilitated from the current condition of hayfields to a viable ecological habitat by planting wetland vegetation throughout the site, increasing water availability to the rooting zones of plants, and preventing cattle grazing on the property.

The Swamp Creek wetland mitigation project would be accomplished by completing the following specific activities: (1) prolong valley bottom flooding and near-surface groundwater levels by constructing meanders and raising the channel bottom of Swamp Creek and two spring-fed channels; (2) terminate hay production in the valley bottom; burn the grass (one or more times), followed by plowing the soil and seeding the area with wetland vegetation; 3 acres of this area would be used for riparian corridor planting along the stream channels; (3) plant willow/alder shrubs in separate "pods" throughout the 15-acre mitigation area in the valley bottom and around the springs to increase wetland diversity and habitat; (4) prohibit cattle grazing on the 18-acre meadow area and the Spring #1 area of the Swamp Creek property and (5) implement a weed control program to prevent invasion of undesirable species into the wetland mitigation areas.

A minimum 50-foot-wide vegetated upland vegetated buffer (3 acres) would be maintained around the wetland rehabilitation area. The east and west sides of the Swamp Creek property are bordered by National Forest System lands; the buffer zone around the wetland mitigation area would help provide some connectivity for the two sides of public land. Construction of the wetland mitigation area on the Swamp Creek property is expected to be conducted over a 2-year period before filling of wetlands at the Poorman Impoundment Site. Once wetland rehabilitation and vegetation planting were completed, the residential house and other buildings on the site would be removed, which would improve overall habitat conditions on the entire 67-acre Swamp Creek property.

MMC would coordinate with the KNF Native Seed Coordinator and the Corps on planting plans and seed mixtures. Forest supervisor direction (Savage 2014) requires use of local native seed from the Forest Service Coeur d'Alene Nursery or the Kootenai Seed Mix (defined in Savage 2014). No introduced species would be used unless unavailability of native seed required such species and unless the KNF and Corps approved such species.

Reed canarygrass is an "exotic" species that is not native to Montana. Reed canarygrass is not considered a noxious weed but it is also not a desired species for wetland restoration. Based on three sites evaluated, reed canarygrass makes up 25 to 80 percent of the cover of the Swamp Creek mitigation site. Reed canarygrass is difficult to control because it has vigorous, rapidly spreading rhizomes and forms a large seed bank. Control of reed canarygrass is most effective when it includes an integrated approach implemented in a sequential and timely order (Waggy 2010). MMC would complete a vegetation survey of the entire mitigation site to define distribution of the grass and presence of more desirable species. MMC's initially would burn areas where reed canarygrass was found during late spring. In areas where reed canarygrass was dominant and/or pervasive, herbicides would be applied. Application of herbicide would be restricted to areas where reed canary grass was the dominant species and where the vegetation survey did not identify sufficient quantities of desirable wetland species. Burning would be completed for the first 3 years to ensure long-term treatment. Vegetation surveys would be completed to assess the success of burning to reduce reed canarygrass presence. Where mowing of the hayfield could reduce the presence of reed canarygrass, it would be completed in conjunction with burning to reduce the ability of reed canarygrass to produce seed heads. Vegetation monitoring would be conducted to ensure mowing was occurring effectively when combined with burning.

Garrison creeping foxtail is another "exotic" species that is not native to Montana that is increasing its dominance in wetland areas. MMC would develop a plan similar to reed canarygrass to control its dominance in the wetland mitigation area.

The water right associated with this Swamp Creek allows for flood irrigation of 26 acres of hay meadow. Rehabilitation of the site to improve its functions as a wetland would not require a water right. The current owner of this parcel has a surface water right to flood irrigate 26 acres of hay meadow between May 1 and October 31, with a maximum diversion rate of 291.72 gpm, and maximum volume of 52 acre-feet per year. MMC would file for a change of use for this water right to an instream flow right. MMC would convey any water right used for the Swamp Creek site to the Forest Service when the title or a perpetual conservation easement of the Swamp Creek mitigation site was conveyed to the Forest Service.

MMC would convey the title to or a perpetual conservation easement on the Swamp Creek mitigation site to the Forest Service after the Corps has determined the sites' performance standards have been met. The requirements for conveyance are described in the grizzly bear mitigation plan (see p. 203). If a perpetual conservation easement was conveyed, the easement would allow for public access to the property. Known Native American traditional use areas are on the uplands adjacent to the proposed Swamp Creek wetlands mitigation site and within the private land boundary. The upland areas at the Swamp Creek site protected by a conservation easement or conveyed to the Forest Service would be managed to protect and provide for future traditional cultural uses. Developed recreational use would not be encouraged.

2.5.7.1.2 Jurisdictional Waters (Streams)

Swamp Creek Site

The Swamp Creek stream mitigation would consist of constructing about 6,500 linear feet of new meandering channels, planting a 10-foot wide riparian zone on each side of the channels totaling about 3 acres, and removing cattle on the property to prevent grazing along the channels. Three primary drainage channels located on the Swamp Creek site would be subject to channel restoration: main Swamp Creek channel and two tributary channels from Spring #2 and Spring #3. The Swamp Creek channel flows through the center of the valley bottom on this property. The two spring-fed tributaries of Swamp Creek flow year-round, with Spring #2 having the highest flows (1.0 to 1.5 cfs baseflow).

The three Swamp Creek channels would be subject to reconstruction to natural meandering conditions that would be accomplished by completing the following: (1) reconstruct the channels to a meandering configuration, raise the channel bottom of Swamp Creek and two spring-fed channels, and incorporate small woody debris structures along some streambank reaches; (2) plant riparian vegetation, including willow/alder shrubs, in a buffer zone along the new meandering channels to create a riparian corridor; and (3) protect the valley bottom area by prohibiting cattle grazing along Swamp Creek and tributary channels. Construction of the stream mitigation project on the Swamp Creek property is expected to be conducted over a 2-year period before filling wetlands at the impoundment site or along the access road.

In some reaches of the new channels, specific areas of hedge-brush layering, willow fascines, and/or salvaged wetland sod mats would be constructed on the channel banks as protection from erosion and to improve establishment of riparian vegetation. These features typically would be limited to selected locations along the outside bank of meanders. The abandoned segments of the original straight channels would be filled with soil from the excavated new channels, and planted with wetland vegetation. These fill areas would remain as slight topographic depressions to provide some small areas of open-water near the new stream channels during periods of high groundwater. A riparian buffer zone 10 feet wide (3 acres) would be developed along each side of the reconstructed channels. Riparian vegetation would be planted in these stream corridors where there is sufficient soil and sod to allow the successful plantings. Shrubs and herbaceous wetland vegetation would be planted in the riparian zone.

Little Cherry Creek Site

Stream mitigation at the Little Cherry Creek sites would consist of replacing the culvert at NFS road #6212 with a bridge, bottomless arch pipe, or a new culvert that would comply with Forest Service stream simulation techniques. The culvert would be replaced before the project affected streams in the impoundment site.

Poorman Creek Sites

Stream mitigation at the Poorman Creek sites would consist of replacing one culvert across the creek at NFS road #278, removing one bridge on a decommissioned NFS road #6212 and stabilizing 400 feet of eroding cut slope adjacent to NFS road #6212. The bridge on NFS road #6212 across Poorman Creek would be removed during construction. MMC would dispose of the bridge structure in accordance with section 2.5.4.4, *Waste Management.* Concrete footers and reinforcement structures would be demolished and removed. Fill material that was placed to provide the proper elevation for the bridge structure and adjacent topography would be excavated and removed. Material removed from the bridge area would be relocated to the Poorman Impoundment Site to be used in construction of the impoundment or placed behind the impoundment. The culvert removal would follow procedures described for the Little Cherry Creek site.

Libby Creek Sites

During the Evaluation Phase, MMC would implement the BMPs shown in Table 19, such as installing, replacing, or upgrading culverts, to bring the proposed access roads (NFS roads #231 and #2316) up to INFS standards and guidelines and Forest Service guidance (USDA Forest Service 2008a, 2015b).

Stream Improvements on Lands Acquired for Grizzly Bear Mitigation

MMC would convey the title to or a perpetual conservation easement on 5,387 acres of land to the Forest Service or private conservation organization independent of MMC for grizzly bear mitigation for Alternative 3. All lands would be acquired before the start of the Construction Phase. The Forest Service would ensure that the specified acres of mitigation properties were managed for grizzly bear habitat in perpetuity. The grizzly bear mitigation plan also would require MMC to implement access management improvements, such as road decommissioning and culvert removal, on mitigation lands. MMC would conduct a survey to assess all mitigation lands for opportunities to improve aquatic resources. Some of the types of activities that would be conducted to mitigate streams include: remove culverts and restore the floodplain, restore disturbed riparian buffer areas by removing roads and revegetating, add woody debris to the floodplain, remove riprap and bridge abutments below the ordinary high water mark, remove berms and other impervious fill material, and install instream habitat features to increase the value to aquatic life. MMC would use the Corps' Montana Stream Mitigation Procedure and the Corps' compensatory mitigation regulations (33 CFR 332) in assessing mitigation opportunities. For the purposes of assessing stream mitigation credits, MMC identified 21 culverts that would be removed and adjacent riparian habitat would be restored on 908 linear feet of stream on potential grizzly bear mitigation lands (MMC 2014a). MMC would use the following BMPs during instream work, such as culvert replacement or removals, within 0.25 mile of a bull trout occupied stream:

- Conduct all in-stream work between July 15 to September 1; work can be completed outside of that time period if it can be implemented in a dry portion of the stream channel and all other potential impacts are fully mitigated
- Place straw bales in the streams below the culvert where practicable
- Minimize the duration of instream work to the extent practicable

2.5.7.1.3 Performance Standards for Jurisdictional Wetlands and Waters of the U.S.

Proposed performance standards for mitigation sites (MMC 2014a) are discussed in section C.4.2 in Appendix C. The Corps may modify proposed performance standards in any 404 permit issued for the project.

2.5.7.1.4 Monitoring

The Corps would use wetlands monitoring to determine if the compensatory mitigation was meeting the performance standards established in any 404 permit issued for the project. The monitoring described in section C.4 in Appendix C may be modified in a 404 permit.

2.5.7.2 Isolated Wetlands

Section 3.23, *Wetlands and Other Waters of the U.S.* discusses that isolated wetlands may be 1) directly affected by facility construction, such as the tailings impoundment and 2) indirectly affect by mine operations, such as operating of a pumpback well system or mine dewatering. The directly-affected wetlands are those affected by a facility, such as the tailings impoundment, and those that are within the disturbance area but outside the footprint of a facility. Federal agencies have responsibilities to avoid, minimize, and mitigate unavoidable impacts on wetlands under Executive Order 11990. Executive Order 11990 requires federal agencies to "consider factors relevant to a proposal's effect on the survival and quality of the wetlands." Federal agencies must find that there is no practicable alternative to new construction located in wetlands, and that the proposed action includes all practicable measures to minimize harm to wetlands. The Corps' wetland mitigation requirements would fulfill the Executive Order's requirements to minimize harm to jurisdictional wetland. The following measures are the KNF's proposed practicable measures to minimize harm to isolated wetlands.

The objective of the compensatory mitigation plan for isolated wetlands is to minimize harm to isolated wetlands and to offset unavoidable adverse impacts on isolated wetlands allowed under a Forest Service approved Plan of Operations. Section 2.5.2.6.3, *Final Tailings Impoundment Design Process* describes the agencies' requirements for the impoundment design before construction would begin. One mitigation measure requires MMC to avoid or minimize, to the extent practicable, filling wetlands and streams, such as described in Glasgow Engineering Group, Inc. (2010). This mitigation would ensure adverse effects would be minimized before considering compensatory mitigation.

Before issuance of the 2008 regulations regarding compensatory wetland mitigation, the Corps in Montana used ratios for various mitigation types in determining compensation requirements (Corps 2005a). In the absence of specific USDA or Forest Service policy or guidance regarding compliance with Executive Order 11990 for isolated wetlands, the KNF used the Corps' mitigation ratios and performance standards as a guide in determining compensation requirements for isolated wetlands. For the analysis purposes, the KNF used 1:1 ratio for created wetlands established and viable before project impact and a 2:1 ratio for created wetlands not established and viable before project impact. For example, wetlands created concurrent with tailings impoundment construction using wetland soils from the impoundment site would receive a credit at a 2:1 ratio. Mitigation credits for the proposed isolated wetland mitigation are discussed in section 3.23.4. MMC would develop final facility designs for agency approval as well as update the two 3D groundwater models (mine area and tailings impoundment) (see section 2.5.2.6, *Final Design Process*). MMC would be responsible for developing mitigation requirements for isolated wetlands for submittal to the KNF. The KNF would review the mitigation plan and is responsible for ensuring that the mitigation plan meets the requirements of Executive Order 11990. The KNF would use the Corps' wetland mitigation regulations (33 CFR 332) and applicable regulatory guidance as guidelines for determining whether the wetland mitigation and monitoring plan meets Executive Order 11990 requirements. Final mitigation requirements for isolated wetlands, which would be incorporated into an amended Plan of Operations, would be based on final facility designs and the updated groundwater models. MMC would be responsible for the isolated wetland mitigation sites and the proper management of those sites until performance standards have been met. The KNF would be responsible for developing and approving final mitigation requirements for isolated wetlands. The KNF would use the Corps' wetland mitigation regulations (33 CFR 332) and applicable regulatory guidance as guidelines for the development of the wetland mitigation and monitoring plan. MMC will submit as part of their amended Plan of Operations a final mitigation plan for isolated wetlands based on KNF's final mitigation requirements, final facility designs, and the updated groundwater models.

MMC submitted a previous Preliminary Mitigation Design Report in January 2014 (MMC 2014b). The report included the creation of wetlands at three sites in the Little Cherry Creek watershed that primarily are on land owned by MMC and a gravel pit on National Forest System lands. In 2014, the Corps indicated that the hydrology information provided by MMC in the revised Preliminary Mitigation Design Report for three Little Cherry Creek sites and the Gravel Pit site was not adequate to demonstrate an adequate hydrology source without compromising existing adjacent wetlands. The KNF retained three Little Cherry Creek sites and the Gravel Pit site as mitigation for isolated wetlands. The KNF recognizes that the proposed sites are within the drawdown area of the pumpback wells as predicted by the 3D tailings impoundment groundwater model. Section 3.10.4.2 indicates operation of a pumpback well system may not affect groundwater levels and five of the springs south of Little Cherry Creek because of an apparent subsurface bedrock ridge that separates groundwater flow between the watershed of Little Cherry Creek from those of Drainages 5 and 10 in the Poorman Impoundment Site (Chen Northern 1989). The geologic and hydrologic data from the area between the Little Cherry Creek and Poorman drainages are not sufficient to eliminate the possibility of the pumpback well system adversely affecting surface resources, particularly groundwater-supported wetlands. The model would be rerun after MMC collected additional data in the Poorman Impoundment Site during the Evaluation Phase. The KNF also retained the three Little Cherry Creek sites and the Gravel Pit site as mitigation for isolated wetlands because many of the isolated wetlands are supported by surface water and not groundwater. Developing the three Little Cherry Creek sites and the Gravel Pit site as wetland mitigation sites concurrent with impoundment construction would allow soils from wetlands to be filled to be used at the mitigation sites, further enhancing their mitigation success. After the 3D model has been rerun, MMC would reevaluate the feasibility of the three Little Cherry Creek sites and the Gravel Pit site as mitigation for isolated wetlands. Should one or more of the sites be determined to be infeasible, MMC could develop similar sites north of Little Cherry Creek where groundwater drawdown would not occur, as described in MMC's submittal for isolated wetland mitigation (MMC 2014c).

2.5.7.2.1 Little Cherry Creek Sites

The three Little Cherry Creek sites have a total combined area of 9 acres; MMC would create 4.5 acres into new wetlands. The Little Cherry Creek sites would be on land owned by MMC, except for a small area of LCM-2 on National Forest System lands. Wetlands would be developed through excavation of shallow depressions in locations where surface water would collect and be retained. Existing vegetation, primarily coniferous forest, would be removed before excavation.

The depressional areas would be excavated 4 to 5 feet below ground surface, with some variations in depth and overall shape configuration to improve habitat diversity. Once the depressions were excavated to within 1 or 2 feet of the spring/early summer water table, hydrologic conditions would likely be present for at least 20 days of the growing season.

Wetland soil, sod, and shrubs would be excavated from existing wetlands at the Poorman Impoundment Site before filling during construction and placed in the wetland mitigation areas. An average of 24 inches of surface soils and 12 inches of subsoils at all wetlands would be excavated and used at wetland mitigation sites. Final design for management of wetland soils would be included in the Soil Salvage and Handling Plan.

A minimum 25-foot-wide vegetated upland buffer would be maintained around the three wetland mitigation areas. Assuming a total upland buffer perimeter of 4,500 feet for the three areas, a 25-foot buffer would create a 2.5-acre buffer. The sites would be constructed concurrently with construction of the Poorman Impoundment so that wetland soil removed from the impoundment disturbance area could be hauled directly to the mitigation sites. MMC expects the three mitigation sites could be constructed and planted during a single non-winter period.

In 2010, MMC installed shallow piezometers (monitoring wells) in the proposed Little Cherry Creek mitigation sites and measured water levels in June and September. Water levels were also measured in May through September in 2011, 2012, and 2013. At the Little Cherry Creek sites, the water table is shallow in the spring and early summer (typically less than 2 feet below ground surface), declining more than 2 feet during late summer and early fall, and then rising again in late fall. Hydrologic support would be provided by direct precipitation or shallow groundwater. Groundwater from beneath the tailings impoundment would not be used to provide hydrologic support as proposed in Alternative 2. MMC would acquire a water right for the created wetlands if the DNRC determined water use for creating wetlands was a beneficial use. If water use for creating wetlands was not a beneficial use, MMC could use water for wetland creation without a beneficial water use permit protecting its right to do so. Water to create wetlands would come from precipitation on MMC and National Forest System lands and the legal availability of that water would not be at risk of appropriation by another user. Any water rights used for wetland mitigation would be conveyed to the Forest Service when the mitigation sites were conveyed.

If the title to or a perpetual conservation easement on Little Cherry Creek mitigation sites had not already been conveyed as part of the grizzly bear mitigation plan, MMC would convey the title or a perpetual conservation easement on the Little Cherry Creek mitigation sites to the Forest Service as compensatory mitigation to offset impacts to isolated wetlands when the sites' performance standards had been achieved. Conveyed lands would be the isolated wetland mitigation sites, vegetated upland buffers, and adjacent existing wetlands contiguous to National Forest System lands. The requirements for conveyance are described in the grizzly bear mitigation plan (see p. 203).

2.5.7.2.2 Gravel Pit Site

The 4-acre Poorman gravel pit site is National Forest System land south of the Poorman Impoundment (Figure 33). MMC would create a 3-acre wetland in this area by excavating several small depressions in the former gravel pit, and lining the depressions with low permeability wetland soil removed from the Poorman Impoundment disturbance area. Hydrologic support would be provided by direct precipitation. A minimum 50-foot-wide vegetated upland buffer would be maintained around the site, creating a 2-acre buffer. The site would be developed concurrently with the Little Cherry Creek sites.

2.5.7.2.3 Performance Standards for Isolated Wetlands

The KNF would use the Corps and EPA's compensatory mitigation regulations (33 CFR 332 and 40 CFR 298) as a guide to offset unavoidable impact on wetlands and to ensure performance standards and the effectiveness of isolated wetland mitigation. Performance standards for jurisdictional wetland mitigation sites described in the Corps' 404 permit would be used as a guide in developing performance standards to assess the success of the isolated wetland mitigation sites.

2.5.7.2.4 Monitoring

Water levels in piezometers in four wetlands (LCC-29, LCC-35A, LCC-36, and LCC-39A) would be measured monthly April through September. Vegetation in these four wetlands also would be monitored, following the methods used for the GDE monitoring (see section C.10.4.2, *Groundwater Dependent Ecosystem Monitoring* in Appendix C). The monitoring would continue through the Closure Phase as long as the pumpback well system operated. Other monitoring for jurisdictional wetland mitigation sites described in the Corps' 404 permit would be used as a guide in developing monitoring requirements.

2.5.7.3 Bull Trout

In the 2013 Biological Assessment (BA) for aquatic species (USDA Forest Service 2013a), the KNF submitted a mitigation plan for Mine Alternative 3 and Transmission Line Alternative D-R to the USFWS that completely replaced MMC's proposed Fisheries Mitigation Plan for Alternative 2. The following description summarizes the KNF's mitigation plan.

2.5.7.3.1 Objectives

The objectives of the proposed bull trout mitigation measures would be to establish conservation actions that in the long-term would fully offset projected impacts from the mine project to bull trout populations and bull trout critical habitat. Because of the uncertainties involved in conservation measure development and the uncertainties in biological response of bull trout to the measures, planning and other activities leading to implementation of the conservation measures would be assessed during the Evaluation Phase with a bull trout mitigation program to follow. An adaptive management approach to the overall mitigation plan would be adopted to implement mitigation.

A hydrologic assessment would be completed during the Evaluation Phase, which would be critical to understanding the extent that streamflow depletion may occur based on a revised and improved numerical groundwater model. Assessment of the various stream reaches proposed in this mitigation plan would be conducted during the Evaluation Phase to provide guidance to the agencies regarding the implementation of the proposed mitigation. Once the hydrologic model results were known, a bull trout mitigation program would be focused to address the predicted impacts.

This Plan describes actions and implementation mechanisms developed with objectives to offset potential adverse impacts on bull trout populations and projected adverse modifications to bull trout critical habitat in the two bull trout Core Areas associated with the proposed project: the Lower Clark Fork Core Area (including Rock Creek, East Fork Rock Creek, and East Fork Bull

River) and the Kootenai Core Area (including Libby Creek). To this end, mitigations were developed for each Core Area that have the potential to reestablish, maintain, create or improve self-sustaining local bull trout populations in stream reaches where they occurred historically but are currently absent, occur at low densities, are at risk of invasion by non-native fish species, or are at risk of being detrimentally impacted by the proposed project, and to improve habitat conditions in Core area streams that are currently not designated as critical habitat.

2.5.7.3.2 Conceptual Mitigation Actions

Proposed mitigation actions for these streams may include:

- Create or secure genetic reserves through bull trout transplanting or habitat restoration to protect existing bull trout populations from catastrophic events.
- Rectify factors that are limiting the potential of streams to support increased production of bull trout.
- Eradicate non-native fish species, especially brook trout that are a hybridization threat to bull trout.

Based on available information on the current condition of the selected streams, factors that influence bull trout populations and the mitigation potential of each stream have been tentatively identified, as described below.

Copper Gulch

Restoration of the aggraded lower reach would be the focus for mitigation. It is anticipated that modification of this reach would provide habitat, and alleviate seasonal drying to allow improved access for migratory bull trout to the central perennial reach where habitat is available to support a viable, self-sustaining bull trout population. An integral part of mitigation planning on Cooper Gulch would be an assessment of the feasibility of eliminating brook trout from the stream and development of a stream rehabilitation plan, if brook trout removal was feasible. Additional feasibility studies for potential bull trout donor stocks would be required to determine genetic health and availability of nearby bull trout populations (*e.g.,* East Fork Bull River) and development of a genetic management plan (if re-introduction of bull trout is considered). If successfully implemented, fish passage restoration and bull trout reintroduction in Copper Gulch could potentially contribute to offsetting both projected losses of bull trout numbers and critical habitat in the East Fork Bull River and the lower Clark Fork Core Area.

West Fork Rock Creek

Available data for this stream indicate that habitat is underused by bull trout compared to previous population density estimates. Additional habitat and population surveys would be conducted to identify limiting factors for bull trout in this stream and to evaluate its potential to provide spawning opportunities for migratory bull trout. If the limiting factors analyses so indicate, mitigation measures in this drainage may be able to partially offset both the projected reductions of bull trout populations and the loss of bull trout critical habitat in Rock Creek and the Lower Clark Fork Core Area.

Rock Creek

Salmon Environmental Services (2012) suggested that bull trout populations in East Fork and West Fork Rock Creek are currently isolated from the threat of brook trout hybridization by an expanse of seasonally intermittent stream which separates the primary bull trout population from a brook trout population downstream of the intermittent stream reach. Removal of the brook trout population in lower Rock Creek (Rock Creek Invasive Species Eradication Project) would lower the risk of brook trout invading the bull trout habitat further upstream. As such, this mitigation measure would complement any habitat of bull trout population mitigation measures deemed appropriate in the West Fork Rock Creek (see above). Additionally, if this mitigation measure (brook trout removal from Rock Creek) is feasible and implemented in a timely manner (before brook trout invade upstream bull trout habitat) it could enhance the chances of success of any mitigation actions taken in the West Fork Rock Creek and contribute to offsetting projected losses of bull trout in Rock Creek. Additionally, migratory bull trout are known to spawn and rear in the stream reach currently occupied by brook trout in lower Rock Creek, implementation of a bull trout population enhancing mitigation measure (removal of brook trout) could contribute to offsetting losses to upstream bull trout populations in Rock Creek.

Libby Creek

On-site mitigation proposed in upper Libby Creek would be preferable to offset potential detrimental impacts on the bull trout population and critical habitat in that stream reach as it would be directly impacted. Projected effects are based on current modeled streamflow depletion estimates which hypothetically could be off-set by habitat improvements to increase the quality of available habitat. The Flower Creek mitigation, which is proposed as primarily a genetic reserve for the unique upper Libby Creek resident bull trout would be retained as a contingency measure to be considered if the Libby Creek mitigation is not successful. Mitigation success would be based on long-term trend monitoring of bull trout densities in the affected reach showing either a maintained or increasing bull trout population.

The reach of Libby Creek upstream of the falls and adjacent to the Libby Adit site displays braiding and channel shifting. Decreased baseflows would further reduce the quality of existing habitat. Installing large wood aggregates in the floodplain and riparian zone would stabilize this reach, restore riparian function, improve spawning and rearing habitat for bull trout by increasing channel depth, complexity and stability, and sediment retention. Large wood aggregates would also allow establishment of riparian vegetation, specifically black cottonwood. Because no brook trout in this reach, there would be no concern for increased interspecific competition for available habitat or a threat of hybridization.

Flower Creek

If the mitigation in Libby Creek above the falls failed, the next highest potential for effective bull trout mitigation in the Kootenai River Core Area lies in Flower Creek. Flower Creek provides a limited contingency to the proposed Libby Creek mitigation. Flower Creek, a historical bull trout stream, is the municipal water supply for the city of Libby. Brook trout are present above and below the existing dams and complete eradication would be impossible. Securing the reach above the upper dam as bull trout habitat would require repeated physical removal of brook trout through electrofishing and gillnetting. Piscicides would never be an option as the watershed is the sole municipal water supply for the city of Libby.

There are several additional mitigation options available in Flower Creek: 1) salvage the Flower Creek bull trout population (if it is still functional) upstream of the water storage dam and rehabilitate the watershed with a non-native species (brook trout) eradication program; 2) establish a genetic reserve with bull trout from upper Libby Creek and Bear Creek in the water supply storage reservoir and upstream in Flower Creek by implementing non-native fish eradication and transferring bull trout to the Flower Creek drainage; 3) re-establish cold water habitats downstream of the water storage dam through construction of a selective withdrawal mechanism in the dam or a stream water by-pass system through the reservoir; 4) rehabilitate the new cold water channel (3, above) with a non-native species eradication program and re-introduce migratory bull trout to the stream; 5) re-establish cold water stream habitat in Flower Creek downstream of the water storage dam through construction of a water bypass channel through the diversion dam reservoir; and 6) re-establish a migratory bull trout population above and below the water diversion dam utilizing fish transfer from other bull trout populations, non-native fish eradication, and selective upstream passage techniques at the low-head water diversion dam. Re-established bull trout populations would offset projected bull trout population declines in the Kootenai River Core Area. Re-established quality bull trout habitat would offset projected permanent losses of bull trout critical habitat, and establishment of a bull trout genetic reserve would protect existing at-risk bull trout populations (Libby Creek) by lowering the risk of catastrophic mine-related incidents affecting that population.

Preferably, upper Libby Creek mitigation would restore habitat for an existing bull trout population in the area of predicted flow depletion. Flower Creek would provide contingency mitigation in the event mitigation in the upper Libby Creek reach above the falls is determined unsuccessful. At that point, the Flower Creek mitigation concepts would be further prioritized based on habitat conditions below the lower dam, habitat conditions between the two dams, non-native species suppression opportunities above the upper dam, the potential to create a genetic reserve, assessment of fish transfer and passage for the lower dam, and assessment of cold water release feasibility.

2.5.7.3.3 Timing

Logically, the Core Area Bull Trout Mitigation Plans would be developed in phases to support advancement of more detailed plans and designs. The phases are intended to allow an iterative approach for MMC to collaboratively work with the KNF, FWP, and USFWS on any modifications that may be determined necessary as more information is collected on the selected streams and improvements are made to the numerical groundwater model during the Resource Evaluation Phase. The first three periods, described below, essentially would be planning phases involving supplemental data collection, project-level plan and design development, and implementation plan and specific work plan development. These activities would begin immediately upon KNF approval to implement the Evaluation Phase, and would be completed during the Resource Evaluation Program. Phase Four would be mitigation project implementation that would be time dependent on a number of factors and would likely not begin for most projects until the KNF allowed MMC to begin the mine Construction Phase (estimated to last 3 to 4 years). Phase Five would be monitoring and maintenance of all fisheries-related mitigation measures, including bull trout. This phase would extend from issuance of KNF approval to implement the Evaluation Phase through when monitoring data indicate mitigation was successful and sustainable. The timeframe for this phase may extend well beyond closure and reclamation of the mine. Depending on the actual post-mining effects on stream baseflows and the success of mitigation measures, all mitigation plan phases could be extended beyond the mine Closure Phase (this would require additional MMC funding or forfeiture of an appropriately sized bond).

A subset of the Core Area Bull Trout Mitigation Plans would be the feasibility assessments needed to ascertain the steps necessary to proceed with selected mitigation proposals in each Core Area; Upper Libby Creek Conservation Project, Flower Creek Bull Trout Conservation Project, and Rock Creek Invasive Species Eradication Project. It is proposed that these assessments and subsequent planning phases would begin immediately upon issuance of the KNF approval to implement the Evaluation Phase and be completed within 18 months of initiation of the Evaluation Phase. Preliminary work plans would be prepared for consideration of approval by the KNF, in consultation with FWP and USFWS (and other partners as deemed appropriate by Forest Service). MMC would review recent literature such as that described below in completing the feasibility assessments:

- *Conservation Strategy for Bull Trout on USFS lands in Western Montana* (USDA Forest Service and USFWS 2013)
- *Consequences of actively managing a small bull trout population in a fragmented landscape* (Al-Chokhachy *et al*. 2015)
- *Strategic modeling to assist conservation of bull trout in the Lower Clark Fork River-Final Report* (Peterson *et al*. 2015)
- *Status and conservation of interior redband trout in the western United States* (Muhlfeld *et al*. 2015)

Phase One: Study Plan

One of the first activities to be conducted under phase one of mitigation planning would be to conduct more detailed surveys of the proposed bull trout mitigation streams. These fisheries and habitat surveys would be designed to gain a better understanding of the status of bull trout populations, non-native fish populations, barriers, and habitat quality. Stream specific study plans would be developed by MMC and submitted as a component of a proposed annual work plan to KNF and appropriate agencies for review and approval. The study plans would describe the methods, effort and costs that would be necessary to collect information needed to support the development of specific objectives and preliminary mitigation project designs for each stream.

Phase Two: Preliminary Design and Supplemental Information

The results from Phase One would be used to refine development of the objectives and preliminary mitigation designs for each proposed mitigation project. It is expected that additional mitigation opportunities could be identified to enhance the original planned mitigation measures. Results from Phase One and the revised numerical groundwater model that would be generated during the Resource Evaluation Program may identify a need for supplemental investigation to support a final mitigation project design. If so, supplemental study plans could be developed prior to or in conjunction with the preliminary mitigation project design. Preliminary mitigation project designs would be submitted to KNF for approval before further planning commences.

Phase Three – Mitigation Work Plan

After completion of Phase One and Phase Two, MMC would advance the approved preliminary design into a final design and proposed implementation work plan. Again, it is possible that additional field work or design work (Phases One and Two) would be required to provide final details prior to completion of a final implementation work plan. A schedule of activities would be part of the final work plan that would consider seasonal flows, fish spawning, and other factors that would influence timing of implementation of the work plan. The final work plan would also include a description of monitoring and maintenance to ensure that mitigation measures are stable and meet objectives (for long-term effectiveness assessments, any fishery monitoring would be incorporated into the Fisheries Monitoring Plan and proposed annual work plans). A draft plan would be submitted for KNF and other agency review and approval. Based on KNF direction, MMC would prepare a Final Mitigation Project Work Plan.

The work plan would also describe what authorizations, approvals, and permits may be required before implementation. MMC would be responsible for applying for and obtaining necessary approvals to support in-stream work and other activities that have not been obtained as part of the overall Montanore Project approval, including access agreements or other similar legal documents that may be required. MMC would provide the agencies with all approvals and authorizations to ensure compliance with applicable laws and regulations.

Phase Four – Implementation

MMC would implement the Final Mitigation Project Work Plan following KNF approval of the Plan and of an annual work plan. Implementation would be conducted in cooperation with the various agencies, property owners, and other parties as appropriate. Due, in part, to seasonal constraints, the implementation schedule may take several seasons to complete and would be coordinated with all parties involved.

Phase Five – Monitoring and Maintenance

The final phase of the plan would be fish population and stream habitat monitoring to assess mitigation success and stability of any stream modifications. Maintenance and repairs would be accomplished by MMC based on the monitoring results. Based on principals of adaptive management, this phase would include any modifications or re-implementation that would be required if mitigation objectives were not being met. Through principals of adaptive management, this could include the development and implementation of new mitigation measures within the affected Core Areas.

2.5.7.4 Wildlife

Alternatives 3 and 4 would incorporate some of the elements of the wildlife mitigation plan for Alternative 2, but would include additional measures to avoid, minimize, and mitigate impacts on wildlife. The agencies' alternatives would include implementation of a wildlife awareness program prepared by MMC. The objectives of the wildlife awareness plan are to: reduce the risk of human-caused mortality of threatened and endangered species, identify other wildlife issues of concern for the Montanore Project, establish company procedures and protocols that address these issues, and develop employee and contractor awareness of wildlife issues. The wildlife awareness program includes the education of employees about bear awareness and safety, refuse management, company policies regarding wildlife, and other wildlife concerns. The following sections describe Alternative 3 and 4 wildlife mitigation measures, which replace the wildlife mitigation plan for Alternative 2.

2.5.7.4.1 Grizzly Bear

The lead agencies' grizzly bear mitigation plan would have similar components as the Alternative 2 mitigation plan: measures to reduce mortality risks, maintain and enhance core habitat, and for mitigation plan management. A number of roads proposed for access changes in Alternative 2 are no longer available for mitigation. In the 2013 BA (USDA Forest Service 2013b), the KNF submitted a mitigation plan for Mine Alternative 3 and Transmission Line Alternative D-R to the USFWS that completely replaced MMC's proposed grizzly bear mitigation plan for Alternative 2. The following description summarizes the KNF's mitigation plan and has been modified slightly to provide an estimate of mitigation requirements needed for the agencies' mine and transmission line alternatives (Table 28, Table 30, and Table 31). MMC would be responsible for submitting a grizzly bear mitigation plan consistent with the KNF wildlife mitigation plan for incorporation into an amended Plan of Operations. Once approved, the Wildlife Mitigation Plan would become a component of the amended Plan of Operations. Mitigation measures would be implemented prior to the Evaluation and Construction Phases. Some measures implemented prior to the Evaluation Phase would be expanded for the Construction Phase. The mitigation plan is included in its entirety in the KNF BA (USDA Forest Service 2013b).

Measures to Reduce Mortality Risks

MMC would fund two new full-time wildlife positions, a Law Enforcement Officer, and a local FWP Grizzly Bear Specialist in Libby in 5-year increments for the life of the mine and through the closure and Closure Phase, or as otherwise agreed by Forest Service in consultation with USFWS. If both Montanore and Rock Creek projects were concurrent, MMC would fund a local FWP Habitat Conservation Specialist, to address grizzly bear/land use issues, coordinate and account for implementation of the mitigation plan, and coordinate all land acquisition and/or conservation easements for required grizzly bear mitigation. Funding would be provided prior to initiation of the Evaluation Phase and implementation of the land acquisition program, and then 5-year increments for the life of the mine through the Closure Phase, including shut-down periods, or until the Oversight Committee determined that the position was no longer needed.

MMC would implement the following measures prior to Forest Service approval to initiate the Evaluation Phase:

- Install and maintain fencing surrounding the Libby Adit Site for the life of the mine.
- Develop a transportation plan for life of the mine to be approved by the Forest Service.
- Fund, develop, and implement an enhanced public outreach information & education (I&E) program to build support and understanding for the conservation of the Cabinet-Yaak grizzly population that would increase to full funding and implementation prior to the Construction Phase, for life of the mine.
- Prohibit use of salt during winter plowing operations for life of the mine.
- Remove big game animals killed by any vehicles daily from road rights-of-way within the permit area and along roadways used for access or hauling ore (NFS roads #231, #278, #4781, and #2316 and new roads built for the project) for life of mine.
- Monitor the number of big game animals killed by vehicle collisions on these roads and report findings annually.
- Monitor and report (within 24 hours) all grizzly bear, lynx, wolf, and black bear mortalities within the permit area and along the access roads for life of the mine.
- Provide funding for purchase and maintenance of up to 35 bear-resistant refuse containers for use at Montanore Project mine facilities and for personal use by mine employees that live in or near grizzly bear habitat, and fund replacements as needed for life of the mine.
- Provide funding for fencing and electrification and maintenance of garbage transfer stations within grizzly bear habitat adjacent to and throughout the CYRZ.

- Provide funding for an initial 10 electric fencing kits that can be installed by FWP bear specialists at additional bear problem sites within grizzly bear habitat adjacent to and throughout the CYRZ. In addition, fund 2 replacements electric fencing kits per year that can be installed by FWP bear specialists at bear problem sites.
- Implement a wildlife awareness program for employees and contractors prepared by MMC.
- Agree that all mortality reduction measures would be subject to modification based on adaptive management, where new information supports changes.

Measures to Maintain and Enhance Grizzly Bear Core Habitat

The analysis of impacts on core grizzly bear habitat within BMU 2, 5, and 6 and impacts on the north-south movement corridor are described in greater detail in the BA. Core habitat effects and required core habitat creation are shown in Table 27. **Figure 94** displays which road access changes specified in Table 28 and Table 29 would create core habitat in the agencies' transmission line alternatives.

Under the direction of the Forest Service, MMC would implement or fund access changes on roads specified in Table 28 and Table 29. These roads would be included in the Road Management Plan. All roads specified in Table 28 and Table 29 are shown on **Figure 35**. In addition MMC would implement or fund monitoring of the effectiveness of closure devices at least twice annually; and complete any necessary repairs immediately. Roads shown in Table 28 that would be seasonally gated would improve conditions on an estimated 808 acres of spring grizzly bear habitat but because these roads would not be gated for the entire active bear season, habitat improved through these seasonal road access changes would not contribute to core or for habitat compensation for core.

As noted in Table 28, if the Rock Creek Mine mitigation restricting the Upper Bear Creek road #4784 with an earthen barrier has not been implemented prior to Forest Service approval to initiate the Evaluation Phase, then MMC would implement or fund this mitigation. MMC would only implement this mitigation if Rock Creek has not yet done so. Monitoring the effectiveness of the closure device at least twice annually and completing any necessary repairs immediately would also be required of MMC until the Rock Creek Mine initiated activity.

Table 27. Impacts on Grizzly Bear Core Habitat and Core Habitat Created by Phase.

Alternative	BMU 2 (acres)	BMU 5 (acres)	BMU 6 (acres)	Total (acres)	Core Replaced 2:1 (acres)
Core Habitat Lost[1]					
3C-R	0	253	0	253	506
3D-R	0	248	18	266	532
3E-R	0	253	18	271	542
4C-R	0	73	0	73	146
4D-R	0	73	18	91	182
4E-R	0	73	18	91	182
Phase and Location	**BMU 2 (acres)**	**BMU 5 (acres)**	**BMU 6 (acres)**	**Total (acres)**	
Created Core from Access Changes[2]					
Prior to Evaluation Phase					
Within North-South Corridor		806	1,001	1,807	
Outside North-South Corridor	274	811	90	1,175	
Prior to Construction Phase					
Within North-South Corridor		2,971		2,971	
Outside North-South Corridor[3]			1,053	1,053	
Total Core Created	274	4,587	2,145	7,006	
Core created for loss of core	0	146-502	0-36	36-542	
Core created to reduce constriction in the north-south corridor (1,070 acres) and core created to mitigate for remaining effects	274	4,085 to 4,441	2,109 to 2,145	6,464 to 6,970	

Acres do not tally to 100% due to rounding.
[1]Core habitat lost (acres) includes both existing core and "core" created prior to Evaluation Phase. This created core resulted from the creation of a larger block of core and was not meant to function as core. However for this analysis it was included in the core total and mitigation for core habitat lost (acres) required at 2:1 ratio.
[2]See *Measures to Compensate for Displacement Effects* section for planned measures to address constriction within the north-south corridor.
Core acres shown for within and outside north-south corridor and totals differ slightly from the Montanore Biological Opinion, Appendix C, Table 1, page 10, USFWS 2014a due to the differences in projects considered for the baseline conditions, road layers used, and the updated ArcGIS calculations used in this NEPA analysis.

Table 28. KNF's Proposed Road Access Changes Prior to Evaluation Phase.

NFS Road Number	Road Name	Length in BMU/BORZ (Miles)	Total Miles	Current Closure Device and Access Status for Motorized Vehicles	Proposed Closure Device and Proposed Access Status for Motorized Vehicles	Notes
231 2316	Libby Creek Road Upper Libby Creek	2.0 / 0.0 1.5 / 0.0	2.0 1.5	Open[1]	Gated seasonally[2] – Restricted to all motor vehicles except mine traffic April 1 to May 15	Gate is located on road 231 below existing Libby Adit Site. Implemented in 2007, with restriction expected to continue through 2-year Evaluation Phase and the 1st year of Construction Phase for reconstruction of roads 6210, 4781, and a portion of road 278.
4778 4778E 5192 5192A	Midas-Howard Creek Midas-Howard Creek E Midas Bowl Midas Bowl A	5.8 / 0.9 0.8 / 0.0 1.6 / 0.0 0.2 / 0.0	6.7 0.8 1.6 0.2	Open[1]	Gated seasonally[2] – Restricted to all motor vehicles, including over-snow April 1 to June 15	Restricted to all motorized vehicles, including over-snow vehicles, during the closure period.
4776A 4778C	Horse Mtn Lookout A Midas Howard Creek C	1.5 / 1.2 1.8 / 0.1	2.7 1.9	Open	Barriered – Restricted yearlong to motor vehicles, Open to over-snow December 1 to March 31	The proposed over-snow access change would minimize disturbance during the grizzly bear spring use period.
14458	Midasize	0.6 / 0.0	0.6	Open	Barriered – Restricted yearlong to all motor vehicles, including over-snow	Proposed change consistent with existing yearlong closure on remaining portion of the road.
4778C	Midas Howard Creek C	1.6/0.0	1.6	Barriered – Restricted yearlong to motor vehicles, including over-snow vehicles	Barriered – Restricted yearlong to motor vehicles, open to over-snow December 1 to March 31	The proposed access change on the 1.9-mile open segment of Road 4778C would result in over-snow-vehicle use being allowed on 1.6 miles.
4776C 4776F 6200 6200D 6200E 6200F 6214 6214F	Horse Mtn Lookout C Horse Mtn Lookout F Granite-Bear Creek Granite-Bear Creek D Granite-Bear Creek E Granite-Bear Creek F Cable-Poorman Creek Cable-Poorman Creek F	0.0 / 0.9 0.7 / 0.4 1.8 / 0.0 0.9 / 0.0 0.3 / 0.0 0.4 / 0.0 3.6 / 0.0 0.6 / 0.0	0.9 1.1 1.8 0.9 0.3 0.4 3.6 0.6	Gated – Restricted yearlong to motor vehicles, open to over-snow vehicles December 1 to April 30	Barriered – Restricted yearlong to motor vehicles, Open to over-snow December 1 to March 31	The proposed over-snow access change would minimize disturbance during the grizzly bear spring use period.
6745	Standard Creek	3.9 / 0.0	3.9	Gated – restricted yearlong to motor vehicles, including over-snow	Barriered – Convert to trail. Restricted yearlong to motor vehicles, including over-snow	No change is proposed to the existing public motorized status.

NFS Road Number	Road Name	Length in BMU/BORZ (Miles)	Total Miles	Current Closure Device and Access Status for Motorized Vehicles	Proposed Closure Device and Proposed Access Status for Motorized Vehicles	Notes
4784[3]	Upper Bear Creek	2.7 / 0.0	2.7	Gated – restricted to motor vehicles Oct. 15 - June 30, open to over-snow Dec 1 - April 30	Barriered – Convert to trail; restrict all motor vehicles yearlong, including over-snow, over life of project	Montanore would only implement if Rock Creek Mine has not yet done so. Convert to trail; Restrict all motorized vehicles year-long, including over-snow to minimize disturbance during grizzly bear spring use period. This differs from the Rock Creek mine mitigation, which restricted motor vehicles yearlong, but did not restrict over-snow vehicles.
	Total access change	32.3 / 3.4				Without the #4784 access change, miles 29.6/3.4

[1]Seasonal closures implemented with the KNF's approval in 2007 to MMC for snow plowing portions of NFS roads #231 and #2316; Road 4778E is impassible with a closure implemented in 2006.
[2]The seasonal access changes, which minimize potential for displacement and reduce mortality risk for grizzly bears on spring range, do not change the status of these existing open roads during the active bear year, and thus do not change OMRD or TMRD within the BMU or open or total linear miles within the BORZ.
[3]Road 4784 is open July 1 to October 14 to motorized vehicles in existing condition. MMC would only implement if Rock Creek Mine has not yet done so.

Table 29. KNF's Proposed Road Access Changes Prior to the Construction Phase.

NFS Road Number	Road Name	Length in BMU/BORZ (Miles)	Total Miles	Current Closure Device and Access Status for Motorized Vehicles	Proposed Closure Device and Proposed Access Status for Motorized Vehicles	Notes
2316 2317 4781 6701 6702	Upper Libby Creek Poorman Creek Ramsey Creek South Ramsey Creek South Libby Creek	0.7/0.0 1.8/0.0 2.8/0.0 0.4/0.0 0.4/0.0	0.7 1.8 2.8 0.4 0.4	Gated – Restricted yearlong to motor vehicles, open to over-snow Dec 1 – April 30	Barriered – Restricted yearlong to motor vehicles, including over-snow	Gate is on segment of road 2316 above existing Libby Adit site. On roads 2316, 2317, and 4781, convert to a trail where necessary.
150A	Rock Lake Trail #935	2.9/0.0	2.9	Gated – Restricted yearlong to motor vehicles, including over-snow.	Barriered – restricted yearlong to motor vehicles, including over-snow	Convert to a trail where necessary.
4725[1]	North Fork Miller Creek	4.2/0.0	4.2	Gated – Restricted yearlong to motor vehicles, including over-snow	Barriered – Restricted yearlong to motor vehicles, including over-snow	No change to current public motorized access
14442	Lampton Pond/Cherry Cr	0.0/0.6	0.6	Gated – Restricted to motor vehicles Oct. 15 - June 30 open to over-snow Dec 1 - April 30	Barriered – Restricted yearlong to motor vehicles, including over-snow	Road access change to offset impacts of the transmission line alternatives on linear open and total road density within the Cabinet Face BORZ
6205D 6787B 6209E 4776B	Big Hoodoo/Getner Cr Big Hoodoo/Bear/Crazy Crazyman Creek Horse Mtn/Libby Creek	0.0/4.0 0.0/1.6 0.0/1.1 0.0/2.9	4.0 1.6 1.1 2.9	Open Open Open Open	Barriered – Restricted yearlong to motor vehicles, including over-snow	Road access changes to offset impacts of the transmission line alternatives on linear open and total road density within the Cabinet Face BORZ
	Total	13.0/10.2				

[1]In Alternatives 3C-R and 4C-R, NFS road #4725 would be barriered after the road was no longer needed for transmission line construction.

Measures to Compensate for Displacement Effects and the Loss of Grizzly Bear Habitat

The analysis of impacts and displacement effects on grizzly bears are described in detail in the BA. Methods used to evaluate displacement effects from the Montanore Project and corresponding habitat compensation are described in the *Revised FEIS Analysis of Grizzly Bear Displacement Effects* (ERO Resources Corp. 2015a).

All activities for both transmission line construction seasons and during decommissioning of the transmission line on National Forest System and State trust lands located within the CYRZ and Cabinet Face BORZ would occur between June 16 and October 14.

Prior to KNF approval to initiate the Operations Phase, to reduce grizzly bear habitat displacement, MMC would ensure sounds emitted from the facilities and adits during the estimated 16- to 20-year Operations Phase would comply with noise levels specified in the plan.

MMC would secure or protect (through conservation easement or acquisition in fee with conveyance of fee or perpetual conservation easement to the Forest Service or private conservation organization independent of MMC) from development (including but not limited to housing and motorized access) and use (timber harvest, grazing, and mining) replacement habitat to compensate for acres lost by physical alterations or displacement (Table 30). All replacement habitat for either displacement or habitat physically lost would be committed by MMC prior to the associated phase of the mine and accepted by the Forest Service (*i.e.*, mitigation habitat review, acquisition, conservation easements, recordation, and transfer to the Forest Service or private conservation organization independent of MMC complete prior to the Evaluation Phase or Construction Phase as required for the phase specific mitigation (Table 30). The Forest Service, in coordination with FWP and after review by USFWS, would establish and maintain priorities for potential mitigation lands within and outside the recovery zone. Following the priority list is required. If necessary, MMC would coordinate with KNF, FWP and USFWS to prioritize replacement habitat lands and priority linkage zones and modify priorities as needed. The Forest Service would ensure that the specified acres of mitigation properties are managed for grizzly bear habitat in perpetuity. Costs of processing mitigation lands would be funded by MMC.

First choice for replacement habitat required for habitat physically lost would be within the disturbed BMUs (5, 6, or 2 in order of priority) and within the north-south movement corridor. If adequate replacement acres were not available in those BMUs or north-south movement corridor, then lands may be located in other BMUs (4, 7, and 8) within the CYRZ. The first 500 acres of replacement habitat required for displacement would be within the north-south corridor within impacted BMUs (2, 5, or 6) due to evaluation adit displacement. The remaining 1,828 acres required for displacement in Alternative 3D-R could be in or outside the north-south corridor within the CYRZ (priority for 774 acres to be located in the north-south corridor) with up to half (914 acres) may be located in the identified linkage area). For both fee title or conservation easements, any habitat enhancement activities needed to improve the mitigation properties, such as the trail conversion, road access changes or removal of buildings and debris, would be planned and funded prior to construction and implemented as soon as feasible.

Fee-title properties must meet standards, requirements, and legal processes for federal acquisition, including, but not limited to:

- be approved by the Office of General Counsel;
- be a Warranty Deed conveyance;

- comply with Department of Justice standards;
- be free of hazardous materials, or develop an agreement among MOU signers as to appropriate remedy prior to acquisition;
- include all surface and subsurface rights including rights-of-way, mineral claims, and/or other easements, unless otherwise advised by the USFWS;
- be acquired in priority order. Lower priority acquisitions may be allowed, after approval of the Forest Service and when consistent with advice from the USFWS to ensure that such a property would contribute to meeting the requirements of the Biological Opinion;
- meet fair market appraised value, according to Forest Service appraisal processes, as approved by the Comprehensive Grizzly Bear Management Plan (see *Plan Management* section, p. 207). Advance approval by the Forest Service, after consultation with the USFWS regarding the ability of the proposed lands to meet the requirements of the Biological Opinion, is required; and
- be acquired, recorded and transferred prior to agency approval to proceed with the associated phase of the mine, with total acquisitions completed prior to the Construction Phase of the mine.

Conservation easements must include language approved in the Comprehensive Grizzly Bear Management Plan (see *Plan Management* section, p. 207) and meet standards, requirements and legal processes for federal acquisition including, but not limited to:

- be approved by the Office of General Counsel;
- be an attachment to the Warranty Deed;
- comply with Department of Justice standards;
- include all surface and subsurface rights including rights-of-way, mineral claims, and/or other easements, unless otherwise advised by the USFWS;
- meet fair market appraised value, according to Forest Service appraisal processes, as approved by the Comprehensive Grizzly Bear Management Plan (see *Plan Management* section, p. 207), if the affected parcels were consistent with advice from the USFWS as being important.
- be based on consultation, current priority ratings (including grizzly bear credit units as described by Kasworm *et al.* 2013b) and other criteria as established by this plan;
- be acquired and recorded prior to agency approval to proceed with the associated phase of the mine, with all mitigation habitat acquired and recorded prior to the Construction Phase of the mine, except for the mitigation habitat associated with the effects of the Rock Lake ventilation adit (about 1 acre). Mitigation habitat for the ventilation adit would be acquired prior to agency approval to proceed with development of the Rock Lake ventilation adit, should it be necessary.

Table 30. Grizzly Bear Habitat Physically Lost and Grizzly Bear Habitat with Increased and/or New Displacement and Required Replacement Habitat Compensation Acreage.

Alternative	Habitat Physically Lost[1]		Required Habitat Compensation for Displacement Effects[2, 5]							Total Required Habitat Replacement for Both Habitat Physically Lost and Displacement Effects (acre)
	Grizzly Bear Habitat Physically Lost (acre)	Required Habitat Replacement Prior To Construction Phase (acre)[1]	Displacement Effects Evaluation Phase[5] (acre)			Displacement Effects Construction Phase[4, 5] (acre)			Total Required Habitat Replacement for Mitigation of Displacement (acre)[2, 6]	
			BMU 2	BMU 5[3]	BMU 6	BMU 2	BMU 5[4]	BMU 6		
3C-R	1,560	3,120	0	500	0	119	1,674	0	2,293	5,413
3D-R	1,567	3,134	0	500	0	119	1,674	0	2,293	5,427
3E-R	1,562	3,124	0	500	0	119	1,674	0	2,293	5,417
4C-R	1,919	3,838	0	500	0	120	1,719	0	2,339	6,211
4D-R	1,926	3,852	0	500	0	120	1,719	0	2,339	6,225
4E-R	1,921	3,842	0	500	0	120	1,719	0	2,339	6,215

[1]Requires conservation easement or acquisition; mitigation requirement for habitat physically lost is shown at 2 to 1 ratio.

[2] Requires conservation easement or acquisition; mitigation requirement for habitat affected by displacement is shown at 1 to 1 ratio.

[3]Priority is 500 acres of replacement habitat within the north-south corridor, although displacement actually occurs on 468 acres within north-south corridor (includes 5-acre Rock Creek Meadows parcel) and 32 acres outside of north-south corridor

[4]Priority for Alternatives 3C-R, 3D-R, and 3E-R is for 776 acres within north-south corridor, and the remaining 898 acres following the priority list developed by the FS/USFWS/FWP; priority for Alternatives 4C-R, 4D-R, and 4E-R would be decided by the FS/USFWS/FWP.

[5]The Final EIS displacement analysis is in ERO Resources Corp. 2015a.

[6]Does not include potential displacement due to helicopter use as that impact would be minimized with a timing restriction.

Source: ERO Resources Corp. 2015a.

Measures to Address Habitat Constriction and Fragmentation within the North-south Movement Corridor

Prior to Forest Service approval to initiate the Evaluation Phase, MMC would secure or protect through conservation easement, including motorized route access changes, or acquisition in fee with conveyance of fee or perpetual conservation easement to the Forest Service or private conservation organization independent of MMC from development (including but not limited to housing, motorized access) and use (timber harvest, grazing, and mining) about 5 acres of replacement habitat near Rock Creek Meadows (NW ¼ Section 6, Township 26N, Range 31 West) that would enhance the north to south habitat corridor in the Cabinet Mountains. The property is located in the East Fork Rock Creek drainage and is accessed by motorized trail #935. These 5 acres contribute toward the 500 acres replacement acres required for displacement.

Prior to Forest Service approval to initiate the Construction Phase, MMC would provide funding for the Forest Service to create core habitat for grizzly bear along trail #935 (Table 28). This would include but is not limited to: replacement of the gate at the trailhead with an earthen barrier, and conversion of motorized trail tread to foot traffic tread conditions where necessary. This measure has a net result of creating 1,065 acres of core habitat. In addition, 288 acres of core created prior to the Evaluation Phase through access changes in NFS roads #2316 and #6702 (Table 28) contribute to this measure. The net result is widening of the main constriction area from about 0.9 miles to 3.4 miles.

Prior to Forest Service approval to initiate the Construction Phase, MMC would provide funding for bear monitoring in the area south of Libby between the CYE and Northern Continental Divide Ecosystem as identified by USFWS. The linkage identification work along US 2 would involve 3 years of monitoring movements of grizzly and black bears along the highway to identify movement patterns and key movement sites. Funding would cover aerial flights for 2 hours per week, 30 weeks per year for 3 years, salary for two seasonal worker for 6 months per year for 3 years, and 15 GPS collars and collar rebuilds each year for 3 years. Funding would supplement ongoing research and monitoring activities in the CYE, would be conducted or coordinated by the USFWS' grizzly bear researcher in Libby or the equivalent, and would focus on grizzly bears in the Cabinet Mountains. Other monitoring methods may be considered if approved by the Oversight Committee.

Measures to Reduce Effects in Grizzly Bear Outside the Recovery Zone (BORZ) Reoccurring Use Areas

MMC would fund and the KNF would implement year-long road access changes to nine roads (4776A, 4776B, 4776C, 4776F, 4778C, 6205D, 6209E, 6787B and 14442) that would reduce open and total road miles within the Cabinet Face BORZ (see Table 28, Table 29 and Figure 35). These changes would reduce year-long open roads within the BORZ by 11.5 miles and total roads by 12.8 miles. Seasonally open roads within the BORZ would decrease by an 0.9 miles during the spring use period April 1 to June 15. The KNF would change the status of new transmission line roads on National Forest System lands to intermittent stored service after line installation was completed and would retain that status throughout operations. Intermittent stored service is discussed in section 2.9.4.2, *Access Road Construction and Use*. Some of these road access changes would occur within the Cabinet Face BORZ and would improve grizzly bear habitat.

Impacts from the proposed activities on grizzly bears in the BORZ and on adjacent private and State lands would also be mitigated through measures, such as funding for grizzly bear personnel, education and outreach, bear-resistant containers, fencing and electrification, and grizzly bear monitoring.

Plan Management

Prior to initiating the Evaluation Phase, the Forest Service, DEQ, FWP and MMC would participate in the development of a MOU, while only the Forest Service, DEQ, and FWP would be signers on the MOU. The MOU would establish roles, responsibilities, and time lines of an Oversight Committee comprised of members of the Forest Service, FWP, and other parties deemed appropriate by the parties named. The USFWS would be an ex-officio, non-voting member of the Oversight Committee, with only advisory responsibilities.

The Oversight Committee would be responsible for the development of a Comprehensive Grizzly Bear Management Plan and its implementation. MMC would have a participating role on the Oversight Committee. The Comprehensive Grizzly Bear Management Plan would focus on the Cabinet portion of the CYE and would fully include all provisions of the mitigation plan for grizzly bears, except where superseded by the USFWS' Biological Opinion. It also would include provisions for adaptive management. The plan would be developed in detail by the parties to ensure that human access to grizzly bear habitat, grizzly bear mortality, and habitat fragmentation would be minimized and that grizzly bear habitat quality would be maintained or improved. Advice and comments on the plan from the USFWS would be requested and fully considered, including advice on whether the plan would meet the requirements of the Biological Opinion. The Oversight Committee, led by the Forest Service, would assume responsibility for coordinating various aspects of the Comprehensive Grizzly Bear Management Plan/Grizzly Bear Mitigation Plan; maintaining effective communication, between parties, and integrating principles of adaptive management.

Prior to Forest Service approval to initiate the Evaluation Phase, MMC would establish a trust fund and/or post a bond, to adequately fund the mitigation plan implementation costs. The amount in the fund or posted in a bond would be commensurate with projected work and associated required mitigation items by phase The Oversight Committee would determine the amount of trust fund deposits, to be made in 5-year increments over the life of the mine. If implementation costs prior/or during either evaluation or Construction Phases exceeded the amount deposited in the trust fund/and or bond, MMC would contribute additional funds to fully implement those actions in a timely manner (as determined by the KNF in consultation with the USFWS). The amount in the fund or posted in a bond would be commensurate with projected work and associated required mitigation items by phase.

Prior to Forest Service approval to initiate the Construction Phase, MMC would contribute funding to support monitoring of bear movements and population status for native Cabinet Mountain bears as well as grizzly bears trans-located into the Cabinet Mountains to confirm the effectiveness of mitigation measures. The Forest Service would ensure that adequate funding, provided by MMC, was available to monitor bear movements and use of the Cabinet Mountains to confirm the effective implementation of mitigation measures. Information gained would be useful in determining whether the mitigation plan was working as intended.

2.5.7.4.2 Canada Lynx

Prior to Forest Service approval to initiate the Construction Phase, MMC would fund habitat enhancement on lynx stem exclusion habitat to mitigate for the physical loss of suitable lynx habitat due to the construction of project facilities and transmission line. Enhancement would be at a 2:1 ratio (2 acres treated for every acre lost). Impacts on lynx habitat and required habitat enhancement are shown in Table 31. Selected stands with poorly-developed understories that do not currently provide winter snowshoe hare habitat would be thinned to allow sun to reach understory vegetation and accelerate development of the dense, horizontal vegetation favored by snowshoe hare. Habitat enhancement work would be done by Forest Service personnel or by others under the direction of the Forest Service. Field verification with snowshoe hare horizontal cover surveys would be conducted before any treatment occurred.

Remote monitoring is difficult and impractical, and new off-road use can easily be monitored from the access roads. To address Northern Rockies Lynx Management guideline HU G4, Forest Service personnel would monitor new snow compaction activities (such as snowmobiling) in the project area and take appropriate action if compaction monitoring identified increased predator access to new areas.

Table 31. Impacts on Lynx Habitat and Habitat Enhancement Requirements.

Agencies' Alternative	Lynx Habitat Impacted (acre)	Required Habitat Enhancement (acre)
3C-R	218	436
3D-R	263	526
3E-R	242	484
4C-R	145	290
4D-R	190	380
4E-R	169	338

Final EIS mitigation requirements based on effects shown in Table 240.

2.5.7.4.3 Gray Wolf

If a wolf den or rendezvous site was located in or near the project facilities by FWP wolf monitoring personnel, MMC would provide funding for FWP personnel to implement adverse conditioning techniques before wolves concentrate their activity around the den site (in early to mid-March) to discourage use of the den. This would occur in the spring before the expected start-up of construction activities. Discouraging use before denning starts would give wolves time to excavate an alternate den site at a safer, more secluded location.

2.5.7.4.4 Key Habitats

Mitigation common to both the mine and transmission line alternatives is discussed in the following sections. Wildlife mitigation specific to the transmission line is discussed in section 2.9.6, *Wildlife Mitigation Measures*.

Snags (Cavity Habitat)

MMC would leave snags within the disturbance area of the mine Alternatives 3 or 4, or the clearing width of transmission line Alternative C-R, D-R, or E-R, unless required to be removed for safety or operational reasons. This mitigation would be incorporated into the Vegetation Removal and Disposition Plan (section 2.5.2.6.2, *Vegetation Removal and Disposition Plan*).

2.5.7.4.5 Mountain Goat

MMC would fund surveys to monitor mountain goats to examine response to mine-related impacts. The surveys would be integrated into the current monitoring effort of the FWP. Aerial surveys would be conducted three times annually (winter-late spring-fall) by the FWP along the east front of the Cabinet Mountains from the Bear Creek drainage south to the West Fisher Creek drainage. Surveys would be conducted for 2 consecutive years before construction, and every year during construction activities. Survey results would be analyzed by the KNF, in cooperation with the FWP, at the end of the construction period to determine the appropriate level and type of survey work needed during the Operations Phase. If the agencies determined that construction disturbance were significantly affecting goat populations, MMC would develop, fund, and implement mitigation measures to reduce the impacts of mine disturbance. Surveys would be conducted using the current protocol of the FWP. Currently, the FWP conducts one aerial survey of the east Cabinet Mountains every other year. This additional level of monitoring would provide information on the status of mountain goat use adjacent to the project area, and potential effects of the project.

MMC would not conduct any blasting at the entrance to any adit portals during May 15 to June 15 to avoid disturbance to the potential goat kidding area on Shaw Mountain.

2.5.7.4.6 Migratory Birds

MMC would coordinate with the KNF and Regional bird monitoring partnership group to fund monitoring of landbird populations as part of the Forest Service Regional effort of the “Integrated Monitoring in Bird Conservation Regions” (IMBCR). The KNF is located with the Northern Rockies Bird Conservation Region 10 (BCR 10), which is characterized by high-elevation mountain ranges with mixed conifer forests and intermountain regions dominated by sagebrush steppe and grasslands (Partners in Flight 2000). BCRs approximate an eco-province, and are the scale recommended by Partners in Flight for monitoring. Across the KNF, transects were identified in 2010, with at least 10 transects monitored each year. Two of these 10 annually monitored transects are located within the Crazy and Silverfish PSUs.

Prior to the Evaluation Phase, and continuing for the life of the mine, MMC would coordinate with the KNF and Forest Service Region 1 bird monitoring specialist to fund and initiate annual monitoring of up to 12 IMBCR transects; up to eight located within a 1 mile influence zone of the proposed facilities or transmission lines (MT-BCR10-K078; MT-BCR10-KO271; MT-BCR10-KO102; MT-BCR10-KR53; MT-BCR10-KR229; MT-BCR10-KR277; MT-BCR10-KO138 if transmission line Alternative C-R was selected, and MT-BCR10-KR133 located adjacent to the private property at Rock Lake where a ventilation adit would be built), and an additional four transects located outside of the facilities and transmission line influence zones for comparison with the influence zone transects.

2.5.7.5 Cultural Resources

All mine and transmission line alternatives would require additional cultural resource inventory to satisfy requirements of Section 106 under the NHPA and 22-3, MCA. Additional survey would be conducted in all previously undisturbed areas where surface disturbance would occur in the alternative selected in the ROD. Such areas would include any surface disturbance required in mitigation plans described in Alternatives 3 or 4, such as culvert replacement and other compensatory wetland mitigation sites. The number of cultural resources that would require mitigation may increase pending the result of these additional inventory efforts. The appropriate type of mitigation would depend on the nature of the cultural resource involved and would ultimately be determined during consultation between MMC, the KNF, and Montana SHPO. Any mitigation plan for cultural resources would be developed by MMC and approved by the KNF in consultation with the Montana SHPO under the project-specific Programmatic Agreement, and would include consulting Confederated Salish and Kootenai Tribes and the Kootenai Tribe of Idaho (Tribes), if affected cultural resources were of cultural significance.

Mitigation could include data recovery (excavation) of prehistoric archaeological sites, a Historic American Building Survey (HABS) for standing structures, or Historic American Engineering Record (HAER) for built resources such as mines, roads, and trails. For landscape-level resources such as the Libby Mining District, the USDI National Park Service's (NPS) Cultural Landscapes Program would be implemented. Mitigation also would include monitoring during ground disturbing activities when the subsurface spatial extent of the resource is unknown or because of the fragility of the resource and its proximity to the activity. Table 83 and Table 84 lists potential mitigation measures for known resources in the analysis area.

The Tribes would be afforded the opportunity to monitor any ground disturbing activities associated with all agency mitigated mine and transmission line alternatives. Section C.3, *Cultural Resources* of Appendix C discusses monitoring requirements.

2.6 Alternative 4—Agency Mitigated Little Cherry Creek Impoundment Alternative

Alternative 4 would be similar to Alternative 3, but would have modifications to MMC's proposed Little Cherry Creek Tailings Impoundment as part of the alternative. All other modifications and mitigations described in Alternative 3, other than those associated with the Poorman Tailings Impoundment Site, would be part of Alternative 4. As in Alternative 3, the Libby Adit evaluation program would be the initial phase of the project and would be completed before construction of any other project facility.

The final design process for Alternative 3 would be used in Alternative 4. Although more subsurface hydrogeologic data are available for the Little Cherry Creek Tailings Impoundment Site, additional data would be needed to implement the agencies' mitigation measures at the Little Cherry Creek Site. Data to be collected would include an assessment of artesian pressures and their potential influence on impoundment stability, an assessment of a subsurface bedrock ridge between Little Cherry Creek and the effect it may have on pumpback well performance, aquifer pumping tests to refine the impoundment groundwater model and update the pumpback well design, and site geology to identify conditions such as preferential pathways that may influence seepage collection system, the pumpback well system, or impoundment stability. The pumpback well system would be designed and operated to minimize effects on wetlands and other waters of the U.S. Technical review of the final tailings facility design would be made by a TAG described in Alternative 3.

In Alternative 4, MMC would use the Libby Plant Site between Libby and Ramsey creeks, construct two additional adits in upper Libby Creek, and use the Water Treatment Plant for treatment and disposal of water instead of the LAD Areas, as in Alternative 3 (Figure 36). In addition to the modifications from Alternative 3, MMC would modify the proposed Little Cherry Creek Tailings Impoundment Site operating permit and disturbance areas to minimize effects on RHCAs (Issue 3) and old growth (Issue 6) in the Little Cherry Creek drainage. Borrow areas would be reconfigured to maximize disturbance within the impoundment footprint and to minimize disturbance of RHCAs (Issue 3), core grizzly bear habitat (Issue 5), and old growth (Issue 6). Waste rock would be stored temporarily within the impoundment footprint to address potential acid rock drainage and metal leaching (Issue 1) and water quality and quantity (Issue 2). The proposed permanent Little Cherry Creek Diversion Channel below the engineered upper section would be modified so it would adequately convey anticipated flows. At closure, surface water runoff would be directed toward the Little Cherry Creek Diversion Channel, and not Bear Creek, an important bull trout stream. The operating permit area would be 2,979 acres, and the disturbance area would be 1,924 acres. The operating permit area would encompass 433 acres of private land owned by MMC for the proposed mine and associated facilities. All other aspects of MMC's mine proposal would remain as described in Alternative 2, as modified by Alternative 3.

2.6.1 Issues Addressed

Alternative 4 would be similar to Alternative 3, but would have modifications to MMC's proposed Little Cherry Creek Tailings Impoundment as part of the alternative. All other modifications and mitigations described in Alternative 3, other than those associated with the Poorman Tailings Impoundment Site, would be part of Alternative 4. In Alternative 4, MMC would use the Libby Plant Site between Libby and Ramsey creeks, construct two additional adits in upper Libby Creek, and elimination of the LAD Areas, as in Alternative 3 (Figure 36). In addition to these modifications from Alternative 3, MMC would modify the proposed Little Cherry Creek Tailings Impoundment Site disturbance areas to avoid RHCAs (Issue 3) and old growth (Issue 6) in the Little Cherry Creek drainage. Borrow areas would be reconfigured to maximize disturbance within the impoundment footprint, and to minimize disturbance of RHCAs (Issue 3), core grizzly bear habitat (Issue 5), and old growth (Issue 6). Waste rock would be stored temporarily within the impoundment footprint to address acid rock drainage and metal leaching (Issue 1) and water quality and quantity (Issue 2). The proposed permanent Little Cherry Creek Diversion Channel below the engineered upper section would be modified to adequately convey anticipated flows. At closure, surface water runoff would be directed toward the Little Cherry Creek Diversion Channel, and not Bear Creek, an important bull trout stream. The issues addressed by the modifications and mitigation measures are summarized in Table 32. The modifications and proposed mitigations that comprise Alternative 4 are described in the following sections. All other aspects of MMC's mine proposal would remain as described in Alternative 2. Chapter 3 contains a more detailed discussion of how the modifications and mitigating measures would reduce or eliminate environmental impacts.

2.6.2 Evaluation Phase

The Libby Adit evaluation program, described as the Evaluation Phase in Alternative 3, would be implemented in the same manner as Alternative 3. Other modifications specific to Alternative 4 are described in the following sections. As in Alternative 3, MMC would submit a final Plan of Operations after final design, including all monitoring and mitigation plans, to the KNF for approval. MMC would submit a final application for an amendment of Operating Permit #00150, including all monitoring and mitigation plans, to the DEQ for approval.

Table 32. Response of Alternative 4 Modifications and Mitigations to Issues.

Key Issue	Mine Plan	Tailings Storage	Water Use and Manage-ment	Reclamation	Monitoring and Mitigation Plans
Issue 1-Acid Rock Drainage and Metal Leaching	✓		✓		
Issue 2-Water Quality and Quantity	✓	✓	✓	✓	✓
Issue 3-Aquatic Life	✓	✓	✓		✓
Issue 4-Visual Resources	✓	✓		✓	
Issue 5-Threatened or Endangered Wildlife Species	✓	✓		✓	✓
Issue 6-Wildlife	✓	✓		✓	✓
Issue 7-Wetlands and Streams	✓			✓	✓

2.6.3 Construction Phase

2.6.3.1 Permit and Disturbance Areas

All permitted disturbance area boundaries would be marked in the field with fence posts and signed to limit potential disturbance outside permitted disturbance areas. Permit areas would total 2,979 acres and the total disturbance area would be 1,924 acres (Table 33).

2.6.3.2 Modified Little Cherry Creek Tailings Impoundment

MMC would modify the proposed permit and disturbance areas to avoid old growth, core grizzly bear habitat, and RHCAs in the Little Cherry Creek drainage (Figure 21). To the extent feasible, MMC would maximize borrow areas within the footprint of the Little Cherry Creek tailings impoundment footprint (Figure 37) to avoid impacts on old growth in Borrow Areas B and C. Acceptable borrow on either side of Little Cherry Creek more than 200 feet from the upstream dam face would be used in Borrow Areas A and B. If suitable borrow were not available within the footprint of the impoundment, MMC would use Borrow Areas C and E, in that order. MMC would locate Borrow Area D south of the Little Cherry Creek impoundment between NFS roads #278 and #6212 to avoid core grizzly bear habitat (Figure 21). As in Alternative 3, unsuitable materials would be stockpiled and backfilled into borrow areas outside the impoundment footprint in borrow areas C and E. Waste rock would be managed in the same manner as Alternative 3.

Table 33. Mine Surface Area Disturbance and Operating Permit Areas, Alternative 4.

Facility	Disturbance Area (acres)	Permit Area (acres)
Existing Libby Adit	18	219
Upper Libby Adit	1	1
Rock Lake Ventilation Adit	1	1
Libby Plant Site and Adits	**76**	**172**
Modified Little Cherry Creek Tailings Impoundment Site and Surrounding Area	**1,619**	**2,215**
Little Cherry Creek Impoundment and Seepage Collection Pond	628	0
Borrow areas outside impoundment footprint	**252**	0
Soil stockpiles	53	0
Other potential disturbance (Diversion Channel, roads, storage areas)	**686**	0
LAD Area 1	**0**	**0**
LAD Area 2	**0**	**0**
Access Roads†		
Bear Creek Road (NFS road #278 from US 2 to Tailings Impoundment)	**79**	**10**
Tailings Impoundment permit area to Libby Plant Site (NFS roads 2317 and #4781, NFS road #278, NFS #6210 and new road)	**89**	**316**
Libby Plant Site to Libby Adit Site and Upper Libby Adit Site (NFS roads #6210 and #2316)	**41**	**44**
Total	**1,924**	**2,979**

†Disturbance area shown for roads excludes 33 feet of existing disturbance along roads.
Bolded values differ from Alternative 2.

NMC conducted geotechnical investigations at the Little Cherry Creek Impoundment Site between 1988 and 1990. NMC reported that bedrock is exposed in the Little Cherry Creek channel and bedrock extended 800 feet downstream of the proposed Seepage Collection Dam (Morrison-Knudsen Engineers, Inc. 1990). Groundwater modeling conducted of the Little Cherry Creek Impoundment Site for MMC (Klohn Crippen 2005) and independently verified by the lead agencies (USDA Forest Service 2008b) assumed that the fractured bedrock strata in the Little Cherry Creek drainage is the primary aquifer for groundwater flow at the site. In Alternative 4, MMC would conduct additional geotechnical work near the Seepage Collection Dam during final design and site the dam lower in the drainage if technically feasible.

In Alternative 4, MMC would use only Drainage 10 for diverted Little Cherry Creek and Drainage 5 would not be used. MMC would complete a hydraulic and hydrologic (H&H) analysis of the proposed runoff channel during final design, and submit it to the lead agencies and the Corps for approval. The H&H analysis would include a channel stability analysis and a sediment transport assessment. The channel would begin at the outlet of the engineered channel and would be designed to have the following characteristics:

- A constructed floodplain and terrace that would allow passage of the 100-year flow volume
- A stream portion of the diversion corridor constructed to meet the 2-year flow event volume and approximate the cross-section, profile, and channel materials of similar sized watersheds found in the project area
- Establishment of fish habitat similar to that currently provided by Little Cherry Creek to the extent feasible with the anticipated lower flows

Several mitigation measures would be implemented along the channel to ensure that erosion and sedimentation resulting from heavy rainfall and from high flow events would be minimized. These measures would include:

- The channel and floodplain would be constructed during low flow periods in late summer or early fall
- Floodplain and channel banks would be seeded with an agencies-approved seed mix immediately following construction
- A temporary biodegradable erosion control fabric would be installed along the channel banks, where needed, and on the floodplain immediately following seeding
- Structures of natural materials, which could include boulders or rock/log weirs or vanes, may be installed to protect streambanks where needed
- Alders would be planted along the channel banks at and above bankfull elevation following placement of the erosion control fabric at a density similar to what is currently present along Little Cherry Creek
- Coarse woody debris would be placed along the channel banks to increase surface roughness to reduce flow velocities

Flow in the diversion channels would increase substantially during two periods, one during the construction period after the Diversion Dam was constructed and flow from upper Little Cherry Creek was diverted into the channel, and one after closure when runoff from the impoundment surface and South Saddle Dam flowed into the channel. MMC would complete habitat surveys in the diverted Little Cherry Creek every 2 years until the reclamation bond had been released. The survey would document distance, elevation, macrohabitat type, pool dimensions, large woody debris, substrate, valley slope and width, and riparian characteristics continuously along the entire length of the creek.

The agencies anticipate the channel would require long-term maintenance; MMC would fund a long-term maintenance account to pay for such maintenance. The decision regarding long-term maintenance funded would be made following closure and before bond release, after runoff from the tailings impoundment flowed into the Diversion Channel. In Alternative 4, soil would be salvaged in two lifts at the Little Cherry Creek Diversion Channel. Soils salvaged from the Diversion Channel would be used as replaced soil on the created floodplain and streambanks of the lower diversion channels and possibly at other disturbances.

In Alternative 2, MMC would build temporary diversion ditches to control run-on within the impoundment site to minimize run-on into the tailings impoundment after Year 2 of operations. As the impoundment filled, new ditches would be excavated farther uphill. Because of the difficulty in routing the run-on into the Little Cherry Creek Diversion Channel, MMC in Alternative 4 would build a permanent diversion ditch between the North Saddle Dam and the Little Cherry Creek Diversion Channel, directing flow either into the Diversion Channel, or Bear Creek (Figure 37). The ditch would be integrated into the surface water management plan of the tailings impoundment at final closure.

The tailings facility design would be finalized as additional site information is obtained during the final design process. The artesian pressures and their potential influence on the stability of the tailings dam would be evaluated during final design and would be based on additional data collection of the impoundment site. A 3D groundwater model would be used to develop a design for a pumpback well system, with a goal of minimizing indirect effects on wetlands and other waters of the U.S. Technical review of the final design would be the same as Alternative 3.

2.6.3.3 Transportation and Access

In Alternative 4, MMC would use the same roads as Alternative 2 for main access during the Libby Adit evaluation program and during operations. MMC would continue to plow the Libby Creek Road (NFS road #231) and the Upper Libby Creek Road (NFS road #2316) year-round during the 2-year evaluation program and the 1-year period during reconstruction of the Bear Creek Road. Road-related mitigation measures described in Alternative 3, such as the Road Management Plan, Transportation Plan, and traffic impact study, would be implemented.

US 2 improvements, reconstruction of the Bear Creek Road (NFS road #278), from US 2 to the Bear Creek bridge, Bear Creek bridge replacement, culvert replacement on NFS roads #231 and #2316, and new Libby Plant Access Road parallel to the existing Bear Creek Road would be the same as Alternative 3. Methods to accommodate joint public and mine haul traffic would be determined by MMC and the KNF during final design. Once oversized haul vehicles were no longer needed between the impoundment and plant site, the segment of the Bear Creek Road parallel to the new Libby Plant Access Road would be decommissioned, and the two culverts crossing Poorman Creek would be removed.

MMC would surface the existing Bear Creek Road (NFS road #278) from the new Libby Plant Access Road to the Libby Creek Road (NFS road #231) with 6 inches of gravel 16 feet wide (Figure 38). This surfacing would ensure the safe transition from the improved section north of the new Libby Plant Access Road and the unimproved section to the Libby Creek Road.

The following sections describe road use and public access along the main access road (Bear Creek Road (NFS road #278) and each proposed permit area. With the exception of the Bear Creek Road in the impoundment permit area, all open roads would be gated and restricted to mine traffic only. Non-motorized public access would be restricted within each permit area by signage at the permit area boundary. Table 34 lists those roads with a change in road status in Alternative 4; these roads are shown on Figure 38. MMC would be responsible for maintaining all existing or new roads and stream crossings used by the mine.

2.6.3.3.1 Little Cherry Creek Tailings Impoundment Area

Road use and access in the tailings impoundment area in Alternative 4 would be similar to Alternative 2. All roads in the operating permit area would be closed to all public access. Little

Cherry Loop Road (NFS road #6212) would be gated during operations and used for mine traffic only (Figure 38). The gates would be near the intersection with the Bear Creek Road on the north end and the tailings impoundment permit area boundary on the south end. NFS road #6212 would remain open to motorized access south of the proposed permit area boundary to the junction with Bear Creek Road. At the end of operations, gates on these roads would be removed and the roads would be reopened to motorized access. A segment of the Little Cherry Loop Road (NFS road #6212) would be covered by the tailings impoundment and would not provide a loop between the Bear Creek Road. With the exception the Cherry Ridge Road (NFS road #6201), other currently gated or barriered roads proposed for use in Alternative 2 in the tailings impoundment area would be used in Alternative 4.

2.6.3.3.2 Libby Plant Site, Libby Adit, and Upper Libby Adit

Access and road use in the Libby Plant Site, Libby Adit, and Upper Libby Adit in Alternative 4 would be the same as Alternative 3 (Figure 38 and Table 34). MMC would develop a parking area and trail as described in Alternative 3.

2.6.3.3.3 Ramsey Creek Drainage

Access and road use on NFS road #4781 up Ramsey Creek and NFS road #6701 would change from gated to barriered to provide grizzly bear mitigation. A short segment of the Ramsey Creek Road would be decommissioned (Figure 38).

Table 34. Proposed Change in Road Status for Roads used during Construction, Operations and Closure in Alternative 4.

Road #	Road Name	Location	Existing Status	Length (miles)	Proposed Status
1408	Libby Creek Bottom	Tailings Impoundment	Open	0.9	Gated, mine traffic only
2316	Upper Libby Creek	Libby Adit Site	Open	2.2	Mixed mine haul and public traffic
2316	Upper Libby Creek	Libby Adit Site	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.3	Gated, mine traffic only
2316	Upper Libby Creek	Libby Adit Site	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.7	Trail
2317	Poorman Creek	Up Poorman Creek	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	1.8	Trail
2317	Poorman Creek	Up Poorman Creek	Open	0.3	Mixed mine haul and public traffic
2317B	Poorman Creek B	Up Poorman Creek	Impassable, open to snow vehicles 12/1-4/30	0.5	Trail
278L	Bear Creek L	Tailings Impoundment	Barriered year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.3	Gated, mine traffic only
4781	Ramsey Creek	Up Ramsey Creek	Open	0.7	Gated, mine traffic only
4781	Ramsey Creek	Up Ramsey Creek	Open	0.5	Decommission
4781	Ramsey Creek	Up Ramsey Creek	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	2.2	Trail

Road #	Road Name	Location	Existing Status	Length (miles)	Proposed Status
5181	L Cherry Loop H Cowpath	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.5	Gated, mine traffic only
5181A	L Cherry Loop H Cowpath A	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.2	Gated, mine traffic only
5182	Little Cherry Bear	Tailings Impoundment	Open	1.6	Gated, mine traffic only
5183	Little Cherry View	Tailings Impoundment	Impassable, open to snow vehicles 12/1-4/30	0.5	Gated, mine traffic only
5184	Bear-Little Cherry	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.7	Gated, mine traffic only
5184A	Bear-Little Cherry A	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.2	Gated, mine traffic only
5185	S Bear-Little Cherry	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.9	Gated, mine traffic only
5185A	S Bear-Little Cherry A	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.3	Gated, mine traffic only
6210	Libby Ramsey	Libby Adit Access Road	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	2.1	Gated, mine traffic only
6210	Libby Ramsey	Libby Adit Access Road	Open	0.4	Gated, mine traffic only
6212	Little Cherry Loop	Tailings Impoundment	Open	3.7	Gated, mine traffic only
6212H	Little Cherry Loop H	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.6	Gated, mine traffic only
8749	Noranda Mine	Libby Adit Site	Private, gated	0.5	Gated, mine traffic only
8749A	Noranda Mine A	Libby Adit Site	Private, gated	0.2	Gated, mine traffic only
8838	Little Cherry MS 10377 8838	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.2	Gated, mine traffic only
8841	Little Cherry MS 10377 8841	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-4/30	1.8	Gated, mine traffic only
14403	Lower Ramsey	Libby Plant Site	Barriered year-long to motor vehicles, open to snow vehicles 12/1-4/30	0.4	Gated, mine traffic only

2.6.4 Operations Phase

2.6.4.1 Water Use and Management

2.6.4.1.1 Project Water Requirements

The water balance in Alternative 4 would be the same as the water balance in Alternative 2. Discharges would occur at the Water Treatment Plant during all phases. In Alternative 4, MMC would maintain MPDES permit MT0030279 at the Libby Adit Site and would seek approval for additional stormwater outfalls. When the 3D model was updated after the Evaluation Phase, MMC would re-evaluate diversions from Ramsey Creek. If MMC's Ramsey Creek diversions may adversely affect this right on Ramsey Creek during any mining phase, MMC would develop a plan during final design to convey treated water from the Water Treatment Plant to a location upstream of this right's point of diversion. Discharge of treated water to Ramsey Creek would require a new outfall in the MPDES permit. Modifications to the Water Treatment Plant described in Alternative 3, such as developing nutrient treatment capability, and increasing treatment capacity, would be implemented in Alternative 4.

2.6.4.1.2 Water Rights

For all mine alternatives, MMC would acquire beneficial water use permits from the DNRC for any new surface water and groundwater appropriation to use water for mining purposes. MMC applied for new surface water and groundwater rights using the project components of Alternative 3 (MMC 2012a). These applications are discussed in section 2.4.3.4.2, *Water Rights.* The rate and points of diversion for each right in Alternative 4 would vary slightly from those described in Alternative 3 (Figure 37).

2.6.5 Closure and Post-Closure Phases

2.6.5.1 Closure and Reclamation of Project Facilities

Short- and long-term reclamation objectives would remain the same as for Alternative 2. These objectives would be achieved through interim and final reclamation of all disturbed sites as described for Alternative 2, with additional mitigation described for Alternative 3 and implementing all erosion- and sediment-control measures described for Alternative 2. The modifications described in section 2.5.5.2, *Revegetation* would be implemented for Alternative 4.

2.6.5.1.1 Little Cherry Creek Tailings Impoundment

Before closure, MMC would manage tailings deposition and beaches to ensure that the final tailings surface would slope southwest toward the Diversion Dam (Figure 39). A spillway in the dam would convey surface flow for the final impoundment surface to a diversion ditch and then to the Diversion Channel. Minor modifications to the design of the Diversion Channel, Diversion Dam, and North Saddle Dam would be completed during final design to incorporate this modification.

As in Alternative 3, MMC would survey tailings settlement at closure on a 100-foot by 100-foot grid to document settlement. The area would be resurveyed after borrow material used for fill was placed to create final reclamation gradients, and again after soil placement to ensure runoff gradients were achieved and soil thicknesses were met. Rocky borrow and geotextile would be needed for construction equipment to work on the tailings surface. In Alternative 2, MMC would place riprap on the dam crest and uppermost part of the dam face to minimize potential gully formation at the tailings dam crest. In Alternative 4, MMC would use rocky borrow from within the disturbance area to provide erosion protection. Borrow material volumes would be determined during final design.

MMC would develop a design to recontour faces of the tailings impoundment dams to more closely blend with the surrounding landscape. Sand deposition would be varied during final cycloning and placement of sand on the dams. This design would incorporate additional rocky borrow at selected locations on the dam face and use benches in some locations. Islands of trees and shrubs would be planted in the rocky areas. The seed mixture on the dam face would vary to reduce uniformity of the revegetated dam.

2.6.5.1.2 Roads

Reclamation of the Bear Creek Road, new roads, and all new bridges used in Alternative 4 would be the same as Alternative 2, except for the following changes. In Alternative 4, the two gates on the Little Cherry Creek Loop Road (NFS road #6212) (near the intersection of the Bear Creek Road on the north side and at the permit area boundary on the south side) would remain in place. Motorized access on Little Cherry Creek Loop Road (NFS road #6212), NFS road #5182, and NFS road #8838 would be restricted to administrative use. All currently gated or barriered roads used in Alternative 4 would be decommissioned by using a variety of treatment methods to achieve desired conditions for other resources.

2.6.6 Monitoring Plans

Operational and post-operational monitoring programs described for Alternative 3 in Appendix C would be implemented for Alternative 4, with the exceptions described below. Plans not modified in Alternative 3 would be the same as Alternative 2. A number of springs and wetlands occur downstream of the proposed Little Cherry Creek Tailings Impoundment. The GDE monitoring would be revised slightly from that proposed in Alternative 3.

2.6.6.1 Groundwater Dependent Ecosystem Inventory and Monitoring

2.6.6.1.1 Spring and Seep Monitoring

The monitoring of GDEs would be completed in Alternative 4, as described in Alternative 3. In addition, flow from springs SP-02, SP-10, S-12, SP-14, SP-15, and SP-29 (Figure 40) would be measured twice in Alternative 4, once in early June when the area was initially accessible, and once between mid-August and mid-September 1 year before construction began. (Springs SP-02 and SP-15 would not be monitored if they were covered by impoundment facilities.) Samples from these springs would be collected 1 year before construction began and analyzed for total dissolved solids, nitrate + nitrite, sulfate, antimony, and manganese. Sampling would be repeated every 2 years until tailings disposal ceased. At each spring, a vegetation survey would be completed 1 year before construction began; the survey and establishment of a prevalence index to monitor wetland vegetation (Appendix C) would be the same as Alternative 3.

2.6.6.1.2 Monitoring of Wetlands Downstream of Tailings Impoundment

In Alternative 2, MMC would monitor unspecified wetlands downstream of the tailings impoundment annually for the first 5 years of mine operation. In Alternative 4, MMC would monitor three wetlands if not filled by project activities: LCC-24, LCC-25, and LCC-39 (Figure 40). MMC would use the procedures established for monitoring of wetland mitigation sites described in Alternative 3 to assess vegetation characteristics and establish a prevalence index. The index would be used to assess changes in vegetation composition. Samples from any standing water in these three wetlands would be collected in mid-summer 1 year before construction began and analyzed for total dissolved solids, nitrate + nitrite, sulfate, antimony, and manganese. Sampling would be repeated in mid-summer every 2 years until tailings disposal ceased.

2.6.7 Mitigation Plans

In Alternative 4, the Wetland Mitigation Plan and the Fisheries Mitigation Plan would differ from that proposed in Alternative 2. The proposed plans for wetlands and fisheries are discussed below. The same general components in the Bull Trout, Wildlife, and Cultural Resources Mitigation Plans of Alternative 3 would be incorporated into Alternative 4. The Hard Rock Mining Impact Plan would be the same as Alternative 2.

2.6.7.1 Wetland Mitigation

2.6.7.1.1 Proposed Sites

In Alternative 2, MMC proposed to mitigate affected forested and herbaceous wetlands at a 2:1 ratio, and herbaceous/shrub wetlands at a 1:1 ratio. MMC's proposed mitigation sites are two sites in the Little Cherry Creek drainage, the Little Cherry Creek Diversion Channel, three sites between Little Cherry and Poorman creeks (in Alternative 3, the Poorman Impoundment Site), one site east of the LAD Area 1, and one site at the Libby Creek Recreational Gold Panning Area.

In Alternative 4, possible wetland mitigation sites would include 2.2 acres at the North Little Cherry Creek site; 27.1 acres at the South Poorman, North Poorman, and Poorman Weather Station sites; and 6.7 acres at the Ramsey Creek site (Figure 33). The Poorman Weather Station site was not included in NMC's 1993 404 permit. According to MMC (MMC 2008), the Poorman Weather Station is not within an area of existing wetlands and has no well-defined drainage. Subsequent to MMC's 2008 updated Plan of Operations submittal, surveys by Kline Environmental Research (2012) found that the site was adjacent a tributary to Libby Creek, segments of which were jurisdictional (Figure 33). Wetlands created at this site may not be jurisdictional if the site did not have a hydrologic connection to a jurisdictional water. If jurisdictional wetlands could not be created at the site, additional mitigation sites would be developed. Six months (April–September) of groundwater monitoring at the mitigation sites would be implemented at sites without any hydrologic data.

According to MMC (MMC 2008), the Ramsey Creek mitigation site is part of an existing man-made wetland area. This description is not consistent with NMC's 1993 404 permit. The Ramsey Creek mitigation site is described in NMC's 1993 404 permit as being located on a gently sloping clearcut, about 20 feet in elevation above Ramsey Creek During periods of runoff, water flows intermittently through the site via a diffuse, poorly defined system of shallow drainages. The natural hydrology of the site has been altered by construction of a logging road through the upper portion of the site. MMC would conduct a wetland delineation of the proposed area during final design to ensure the wetland is jurisdictional. If the site were appropriate for mitigation of effects on jurisdictional wetlands, the site would be expanded by spreading out streamflow that would provide hydrologic support.

In Alternative 4, the site at Little Cherry Creek not specifically identified by MMC in Alternative 2 would not be used. At this site, MMC would use groundwater collected from beneath the tailings impoundment to create and maintain wetlands. Groundwater beneath the tailings impoundment may be mixed with tailings water, and contain elevated nutrients and metal concentrations. Use of groundwater beneath the tailings impoundment would not provide hydrologic support after operations cease. The mitigation site at the Libby Creek Recreational Gold Panning Area was not part of the NMC's 1993 404 permit. Because of the proximity to high public use at the Recreational Gold Panning Area, it would not be used in Alternative 4.

MMC would implement the wetland rehabilitation and stream restoration at Swamp Creek, the culvert replacement on NFS road #278 at Poorman Creek, and culvert removal on lands acquired for grizzly bear mitigation. The discussion found on page 116 regarding mitigation requirements and on-site and off-site mitigation also applies to Alternative 4. Insufficient mitigation sites were identified to achieve the Corps' minimum ratios for effects on jurisdictional wetlands, and additional mitigation sites would be necessary if this alternative were permitted. MMC would implement the mitigation described for the Gravel Pit site in Alternative 3 for mitigation for isolated wetlands.

2.6.7.1.2 Monitoring of Wetland Mitigation Sites

Monitoring of mitigation sites would be the same as Alternative 3, except for wetlands downgradient of the tailings impoundment (see sections C.4 and C.10 in Appendix C).

2.6.7.2 Fisheries

2.6.7.2.1 Fish Loss in Little Cherry Creek Diversion

In Alternative 2, MMC proposed to implement the mitigation developed in 1993 to mitigate the loss of recreational fishing opportunity and the loss of fisheries production in Little Cherry Creek. The effects analysis and mitigation did not consider the likely need for a pumpback well system to prevent tailings seepage from reaching surface water. Flow in the diverted Little Cherry Creek would be substantially reduced during operations and closure, as the pumpback well system, as long as it operated, would likely eliminate very low flow in the diverted creek. The loss of available habitat in the diverted Little Cherry Creek would adversely affect the redband trout population in the diverted creek because the remaining habitat would not support the population at its current numbers, if at all. In Alternative 4, additional mitigation for fish loss described for Alternative 2 in section 2.4.6.2, *Fisheries* would be implemented. Projects to be implemented would follow the principals described for Alternative 2.

2.7 Alternative A—No Transmission Line

In this alternative, MMC would not build a 230-kV transmission line to provide power. The BPA would not tap the Noxon-Libby 230-kV transmission line nor would it build the Sedlak Park Substation. The environmental, social, and economic conditions described in Chapter 3 would continue, unaffected by the construction and operation of the transmission line. If the transmission line was not constructed, generators could be used to meet the electrical power requirements of the mine. The DEQ's approval of the Montanore Project, as permitted by DEQ Operating Permit #00150, would remain in effect. The DEQ's approval of revisions to DEQ Operating Permit #00150 (Minor Revisions 06-001, 06-002, and 08-001) also would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that did not affect National Forest System lands. The conditions under which the permitting lead agencies could select the No Action Alternative, or deny the transmission line certificate, are described in section 1.6, *Agency Roles, Responsibilities, and Decisions*.

2.8 Alternative B—MMC's Proposed Transmission Line (North Miller Creek Alignment Alternative)

2.8.1 Alignment and Structure Type

The Ramsey Plant Site's electrical service would be 230-kV, 3-phase, and 60-cycle, provided by a new, overhead transmission line. MMC would be responsible for funding construction of the transmission line, substation, and loop line that would connect the substation to the Noxon-Libby 230-kV transmission line. MMC's proposed transmission line alignment would be in the watersheds of the Fisher River, Miller Creek, an unnamed tributary to Miller Creek, Midas Creek, Libby Creek, and Ramsey Creek (Figure 41). The proposed alignment would head northwest from the substation for about 1 mile paralleling US 2, and then follow the Fisher River and US 2 north 3.3 miles. The alignment would then turn west and generally follow the Miller Creek drainage for 2.5 miles, and then turn northwest and traverse up a tributary to Miller Creek. The alignment would then cross into the upper Midas Creek drainage, and then down to Libby Creek. The alignment would cross the low ridge between Libby Creek and Ramsey Creek, and then generally follow Ramsey Creek to the Ramsey Plant Site. The maximum annual energy consumed by the project is estimated at 406,000 megawatts, using a peak demand of 50 megawatts.

The characteristics of MMC's proposed North Miller Creek Alignment Alternative and the lead agencies' three other transmission line alignment alternatives are summarized in Table 35. A comparison of the mitigation and modifications the agencies made to MMC's proposal is presented in Table 36. MMC's proposed alignment (Alternative B) would end at a substation at the Ramsey Plant Site; the lead agencies' alternatives (Alternatives C-R, D-R, and E-R) would end at a substation at the Libby Plant Site.

Estimated transmission line construction costs range from $7.3 million for Alternative B to $5.5 million for Alternative C-R. Cost estimates are based on preliminary design and material costs in 2012 (Table 35). High steel costs would make the steel monopoles proposed in Alternative B considerably more expensive than the wooden H-frame structures proposed in the other alternatives. The lower cost of wooden H-frame structures in Alternatives C-R, D-R, and E-R would offset the cost of helicopters to set structures and clear timber in these alternatives. Estimated mitigation costs of the agencies' alternatives are about $11 million.

2.8.2 Substation Equipment and Location

Two substations would be required. One substation would be used to tap the Noxon-Libby 230-kV transmission line and supply power to the mine site over a new 230-kV transmission line. BPA's proposed Sedlak Park Substation Site at the Noxon-Libby 230-kV transmission line is in an area known locally as Sedlak Park, 30 miles southeast of Libby on US 2 (Figure 42). At the Ramsey Plant Site, a second, 150-foot by 300-foot substation would be built (Figure 5) to distribute electricity through lower voltage lines to equipment in various locations at the Ramsey Plant Site, the Libby Adit Site, the Little Cherry Creek Tailings Impoundment site, and within the underground mine.

The BPA would design, construct, own, operate, and maintain the Sedlak Park Substation and loop line that would connect the substation to the Noxon-Libby 230-kV transmission line. MMC would be responsible for funding construction of the transmission line, substation, and loop line. The BPA is prohibited by law from directly serving the mine; Flathead Electrical Cooperative would be the retailer of power to the mine project. The proposed location of Sedlak Park Substation is common to the four transmission line alternatives. Sedlak Park Substation construction would require disturbing 2 acres. The substation would be near US 2 and require a short access road from US 2 (Figure 42). The access road from US 2 would be designed and constructed to MDT standards. The BPA would apply to the DEQ for authorization to discharge stormwater from the site during construction. The agencies anticipate the BPA would be eligible for coverage under the General Permit for Storm Water Discharges Associated with Construction Activity. The BPA also would develop a SWPPP for construction of the Sedlak Park Substation and loop line.

Table 35. Characteristics of Transmission Line Alignment Alternatives.

Characteristic	Alternative B – North Miller Creek	Alternative C-R – Modified North Miller Creek	Alternative D-R – Miller Creek	Alternative E-R – West Fisher Creek
Length (miles)[†] Steel Monopole Wooden monopole Wooden H-frame Total	 16.4 0.0 <u>0.0</u> 16.4	 0.0 0.0 <u>13.1</u> 13.1	 0.0 0.0 <u>13.7</u> 13.7	 0.0 0.5 <u>14.6</u> 15.1
Number of structures[‡]	108	80	91	104
Average span length (ft.)	799	862	793	767
Helicopter use				
Structure placement	Contractor's discretion	26 structures, primarily in Miller Creek and Midas Creek drainages	16 structures, primarily in Miller Creek and Howard Creek drainages	31 structures, primarily in West Fisher Creek and Howard Creek drainages
Vegetation clearing	Contractor's discretion	4.8 miles at selected locations; see Figure 44	2.5 miles at selected locations; see Figure 44	4.3 miles at selected locations; see Figure 44
Line stringing	Contractor's discretion	Yes, entire line	Yes, entire line	Yes, entire line
Annual inspection	Yes	Yes	Yes	Yes
Estimated cost in millions $[§]				
Construction	$7.3	$5.4	$5.4	$6.6
Mitigation	$3.9	$10.8	$10.8	$10.8

[†]Length is based on line termination at the Ramsey Plant Site in Alternative B and the Libby Plant Site in the other three alternatives.
[‡]Number and location of structures based on preliminary design and may change during final design. The lead agencies' analysis of MMC's preliminary design and structure locations indicates additional structures and access may be needed to avoid long spans.
[§]Estimated cost used reasonable assumptions regarding costs of construction materials, clearing, land acquisition, and engineering. Final cost could vary from those shown. Estimated construction cost by HDR Engineering, Inc. 2012; estimated mitigation cost by KNF (2015).

Table 36. Comparison of Mitigation in Transmission Line Alternatives.

Feature/Resource	Alternative B – North Miller Creek	Alternative C-R – Modified North Miller Creek	Alternative D-R – Miller Creek	Alternative E-R – West Fisher Creek
		New Access Road Management		
New roads on National Forest System Lands	Soiled and reseeded after construction; used as necessary for mainte-nance; decommissioned at closure	Placed in intermittent stored service after construction; used as necessary for maintenance; decommissioned at closure	Same as Alternative C-R	Same as Alternative C-R
New roads on Plum Creek lands	Soiled and reseeded after construction; gated and used as necessary for maintenance	Same as Alternative B	Same as Alternative B	Same as Alternative B
New roads on other private land	None	Soiled and reseeded after construction; gated and used as necessary for maintenance	Same as Alternative C-R	Same as Alternative C-R
		Vegetation Management		
Right of Way Width	100 feet; danger trees outside the right-of-way removed as necessary; analysis assumed 150-foot clearing width	150 feet; danger trees outside the right-of-way removed as necessary; analysis assumed 200-foot clearing width	Same as Alternative C-R	Same as Alternative C-R except for short section of monopoles with a 100-foot right-of-way
Vegetation Clearing	Vegetation removed	Prepare and implement Vegetation Clearing and Removal Plan; minimize heavy equipment use in RHCAs	Same as Alternative C-R	Same as Alternative C-R
Helicopter Use for Vegetation Clearing	At contractor's discretion	In areas adjacent to core grizzly bear habitat (4.8 miles)	Same as Alternative C-R (2.5 miles)	Same as Alternative C-R (4.3 miles)

Feature/Resource	Alternative B – North Miller Creek	Alternative C-R – Modified North Miller Creek	Alternative D-R – Miller Creek	Alternative E-R – West Fisher Creek
Seed Mixes	Interim and permanent seed mixes with native and introduced species	Permanent seed mix with native species only, if commercially available	Same as Alternative C-R	Same as Alternative C-R
Timber Production on Lands Covered by FWP Conservation Easement	Not proposed	Convey title or a conservation easement to FWP to 91 acres of private land adjacent to the easement; acquired lands or easements would be added to the existing conservation easement	Same as Alternative C-R	Same as Alternative C-R on 94 acres
Wildlife see Table 8 for additional mitigation for the mine				
Snags (Cavity Habitat)	Not specified	Leave snags in clearing area, unless required to be removed for safety reasons	Same as Alternative C-R	Same as Alternative C-R
Down Wood Habitat	Not specified	Leave up to 30 tons per acre of coarse woody debris within clearing area on National Forest System lands and State lands	Same as Alternative C-R	Same as Alternative C-R
Big Game	Construction would not occur during winter on big-game winter range (December 1 and April 30)	No transmission line construction or decommissioning in elk, white-tailed deer, or moose winter range between December 1 and April 30 unless approved by the agencies. No waiver of winter range timing restrictions would be approved on National Forest System or State trust lands where the grizzly bear mitigations would apply.	Same as Alternative C-R	Same as Alternative C-R

Feature/Resource	Alternative B – North Miller Creek	Alternative C-R – Modified North Miller Creek	Alternative D-R – Miller Creek	Alternative E-R – West Fisher Creek
Bald Eagle	Not specified	Either not clear vegetation or conduct construction activities during breeding season in bald eagle habitat or fund or conduct surveys to locate active nests in appropriate habitat. Follow timing restrictions in the Montana Bald Eagle Management Plan for any identified active nests. Construct transmission line according to recommendations outlined in Reducing Avian Collisions with Power Lines (APLIC 2012) and Suggested Practices for Raptor Protection on Power Lines (APLIC 2006)	Same as Alternative C-R	Same as Alternative C-R
Western Toad	Not specified	Retain shrub habitat in wetlands and riparian areas	Same as Alternative C-R	Same as Alternative C-R
Migratory Birds	Not specified	Fund or conduct monitoring of landbird populations annually on two, standard Region One monitoring transects within the Crazy and Silverfish PSUs. Construct transmission line according to recommendations outlined in Reducing Avian Collisions with Power Lines (APLIC 2012) and Suggested Practices for Raptor Protection on Power Lines (APLIC 2006)	Same as Alternative C-R	Same as Alternative C-R

Feature/Resource	Alternative B – North Miller Creek	Alternative C-R – Modified North Miller Creek	Alternative D-R – Miller Creek	Alternative E-R – West Fisher Creek
Grizzly Bear				
Road and Trail Access changes	See proposed road access changes in Table 8	See proposed road access changes in Table 8	Same as Alternative C-R	Same as Alternative C-R
Land Acquisition for Physical Disturbance	Acquire 68 acres; part of land acquisition described in Table 8	Secure or protect replacement grizzly bear habitat of 26 acres in the CYE	Secure or protect replacement grizzly bear habitat of 40 acres in the CYE	Secure or protect replacement grizzly bear habitat of 30 acres in the CYE
Timing Restriction for Short-term Displacement Effects on the Grizzly Bear	No motorized activity associated with construction from April 1 to June 15 within bear habitat in the Miller Creek and Midas Creek drainages	All activities on National Forest System and State trust lands for both construction seasons and during decommissioning of the transmission line between June 16 and October 14	Same as Alternative C-R	Same as Alternative C-R

The substation site would be fenced. The area surrounding the substation would be graveled and kept free of vegetation. No water would be required at the Sedlak Park Substation site, and toilet facilities would be self-contained. The Sedlak Park Substation would be designed to exclusively serve the mine. No additional lines have been proposed to enter or leave the Sedlak Park Substation.

2.8.3 Line and Road Construction Methods

The construction of the proposed transmission line would follow the sequence of: 1) centerline surveyed and staked; 2) right-of-way cleared and access roads built; 3) work areas cleared and leveled as needed; 4) foundations installed, and transmission line structures erected and installed; 5) ground wire, conductors, and ground rods installed, and 6) the site would be cleaned up and reclaimed. Construction of the line is expected to take 2 years.

Before the KNF and DEQ would allow MMC to start construction, MMC would have to obtain a permit to discharge stormwater from other disturbances associated with transmission line and road construction. MMC could modify its MPDES permit or obtain coverage under Montana's General Permit for Storm Water Discharges Associated with Construction Activity if the project was eligible for coverage under the General Permit. MMC would modify its SWPPP to include construction activities associated with the transmission line. MMC's proposed Environmental Specifications for the 230-kV transmission line (MMI 2005b) contain additional measures to minimize sedimentation and erosion.

2.8.3.1 Surveying

Construction survey work would consist of establishing a centerline location, specific pole locations, right-of-way boundaries, work area boundaries, and access roads to work areas. The specified right-of-way boundaries, work areas, access roads, and other features would be marked with painted laths or flags. Markers would be maintained until final cleanup and/or reclamation was completed, after which they would be removed.

2.8.3.2 Access Road Construction and Use

Where possible, roads currently open year-round would be used for construction access. Roads currently closed either seasonally or year-round would only be opened for construction access where necessary. Where seasonally closed roads would be used, efforts would be made to minimize their use during the periods when these roads would otherwise be closed. Alternative B would require the use of roads currently closed with an earthen barrier with no administrative use. Table 37 lists those existing restricted roads used in Alternative B. MMC would maintain access restriction to the general public as it currently exists on all roads planned for use. Roads currently open to the public would remain as such and those closed would remain closed. The use of gates and berms would be installed as appropriate to control access.

Roads opened or constructed for transmission line access on National Forest System lands would be closed after the transmission line was built. The road surface would be reseeded as an interim reclamation activity designed to stabilize the surface. Where soil had been salvaged from new roads, the road surface would be covered with soil and then reseeded. The prism of new roads would remain during mine operations. Management of newly constructed roads on Plum Creek land would depend on the easement agreement between Plum Creek and MMC. For purposes of

Table 37. Existing Restricted Roads used for Construction Access in Alternative B.

Road #	Road Name	Location	Existing Closure Device	Length (miles)
14403	Lower Ramsey	Between Libby and Ramsey creeks	Barriered	0.5
4725	North Fork Miller Creek	Miller Creek Tributary	Gated	4.2
4773	Howard Midas Creek	East of Howard Lake	Barriered	1.1
4777	Lower Midas - Howard Lake	East of Howard Lake	Barriered	0.8
4778	Midas Howard Creek	Midas Creek	Barriered	0.7
4778P	Midas Howard Creek P	Between Midas Creek and Howard Lake	Barriered	0.3
4781	Ramsey Creek	Ramsey Creek	Gated	2.4
6210	Libby Ramsey	Libby Creek	Gated	1.0

analysis, the lead agencies assumed newly constructed roads on Plum Creek land would be gated after line construction to allow Plum Creek or State access.

Existing roads would be used for construction access where possible and new roads or spurs would be built only where necessary (Figure 41). New roads would be 12 feet wide and cleared of all trees and shrubs. In the agencies' analysis in Chapter 3, total roadway width, including cuts and fills, was assumed to be 25 feet. Wood refuse and cleared shrubs would be placed on the downhill edge of the road for erosion control. A road within the right-of-way would be required for line stringing operations across side slopes greater than 10 percent. MMC anticipates that no drainage would be provided for the new roads, but would follow the agencies' guidance if installation of culverts were required. No motorized activity associated with transmission line construction would occur from April 1 to June 15 within bear habitat in the Miller Creek and Midas Creek drainages. Construction would not occur during the winter in big-game winter range (December 1 through April 30). Estimated access road lengths required for each alternative are shown in Table 38.

Improvement of existing roads would be required in some areas to allow access of construction equipment into the transmission line corridor. Upgrades could include widening, lengthening of culverts, placing fill on or near streambanks, clearing, and regrading. Final design plans detailing the location of work areas and new and existing access roads would be submitted to the lead agencies for approval before construction.

MMC identified four possible stream crossing methods in constructing and upgrading roads: fords, culverts, arches, and bridges. MMC anticipates that culverts would be the most commonly used crossing method. BMPs outlined in "Water Quality BMPs for Montana Forests" (Logan 2001) would be followed. Erosion-control BMPs, such as the installation of water bars and dips would be implemented during construction and improvement of access roads. Special considerations could occur in the design and installation of culverts in waters that contain fish or support fisheries habitat. Based on a preliminary design, MMC anticipates requiring new stream crossings of new access roads at six locations: five in an unnamed tributary of Miller Creek, and one in Ramsey Creek. Additional stream crossings may be needed during timber clearing, and

Table 38. Miles of Open, Closed, and New Access Roads Required for Transmission Line Construction.

Road Type	Alternative B – North Miller Creek	Alternative C-R – Modified North Miller Creek	Alternative D-R – Miller Creek	Alternative E-R – West Fisher Creek
Open road	20.6	21.9	16.8	12.8
Closed road	11.1	14.2	10.4	13.4
Extensive upgrade required	0.3	0.0	0.0	0.7
Other closed roads	10.8	14.2	10.4	12.7
New road	9.9	3.1	5.1	3.2
Total	42.0	38.6	31.5	28.6

Totals may vary slightly due to rounding
Source: GIS analysis by ERO Resources Corp. using MMC and HDR Engineering data.

line stringing, if a helicopter were not used. Disturbance on active floodplains would be minimized to reduce sedimentation of streams during annual runoff. Construction activities would be restricted or curtailed during heavy rains or high winds to prevent erosion and soil loss. MMC's proposed Environmental Specifications for the 230-kV transmission line (MMI 2005b) contain additional measures to minimize effects of transmission line and access road construction.

2.8.3.3 Vegetation Clearing

Before any vegetation clearing at the substation site, the BPA would acquire a Montana general stormwater permit from the DEQ. The BPA would clear all trees at the Sedlak Park Substation Site, which would include the 2-acre substation and short access road from US 2 to the substation. Trees within the up to 300-foot right-of-way of the loop line also would be cleared. The BPA would conduct a noxious weed survey at the proposed Sedlak Park Substation Site before and after construction of the substation. It also would revegetate all disturbed areas outside of the access road prism and substation yard.

For the new 230-kV transmission line to the mine, most construction activity would be contained in the 100-foot right-of-way for steel monopole structures (Figure 43) with major exceptions being access road construction and conductor pulling and stringing. General right-of-way clearing would be governed by safety, reliability, environmental, and cost considerations. A 100-foot right-of-way would be cleared as necessary and additional tree clearing outside the 100-foot right-of-way would be necessary to prevent trees from falling into the line, or fires from flashovers where trees were too close to the conductor. For analysis purposes, the lead agencies have assumed the proposed line would require a maximum of 150 feet of clearing along the entire alignment (Figure 43). Some areas within the 150-foot clearing area would not require clearing, such as within high spans across valleys. Actual acreage cleared would be less and would depend on tree height, slope, and line clearance above the ground. Clearing would produce a "feathered" edge on the right-of-way clearing, with the width of right-of-way clearing varying along the line. Trees within the right-of-way would be removed to provide a minimum of 18 feet clearance between the vegetation and the conductor. Trees that would extend within 18 feet of the conductors within 5 years also would be removed. Other trees on or off the right-of-way that could fall into the line would be removed. In some areas, such as steep drainages, trees beneath the line would not be cleared if sufficient clearance existed between the line and the tree. Merchantable timber would be measured, purchased from the KNF, and then salvaged from the right-of-way; cleared smaller trees and brush would be burned or chipped. Non-merchantable trees and slash would be piled into windrows (using a brush blade to minimize soil accumulation) and burned. MMC did not specify the type of vegetation clearing that would be used. For analysis purposes, the lead agencies assumed all vegetation clearing would be completed conventionally without the use of a helicopter.

2.8.3.4 Foundation Installation

Excavations for foundations would be made with power auger equipment. Where the soil allowed, a vehicle-mounted power auger would be used. The foundation excavation and installation requires equipment access to the foundation sites. If rocky areas were encountered, foundations may require blasting. The foundation excavation and installation would require access to the site by a power auger or drill, a crane, material trucks, and ready-mix trucks. Concrete for use in constructing foundations would be obtained from commercial sources or from a remote batch plant on private land, depending on contractor needs.

Foundation holes left open or unguarded would be covered and/or fenced where practical to protect the public and wildlife. Soil removed from foundation holes would be stockpiled on the work area and used to backfill holes. All remaining soil not needed for backfilling would be spread on the work area. Concrete trucks would wash their chute debris into a depression in the permanent disturbance area at the pole site and soil from the foundation excavation would be used to cover the chute debris.

Where bedrock was encountered while excavating structure holes, a rock drill and compressor would be used to drill the rock. A hole would be blasted using explosives. Blasting would not expand the area needed for operations around the hole, but would increase the amount and duration of associated construction activity. It also would slightly affect the sequence and schedule of operations around those holes, extending the amount of time that the structures remain at the site before they can be set.

2.8.3.5 Structure Installation

MMC would use steel monopole structures a maximum of 95 feet high along the 100-foot right-of-way (Figure 43; Table 39). The distance between structures would vary from less than 200 feet to more than 2,000 feet, depending on the alignment selected and terrain crossed (Figure 41; Table 39). The lead agencies' analysis of MMC's preliminary design and structure locations indicates additional structures and access may be needed to avoid long spans and to achieve the proposed structure height. The cor-ten steel structures would be built to provide low reflectivity and long life. Cor-ten steel develops a stable rust-like appearance if exposed to the weather for several years. Tree clearing also would vary depending on span length and tree and structure height. MMC would work with the lead agencies to optimize structure height and span length to minimize concerns over tree clearing and visual considerations along any approved alignment and centerline.

Table 39. Comparison of H-frame and Monopole Structures.

Design Element	H-Frame	Monopole
Right-of-Way Width (ft)	150	100
Estimated Clearing Width (ft)	200	150
Peak current loading (amps)	125	125
Nominal Voltage (volts)	230,000 (230-kV)	230,000 (230-kV)
Conductor Size	795 kcmil Drake	795 kcmil Drake
Conductor Type	ACSR	ACSR
Overhead Ground Wire (Approximate)	1 3/8-inch-dia galvanized and 1 Optical ground wire	Optical ground wire (diameter of <0.433 inches)
Electric field at edge of right-of-way at 3 ft above ground level (kV/m)	0.52	0.62
Magnetic field at edge of right-of-way (mG)	3.2	1-conductor side: 4.0 2-conductor side: 4.2
Typical Structure Height above Ground (ft)	74.5	83.5†
Minimum Ground Clearance of Conductor (ft at 212º F)‡	25	25
Typical Structure Base Dimensions	2 poles, 2 foot x 2 foot	1 pole, 17.33 inch diameter
Total land temporarily disturbed for conductor reel and pole storage yards (acres)	Similar to monopole	Up to 3.5

†Additional structures and access may be needed to avoid long spans and to achieve the proposed structure height.
‡Minimum ground clearance used in developing preliminary plan and profiles; actual ground clearance would vary.
ACSR = aluminum core steel reinforced; Kcmil = 1,000 circular mils; kV = Kilovolts;
kV/m = kilovolts per meter; mG = milligauss
Source: MMI 2005b; Power Engineers 2005; HDR Engineering, Inc. 2007.

Ground disturbance necessary for some pulling and tensioning sites may extend up to 100 feet beyond the right-of-way boundary where the line makes a significant angle. These sites usually require an area up to 40 feet by 150 feet. The proposed alignment would require 13 of these sites.

Structure construction activity is expected to occur within 30 feet of the holes where the structures were installed. Activities conducted outside the 30-foot radius would include pole assembly, framing conductor supports, and establishing an operating location for the crane. The optimal crane operating conditions require that the crane be as close to the hole as possible but because of uneven terrain at certain sites, cribbing with timbers under the crane outriggers would be necessary to level the crane. The need for the crane to be outside of the 30-foot radius would probably be the exception. Temporary construction yards may be necessary and would be located on existing disturbed areas or other areas on private lands along the line alignment.

2.8.3.6 Line Stringing

Once structures were in place, a pilot line would be pulled (strung) from structure to structure and threaded through the stringing sheaves on each structure. A larger diameter, stronger line would then be attached to the pilot line. This is called the pulling line, and one pulling line is connected to a conductor or overhead ground wire. Each conductor or ground wire is then pulled through the sheaves in succession and held under tension until connected to the insulators. This process would be repeated until all the ground wires and conductors were pulled through all sheaves. Conductor splicing would be required at the end of a conductor spool or if a conductor were damaged during stringing. The work would occur on work areas for the structures or pulling/tensioning sites. Conductors would be strung using powered pulling equipment at one end and powered braking or tensioning equipment at the other end. For public protection during wire installation, guard structures would be erected over roadways, transmission lines, structures, and other obstacles. Guard structures consist of temporary H-frame structures placed on either side of an obstacle.

Helicopters may be necessary to assist in the construction of the line where ground access was not possible or where the contractor decided it would be cost effective. In such cases, helicopters would be used to bring equipment to structure sites, place transmission structures, and string the conductor. This method of construction would replace the need for small portions of access roads in these locations, and would eliminate vehicle access to the structures to perform maintenance activities. Maintenance in these structure locations would be restricted to helicopter access and maintenance or pedestrian access. Ground disturbance associated with the use of helicopter construction would include work areas for each structure site measuring about 15 feet by 15 feet, depending on the topography of the site. All necessary equipment would be lowered from a helicopter to allow foundation installation and structure setting. Vegetation would be removed and the work area would be graded by hand to flatten as needed for the safe operation of equipment and access by work crews. In the lead agencies' analysis of the North Miller Creek Alternative (Alternative B) in Chapter 3, no helicopter use to construct structures was assumed. Helicopter use was assumed for line stringing as helicopter use is expected to be less expensive than conventional ground stringing. Helicopter use for line stringing would take about 10 days.

Three conductors with a horizontal spacing of about 20 feet and a vertical spacing of 6.5 feet are proposed. A fiber optic static wire for protection against lightning strikes and communication would be located at the top of each structure 17 feet above the top conductor.

2.8.4 Operations, Maintenance, and Reclamation

The line would be designed and operated to comply with applicable standards. MMC would adhere to its proposed Environmental Specifications for the 230-kV transmission line regarding construction, operations, maintenance, and decommissioning activities (MMI 2005b). To minimize the potential for bird collisions or electrocution, the line would be constructed according to recommendations outlined in Reducing Avian Collisions with Power Lines (APLIC 2012) and Suggested Practices for Raptor Protection on Power Lines (APLIC 2006).

Following construction, land within the right-of-way and other disturbed areas outside of the right-of-way, such as tensioning sites, that had been rutted, compacted, or disturbed would be reclaimed. Access roads would be regraded, scarified, and seeded. All permanent cut-and-fill slopes on maintenance roads would be seeded, fertilized, and stabilized with hydromulch, netting, or other methods. Drive-through dips, open-top box culverts, waterbars, or crossdrains would be installed on maintenance roads to prevent erosion. Unauthorized traffic would be blocked with appropriate structures.

Monitoring at monthly intervals during the growing season would be conducted along the right-of-way and access roads to detect the invasion of spotted knapweed or other noxious weeds. Spotted knapweed plants found on areas disturbed by the project would be treated by spot spraying individual plants. Herbicides would be carried in tanks mounted on vehicles or in backpack tanks. Herbicide spray would be applied only when wind velocity was less than 8 miles per hour to prevent wind drift. No herbicides would be applied within 25 feet of water bodies. All herbicide applications would comply with all applicable state and federal regulations.

The BPA would pre- and post-construction weed surveys at the Sedlak Park Substation and treat weeds caused by substation construction. The BPA would be responsible for weed control at the substation during operations and decommissioning. All herbicide applications would comply with all applicable state and federal regulations.

Inspection and repair of the line would be conducted by helicopter. Line inspections would be conducted annually to assess structural integrity and to identify maintenance needs; additional inspections may be needed after a fire or ice storm. MMC estimates a line crew would access the line about 5 days per year for maintenance of hardware and removal of trees. MMC would rely on the BPA followed by Flathead Electrical Cooperative and then MMC's own resources for installation, maintenance, repairs, and inspections.

Hazard trees that would interfere with or fall into the transmission line or associated facilities would be identified during routine maintenance inspections. Targeted trees and tall shrubs would be removed in a non-motorized manner. Clearing of danger trees and tall shrubs would continue until the line was decommissioned. Slash would be lopped and scattered evenly throughout the surrounding terrain. Stumps would be cut to less than 1 foot tall, and lopped slash would be left as close to the ground as possible.

Land use in the right-of-way normally would not be restricted except for those activities that interfere with the line operation and maintenance. Line operation would not require any permanent employees, although MMC would have a trained fire crew and would cooperate with the KNF and local fire departments in controlling forest fires in the area.

MMC expects the transmission line facilities would be the last facilities reclaimed following mine closure. Newly constructed roads needed for construction of the transmission line would be soiled and reseeded immediately after construction was completed. Because the access roads would rarely be used following construction, MMC anticipates these roads would have stabilized naturally or by MMC through interim reclamation. The substation at the plant site would be removed. MMC would remove all other transmission line equipment at closure, such as structures, insulators, line, and other hardware from the right-of-way. All concrete foundations/footers would be broken up and buried in place. Poles and other structures would be dismantled and sold, scraped, and/or disposed of off-site. After the transmission line was removed, all newly constructed roads on National Forest System lands would be bladed and recontoured to match existing topography, obliterating the road prism. Management of newly constructed roads on Plum Creek land after the transmission line was removed would depend on the easement agreement between Plum Creek and MMC. Alternative B would not require any road use on State lands. Where culverts were removed, streambanks would be recontoured and reseeded. Native shrubs, such as alder or willow, would be planted on streambanks to reduce bank erosion during high streamflow.

The BPA would dismantle the substation and remove the loop line following mine closure, assuming it had no need for the facilities. The substation and access road would be revegetated after materials had been removed from the site.

2.9 Alternative C-R—Modified North Miller Creek Transmission Line Alternative

2.9.1 Issues Addressed

This alternative includes modifications to MMC's transmission line proposal described in Alternative B. This alternative could be selected with any of the mine alternatives. For analysis purposes, this alternative would terminate at the Libby Plant Site. This alignment was modified between the Draft EIS and the Supplemental Draft EIS, and further modified between the Supplemental Draft EIS and the Final EIS. Both modifications were in response to public comment to reduce effect on private property. The alignment was modified between the Supplemental Draft EIS and the Final EIS so a 2-mile segment would cross the Fisher River about 800 feet north of the alignment presented in the Supplemental Draft EIS.

The agencies developed two primary alignment modifications to MMC's proposed North Miller Creek alignment in Alternative B. One modification would route the line on an east-facing ridge immediately north of the Sedlak Park Substation instead of following the Fisher River. This modification addresses issues associated with water quality and aquatic life (Issues 2 and 3) by reducing the crossing of soils that are highly erosive soils and those with potential for high sediment delivery. This modification also addresses the issue of scenic quality (Issue 4) by reducing the visibility of the line from US 2. Fewer residences would be within 0.5 mile of the line. The other alignment modification, which would use an alignment up and over a ridge between West Fisher Creek and Miller Creek, would increase the use of public land and reduce the use of private land. During final design, MMC would submit a final Vegetation Removal and Disposition Plan for lead agencies' approval. The plan's goal would be to minimize vegetation clearing, particularly in riparian areas.

The agencies modified MMC's proposed Environmental Specifications to incorporate current transmission line construction practices. The agencies' Environmental Specifications, shown in Appendix D, would be implemented for transmission line construction, operations, maintenance, and decommissioning activities in all of the agencies' transmission line alternatives. The agencies' Environmental Specifications also include sensitive areas where special measures would be taken to reduce impacts during construction and reclamation activities. Sensitive areas are wetlands; riparian areas; bull trout critical habitat; old growth; core grizzly bear habitat; bald eagle primary use areas; areas with high risk of bird collisions; big game winter range; visually sensitive and high visibility areas; and cultural and paleontological resources. Additional areas for monitoring may be identified following the preconstruction monitoring trip by the agencies or preconstruction surveys by MMC.

BPA's plans for the Sedlak Park Substation Site would be the same as Alternative B.

2.9.2 Preconstruction Surveys

In Alternative C-R, MMC would complete, before any ground-disturbing activities, an intensive cultural resources survey and a jurisdictional wetland delineation on all areas where such surveys have not been completed and that would be disturbed by the alternative. Similarly, MMC would complete a survey for threatened, endangered, or Forest sensitive plant species on National Forest System lands for any areas that would be disturbed by a transmission line alternative where such surveys have not been completed or for any species listed since 2005. MMC also would update surveys in suitable habitat for threatened, endangered, and state-listed plant species potentially occurring on non-National Forest System lands. The survey results would be submitted to the agencies for approval. If wetlands, cultural resources, or species of concern were identified and adverse effects could not be avoided, MMC would develop appropriate mitigation plans for the agencies' approval. The mitigation would be implemented before any ground-disturbing activities. To the extent feasible, MMC would make adjustments to structure and road locations, and other disturbing activities to reduce impacts.

2.9.3 Alignment and Structure Type

The substation would be as proposed by BPA at Sedlak Park. From the substation, the alignment would traverse an east-facing ridge immediately north northwest of the substation, and would cross Hunter Creek 2 miles north northwest of the substation. After crossing Hunter Creek, the alignment would head west, crossing US 2, the Fisher River, West Fisher Creek, and NFS road #231 (Libby Creek Road). The alignment then would head northwest, up and over the ridge between West Fisher Creek and Miller Creek. The alignment would then follow an unnamed tributary of Miller Creek and then cross into the upper Midas Creek drainage, and then down into the Libby Creek drainage, ending at a substation at the Libby Plant Site (Figure 44).

MMC would use the same general methods to operate, maintain, and reclaim the line and access roads as Alternative B. Wooden H-frame structures would be used instead of the steel monopoles proposed by MMC in the North Miller Creek Alternative. The lead agencies selected wooden H-frame structures to reduce structure height. H-frame structures also would provide for longer span lengths and consequently would require fewer structures and access roads (Table 35). Using H-frame structures would require more right-of-way and tree clearing (Figure 43). To eliminate the need to use or construct roads that may affect core grizzly bear habitat, 26 structures in the Miller Creek, Midas Creek, and Howard Creek drainages would be constructed using a helicopter (Figure 44).

The centerline of the alignment for Alternative C-R would be near existing or proposed residences at two locations: near the Fisher River and US 2 crossing north of Hunter Creek (Section 32, Township 27N, Range 29 West) and near the Miller Creek crossing (Section 22, Township 27N, Range 30 West). Montana regulations allow the final centerline to vary by up to 250 feet of the centerline (ARM 17.20.301 (21)) unless there is a compelling reason to increase or decrease this distance. During final design, MMC would minimize effects on private land by keeping the centerline at least 200 feet from these residences, unless no practicable alternative existed, to be determined in cooperation with the agencies, and implementing the measures for sensitive areas described in the Environmental Specifications for the 230-kV transmission line (Appendix D).

After a more detailed topographic survey was completed, MMC would complete a detailed visual assessment of the alignment at these locations. Based on the assessment, MMC would locate the transmission line through existing open areas in the forest, where feasible, and incorporate into the Vegetation Removal and Disposition Plan measures to minimize vegetation clearing and clearing visibility from residences through modification of pole height, span length, and vegetation growth factor. The quantity and location of poles to be installed by helicopter would be modified as necessary to minimize access roads visible from private property and Howard Lake.

Based on a preliminary design, four structures would be in a RHCA on National Forest System lands and three structures would be in a riparian area on private lands. During final design, MMC would locate these structures outside of riparian areas if the agencies determined alternative locations were technically and economically feasible.

2.9.4 Line and Road Construction Methods

2.9.4.1 Vegetation Clearing

Vegetation would be cleared in the same manner as Alternative B with the following changes. During final design and submittal of an amended Plan of Operations and permit application before the Construction Phase, MMC would submit a final Vegetation Removal and Disposition Plan for lead agencies' approval (see section 2.5.2.6.2, *Vegetation Removal and Disposition Plan* in the Alternative 3 discussion). The plan would apply to all National Forest System lands covered by the Plan of Operations and all State and private lands covered by the transmission line certificate. It would not apply to private lands affected by the substation and loop line. One of the plan's goals would be to minimize vegetation clearing, particularly in riparian areas. The plan would identify areas where clearing would be avoided, such as deep valleys with high line clearance, and measures that would be implemented to minimize clearing. It would evaluate the use of monopoles to reduce clearing in select areas, such as old growth. The plan also would evaluate the potential uses of vegetation removed from disturbed areas, and describe disposition and storage plans during life of the line. For example, the growth factor used to assess which trees would require clearing could be reduced in sensitive areas, such as RHCAs, from 15 years to 5 to 8 years. Reducing the growth factor could reduce clearing width, but increase maintenance costs. Heavy equipment use in RHCAs would be minimized. Shrubs in RHCAs and in the line of sight between the line and private land would be left in place unless they had to be removed for safety reasons. Vegetation management in riparian areas on private lands would be decided by MMC and the private landowner. Sediment and runoff from all disturbed areas would be minimized through the use of BMPs developed in accordance with the Forest Service's *National Best Management Practices for Water Quality Management on National Forest System Lands* (USDA Forest Service 2012a) and the BMP requirements in the MPDES permit.

All activities on National Forest System and State trust lands during both construction seasons and decommissioning of the transmission line would occur between June 16 and October 14. The mitigation would not apply to State lands managed by the Montana Department of Transportation.

Most construction activity would be contained in the 150-foot right-of-way with major exceptions being access road construction. For analysis purposes, the lead agencies have assumed the proposed line would require a maximum of 200 feet of clearing along the entire alignment (Figure 43). In areas adjacent to core grizzly bear habitat (4.8 miles), MMC would use a helicopter to clear timber, reducing the need for access roads (Figure 44). A helicopter also may be used to remove timber from steep areas, such as north of West Fisher Creek. As described above, helicopters would be used for structure construction in some segments. Line construction would require up to two construction seasons of helicopter use, but would occur for one season for any particular line segment. The total duration of helicopter use for each line segment would be about 2 months for one construction season. Conventional vegetation clearing techniques would be used in other areas. Merchantable timber would be transported to designated landings or staging areas, and branches and tops would be removed and piled. Helicopter landing sites would generally be on roads (Figure 44). The KNF would be responsible for disposing of the piles. Non-merchantable material would be left within the transmission line clearing area, and would be lopped and scattered. Large woody debris would be left as necessary to comply with the wildlife mitigation described below (see section 2.9.6.1, *Down Wood Habitat*).

Ground disturbance necessary for some pulling and tensioning sites may extend up to 100 feet beyond the right-of-way boundary where the line makes a significant angle. These sites usually require an area up to 40 feet by 150 feet. Alternative C-R would require 18 of these sites.

The FWP holds a conservation easement on some lands owned by Plum Creek where the transmission line may be located. The easement was partially funded by the Forest Legacy Program for the purpose of preventing the land from being converted to non-forest uses. One of the stated purposes of the conservation easement is to “preserve and protect in perpetuity the right to practice commercial forest and resource management.” MMC would convey title or a conservation easement to FWP to 91 acres of private land adjacent to the FWP conservation easement prior to the start of the transmission line construction. Final acquisition requirements would be determined during final design of the transmission line. MMC would follow any FWP requirements for conveyance. Acquired lands or easements would be added to the existing conservation easement.

2.9.4.2 Access Road Construction and Use

New roads would be constructed, and currently gated roads would be upgraded, similar to Alternative B. Estimated access road requirements are shown on Figure 44. A final Road Management Plan described in Alternative 3 (section 2.5.2.3.2, *Road Use and Improvements*) would be developed and implemented for Alternatives C-R, D-R, and E-R. Any new, gated, or barriered road used for construction and decommissioning of the transmission line would be restricted from all motorized access with a gate or earthen barrier prior to the general hunting season. If construction access roads onto US 2 were necessary, an encroachment permit would be required before entering MDT right-of-way.

In Alternative C-R, installation of culverts, bridges, or other structures at perennial stream crossings would be specified by the agencies following on-site inspections with DEQ, Forest Service, FWP, landowners, and the local conservation district. Installation of culverts or other structures in a water of the United States would be in accordance with any U.S. Army Corps of Engineers 404 permit and DEQ 318 authorization conditions. Work in streams within the transmission line corridor would be in accordance with MFSA certificate requirements. All culverts would be sized according to Revised Hydraulic Guide (KNF 1990) and Parrett and Johnson (2004). Where new culverts were installed, they would be installed so water velocities or positioning of culverts would not impair fish passage. Stream crossing structures would be able to pass the 100-year flow event without impedance.

In all transmission line alternatives, roads built for the installation of the transmission line would be needed for future reclamation of the line. The KNF would change the status of new transmission line roads on National Forest System lands to intermittent stored service after line installation was completed. Intermittent stored service roads would be closed to motorized traffic and would be treated so they would cause little resource risk if maintenance were not performed on them during the operation period of the mine and before their future need. They would not be used for routine maintenance of the transmission line, but could be used for emergency repairs, such as a damaged insulator. Intermittent stored service roads would require some work to return them to a drivable condition. Intermittent stored service road treatments would include:

- Conducting noxious weed surveys and performing necessary weed treatments before storage activities
- Blocking entrance to road prism
- Removing culverts determined by the KNF to be high-risk for blockage or failure; laying back streambanks at a width and angle to allow flows to pass without scouring or ponding so that revegetation has a strong chance of success
- Installing cross drains so the road surface and inside ditch would not route any intercepted flow to ditch-relief or stream-crossing culverts
- Removing and placing unstable material at a stable location where stored material would not present a future risk to watershed function
- Replacing salvaged soil and revegetating with grasses in treated areas and unstable roadway segments to stabilize reduce erosion potential

New transmission line roads on National Forest System lands would be decommissioned after closure of the mine and removal of the transmission line. Decommissioned roads would be removed from service and would receive a variety of treatments to minimize the effects on other resources. In addition to all the intermittent stored service road treatments, a decommissioned road would be treated by one or more of the following measures:

- Conducting noxious weed surveys and performing necessary weed treatments before decommissioning
- Removing any remaining culverts and removing or bypassing relief pipes as necessary
- Stabilizing fill slopes
- Fully obliterating road prism by restoring natural slope and contour; restoring all watercourses to natural channels and floodplains
- Revegetating road prism
- Installing water bars or outsloping the road prism
- Removing unstable fills

Newly constructed roads on Plum Creek lands would be gated after construction. Road management would depend on the easement agreement between the Plum Creek and MMC. Alternative C-R would not require roads or structures on any other private land other than Plum Creek. Newly constructed roads on State land would be gated after construction and managed in accordance with an easement agreement between the DNRC and MMC. Alternative C-R would require the use of roads currently barriered with no administrative use. Table 40 lists those roads that MMC would be authorized to use in Alternative C-R.

Table 40. Existing Restricted Roads used in Construction Access for Alternative C-R.

Road #	Road Name	Location	Existing Closure Device	Length (miles)
4725	North Fork Miller Creek	Miller Creek Tributary	Gated	4.0
4726	Miller Creek Ridge	South of Miller Creek	Gated	2.3
4726F	Miller Creek Ridge F	South of Miller Creek	Gated	1.3
6210	Libby Ramsey	Libby Creek	Gated	1.0
8770	4W Ranch (Cactus Wade)	East of Fisher River	Gated	0.4
8773	Wade’s Back Entry	East of Fisher River	Gated	0.2
99760	Brulee-Hunter 99760	Hunter Creek (Plum Creek land)	Gated	1.1
99806	Wade-Kenelty D 99806	Fisher River (Plum Creek land)	Gated	3.1
99806D	Wade-Kenelty D 99806D	Fisher River (Plum Creek land)	Gated	0.3
99830	West Fisher 99830	West Fisher Creek (Plum Creek land)	Barriered	0.6

2.9.4.3 Line Stringing

A helicopter would be used for line and ground wire stringing in Alternative C-R. Completed segments of the line would be strung at the end of the construction season. The duration of helicopter use for line stringing would be the same as Alternative B (about 10 days).

2.9.5 Operations, Maintenance, and Reclamation

As in Alternative B, annual inspection of the line would be conducted by helicopter in the other transmission line alternatives. Roads placed in intermittent stored service or decommissioned would not be used for routine maintenance of the transmission line, but could be used for emergency repairs, such as a damaged insulator. Increased helicopter use would be required to conduct routine maintenance and line decommissioning. Clearing of danger trees would continue until the line was decommissioned. All vegetation clearing in core grizzly bear habitat would be completed without motorized access.

2.9.6 Wildlife Mitigation Measures

Mitigation common to both the mine and transmission line alternatives is discussed in section 2.5.7, *Mitigation Plans* under Mine Alternative 3. Some monitoring described for Mine Alternative 3 also would apply to transmission line alternatives (see section 2.5.6, *Monitoring Plans*). Except where noted, all wildlife mitigation measures would be implemented during construction of the transmission line.

2.9.6.1 Down Wood Habitat

MMC would leave large woody material for small mammals and other wildlife species within the cleared transmission line corridor on National Forest System and State lands. The mitigation would not apply to State lands managed by the Montana Department of Transportation. Woody material would be scattered and not concentrated within the clearing area. Piece size should exceed 3 inches in diameter, and preference would be for a down “log” to be at least 8 feet in length with a small-end diameter of 6 inches or more. This material would originate from existing logs on site, unused portions of designated cut trees, broken tops, or similar materials. This mitigation would be incorporated into the Vegetation Removal and Disposition Plan. Monitoring of woody material would be implemented through a timber sale contract. The following amounts of coarse woody debris (CWD) would be left:

- Vegetative Response Unit (VRU) 1: leave 5 to 9 tons (6 to 14 logs) per acre of CWD on site after timber clearing
- Vegetative Response Unit (VRU) 2 and 9: leave 10 to 15 tons (15 to 20 logs) per acre of CWD on site after timber clearing
- Vegetative Response Unit (VRU) 3, 4, and 5: leave 15 to 30 tons (23 to 30 logs) per acre of CWD on site after timber clearing

2.9.6.2 Sensitive Species and Other Species of Interest

2.9.6.2.1 Bald Eagle

MMC would either: 1) not clear vegetation or conduct other construction activities during the breeding season (February 1 to August 15) in potential bald eagle nesting habitat or; 2) fund or conduct field and/or aerial reconnaissance surveys to locate any new bald eagle or osprey nests along specific segments of the transmission line corridor in Alternatives C-R, D-R, and E-R. Surveys would be conducted between March 15 and April 30, one nesting season immediately before transmission line construction. The survey could be integrated into the current monitoring of the KNF’s Libby Ranger District, or could be contracted by MMC. Transmission line segments to be surveyed by alternative would be:

- Alternative C-R: from Sedlak Park Substation in Section 9, Township 26N, Range 29 West to the western edge of Section 31, Township 27N, Range 29 West in West Fisher Creek
- Alternative D-R: from Sedlak Park Substation in Section 9, Township 26N, Range 29 West to the western edge of Section 31, Township 27N, Range 29 West in West Fisher Creek; and from the northern end of Section 19, Township 27N, Range 30 West to the northern edge of Section 13, Township 27N, Range 31 West, which is the area to the east and northeast of Howard Lake
- Alternative E-R: from Sedlak Park Substation in Section 9, Township 26N, Range 29 West to the western edge of Section 4, Township 26N, Range 30 West in West Fisher Creek; and from the northern end of Section 19, Township 27N, Range 30 West to the northern edge of Section 13, Township 27N, Range 31 West, which is the area to the east and northeast of Howard Lake

If an active nest were found, guidelines from the Montana Bald Eagle Management Plan (Montana Bald Eagle Working Group 2010) would be followed to provide management guidance for the immediate nest site area (Zone 1), the primary use area (Zone 2), and the home range area (Zone 3) as long as they were in effect. This would include delineating a 0.25-mile buffer zone for the nest site area, along with a 0.5-mile buffer zone for the primary use area. High intensity activities, such as heavy equipment use, would not be permitted during the nesting season (February 1 to August 15) within these two zones. The USFWS guidelines would be followed if the Montana Bald Eagle Management Plan guidelines are not in effect.

MMC committed to constructing the transmission line according to recommendations outlined in Reducing Avian Collisions with Power Lines (APLIC 2012) and Suggested Practices for Raptor Protection on Power Lines (APLIC 2006). Specific recommendations that would be implemented are described for migratory birds in section 2.9.6.4, *Migratory Birds*.

The agencies' Environmental Specifications (Appendix D) include additional monitoring and mitigation not described in MMC's Environmental Specifications. As described in Appendix D, areas of high risk for bird collisions where line-marking devices may be needed, such as the Fisher River crossing, and recommendations for type of marking device would be identified through a study conducted by a qualified biologist and funded by MMC.

2.9.6.2.2 Western Toad

In transmission line Alternatives C-R, D-R, or E-R, all shrub habitat would be retained in wetlands and riparian areas crossed by the proposed transmission line. Wetlands avoidance, minimization, and mitigation and avoidance measures also would ensure that impacts on western toad breeding habitat were minimized.

2.9.6.3 Elk, White-tailed Deer, and Moose Winter Habitat

MMC would not conduct transmission line construction or decommissioning activities in elk, white-tailed deer, or moose winter range between December 1 and April 30. These timing restrictions may be waived in mild winters if MMC could demonstrate that snow conditions were not limiting the ability of these species to move freely throughout their range. MMC must receive a written waiver of these timing restrictions from the KNF, DEQ, and FWP before conducting construction or decommissioning activities in elk, white-tailed deer, or moose winter range between December 1 and April 30. Timing restrictions would not apply to substation construction. Grizzly bear mitigations in the agencies' alternatives include restrictions on the timing of transmission line construction and decommissioning. These restrictions would apply to NFS and State trust lands. This grizzly bear mitigation would require that MMC be restricted to June 16 to October 14 for conducting transmission line construction and decommissioning. No waiver of winter range timing restrictions would be approved on National Forest System or State trust lands where the grizzly bear mitigations would apply.

2.9.6.4 Migratory Birds

MMC committed to constructing the transmission line according to recommendations outlined in Reducing Avian Collisions with Power Lines (APLIC 2012) and Suggested Practices for Raptor Protection on Power Lines (APLIC 2006). MMC would ensure the following recommendations would be implemented:

During Construction

- Provide 60-inch minimum horizontal separation between energized conductors and/or energized conductors and grounded hardware.
- Provide 36-inch minimum vertical separation between energized conductors and/or energized conductors and grounded hardware.
- Insulate hardware or conductors against simultaneous contact where adequate spacing not possible. If transformers, cutouts, or other energized or grounded equipment were present on the structure, then jumpers, cutouts, and bushings should be covered to decrease the chance of a bird electrocution.

- Covering conductors may be necessary at times if adequate separation of conductors, or conductors and grounded parts, could not be achieved. On three phase structures, the cover should extend a minimum of 3 feet from the pole top pin insulator.
- Discourage birds from perching in unsafe locations by installing bird perch guards (triangles) or triangles with perches.
- Increase the visibility of conductors or shield wires where necessary to prevent avian collisions. This may include installation of marker balls, bird diverters, or other line visibility devices placed in varying configurations, depending on line design and location. Areas of high risk for bird collisions where such devices may be needed, such as major drainage crossings, and recommendations for type of marking device would be identified through a study conducted by a qualified biologist and funded by MMC.

During Operations

- Replace or modify a structure where there has been a documented problem with a nest site or an avian electrocution. This may include the installation of elevated perches (or nesting platforms in the case of osprey).

2.9.7 Other Modifications and Mitigation

The agencies modifications to MMC's proposed Environmental Specifications, shown in Appendix D, would be implemented for transmission line construction, operations, maintenance, and decommissioning activities. Modifications described in Alternative 3 for the mine, such as affording Native American Tribes the opportunity to monitor any ground disturbing activities, revising seed mixtures (Table 26), modifying revegetation success criteria, implementing measures to protect visual resources, and revising weed control, would be implemented in Alternative C-R.

2.10 Alternative D-R—Miller Creek Transmission Line Alternative

2.10.1 Issues Addressed

This alternative includes modifications to MMC's transmission line proposal regarding H-frame structures, helicopter use, vegetation clearing, road construction and post-construction management, line stringing, operations, maintenance, and reclamation, and seed mixtures described in Alternative C-R. This alternative could be selected with any of the mine alternatives. For analysis purposes, this alternative would terminate at the Libby Plant Site. This alignment was modified between the Draft EIS and the Supplemental Draft EIS, and further modified between the Supplemental Draft EIS and the Final EIS. Both modifications were in response to public comment to reduce effect on private property. The alignment was modified between the Supplemental Draft EIS and the Final EIS so a 2-mile segment would cross the Fisher River about 800 feet north of the alignment presented in the Supplemental Draft EIS.

As in the Modified North Miller Creek Alternative (Alternative C-R), this alternative modifies MMC's proposed North Miller Creek alignment by routing the line on an east-facing ridge immediately north of the Sedlak Park Substation (Figure 44). This modification would address issues associated with water quality and aquatic life (Issues 2 and 3) by crossing less area with soils that are highly erosive soils and those with potential for high sediment delivery. The issue of scenic quality (Issue 4) was addressed by this modification by reducing the visibility of the line from US 2. Fewer residences would be within 0.5 mile of the line. Another modification, developed following comment on the Draft EIS, was to use the same alignment as Alternative C-R into the Miller Creek drainage, and then along NFS road #4724 on the south side of Miller Creek. This modification would increase the use of public land and reduce the use of private land. The issue of effects on threatened or endangered wildlife species (Issue 5) was addressed by routing the alignment along Miller Creek and avoiding core grizzly bear and lynx habitat in Miller Creek and the unnamed tributary of Miller Creek. Other alignment modifications, which would use an alignment up and over a ridge between West Fisher Creek and Miller Creek and move the alignment from private land near Howard Lake, would increase the use of public land and reduce the use of private lands.

This alternative would use an alignment about 0.5 mile east of Howard Lake, a popular recreation facility in the project area. In the 1992 Final EIS, a similar alignment was considered, but was eliminated in part because of visual concerns from Howard Lake. The issue of scenic quality from Howard Lake was addressed by using H-frame structures, which would be shorter than steel monopoles. In addition, screening vegetation has grown taller between the lake and the alignment in the intervening 20 years. More detailed engineering was completed for the alternatives analyzed in this EIS, and H-frame structures would be used to minimize the visibility of the line from Howard Lake (Issue 4).

As in Alternative C-R, a helicopter would be used for vegetation clearing and structure construction in some locations. New access roads on National Forest System lands would be managed in the same manner as Alternative C-R. These modifications would address issues associated with water quality, aquatic life, threatened and endangered species, and wildlife (Issues 2, 3, 5, and 6) by reducing clearing and wildlife displacement associated with new access roads. The issues addressed by the modifications and mitigation measures are summarized in Table 41. Chapter 3 contains a more detailed discussion of how the modifications and mitigating measures would reduce or eliminate environmental impacts.

Table 41. Response of Alternative D-R Modifications and Mitigations to Issues.

Key Issue	Alignment	Structure Type	Construction Techniques
Issue 1-Acid Rock Drainage and Metal Leaching			
Issue 2-Water Quality and Quantity	✓	✓	✓
Issue 3-Aquatic Life	✓	✓	✓
Issue 4-Visual Resources	✓	✓	✓
Issue 5-Threatened or Endangered Wildlife Species	✓	✓	✓
Issue 6-Wildlife	✓	✓	✓
Issue 7-Wetlands and Streams			

2.10.2 Alignment and Structure Type

The substation would be as proposed by BPA at Sedlak Park. From the substation, the alignment would follow the same alignment as Alternative C-R until the alignment crossed the ridge between West Fisher Creek and Miller Creek (Figure 44). After departing from the Modified North Miller Creek alignment, this alternative would follow NFS road #4724 (South Fork Miller Creek Road) to a ridge separating Miller Creek from the Standard Creek drainage. The alignment would traverse the ridge into the Howard Creek drainage. The centerline would be about 500 feet east of the northeast corner of a private land parcel about 0.5 mile south of Howard Lake (Figure 44). North of the private land, the alignment would generally parallel Howard Creek and eventually be the same as the Modified North Miller Creek alignment.

The lead agencies selected wooden H-frame structures to reduce structure height. H-frame structures also provide for longer span lengths and consequently fewer structures and access roads (Table 35). Using H-frame structures would require more right-of-way and tree clearing (Figure 43). To minimize the need to use or construct roads that may affect core grizzly bear habitat, a helicopter would be used for structure construction at 16 locations in the Miller Creek and Howard Creek drainages (Figure 44). Other mitigation described in Alternative C-R would be incorporated into Alternative D-R.

The centerline of the alignment for Alternative D-R would be near existing residences at three locations: near the Fisher River and US 2 crossing north of Hunter Creek (Section 32, Township 27N, R. 29 West), in the Standard Creek drainage (Section 29, Township 27N, R. 30 West), and southeast of Howard Lake (Section 19, Township 27N, R. 30 West). Montana regulations allow the final centerline to vary by up to 250 feet of the centerline (ARM 17.20.301 (21)) unless there is a compelling reason to increase or decrease this distance. During final design, MMC would minimize effects on private land by keeping the centerline at least 200 feet from these residences and implementing the measures for sensitive areas described in the Environmental Specifications for the 230-kV transmission line (Appendix D).

After a more detailed topographic survey was completed, MMC would complete a detailed visual assessment of the alignment at these locations, plus at the locations east and southeast of Howard Lake. Based on the assessment, MMC would locate the transmission line through existing open areas in the forest, where feasible, and incorporate into the Vegetation Removal and Disposition Plan measures to minimize vegetation clearing and clearing and transmission line visibility from residences and Howard Lake through modification of pole height, span length, and vegetation growth factor. The quantity and location of poles to be installed by helicopter would be modified as necessary to minimize access roads visible from private property and Howard Lake.

Based on a preliminary design, six structures would be in a RHCA on National Forest System lands and three structures would be in a riparian area on private lands. During final design, MMC would locate these structures outside of riparian areas if the agencies determined alternative locations were technically and economically feasible.

2.10.3 Line and Road Construction Methods

2.10.3.1 Access Road Construction and Use

New roads would be constructed, and currently gated roads would be upgraded, similar to Alternative B. Estimated access road requirements are shown on Figure 44. MMC would develop and implement a final Road Management Plan. In Alternative D-R, new access roads on National Forest System, State, and Plum Creek lands would be managed in the same manner as Alternative C-R. Alternative D-R would require the use of roads currently barriered with no administrative use. Table 42 lists those existing restricted roads used for construction access in Alternative D-R.

2.10.3.2 Vegetation Clearing

Vegetation would be cleared in the same manner as Alternative B with the modifications of Alternative C-R incorporated. A helicopter would be used to remove timber from 2.4 miles of line in core grizzly bear habitat. A helicopter also may be used to remove timber from steep areas, such as north of West Fisher Creek. BPA's plans for the Sedlak Park Substation Site would be the same as Alternative B. Most construction activity would be contained in the 150-foot right-of-way with major exceptions being access road construction. For analysis purposes, the lead agencies have assumed the proposed line would require a maximum of 200 feet of clearing along the entire alignment (Figure 43). In areas adjacent to core grizzly bear habitat, MMC would use a helicopter to clear vegetation, reducing the need for access roads. Helicopter landing sites would generally be on roads (Figure 44).

Ground disturbance necessary for some pulling and tensioning sites may extend up to 100 feet beyond the right-of-way boundary where the line makes a significant angle. These sites usually require an area up to 40 feet by 150 feet (0.1 acre). Alternative D-R would require 19 of these sites.

As discussed for Alternative C-R, MMC would convey title or a conservation easement to FWP to 91 acres of private land adjacent to the FWP conservation easement.

Table 42. Existing Restricted Roads used for Construction Access in Alternative D-R.

Road #	Road Name	Location	Existing Closure Device	Length (miles)
4724	South Fork Miller Creek	Miller Creek and South Fork Miller Creek	Barriered	0.2
4726	Miller Creek Ridge	South of Miller Creek	Gated	2.3
4726F	Miller Creek Ridge F	South of Miller Creek	Gated	1.3
6210	Libby Ramsey	Libby Creek	Gated	0.9
8770	4W Ranch (Cactus Wade)	East of Fisher River	Gated	0.4
8773	Wade's Back Entry	East of Fisher River	Gated	0.2
99760	Brulee-Hunter 99760	Hunter Creek (Plum Creek land)	Gated	1.1
99806	Wade-Kenelty D 99806	Fisher River (Plum Creek land)	Gated	3.1
99806D	Wade-Kenelty D 99806D	Fisher River (Plum Creek land)	Gated	0.3
99830	West Fisher 99830	West Fisher Creek (Plum Creek land)	Barriered	0.8

2.10.4 Other Modifications and Mitigation

Modifications described in Alternative 3 for the mine or Alternative C-R for the transmission line (*e.g.*, conducting cultural resources, wildlife, plant, and wetland surveys; implementing wildlife mitigation; conveying land or conservation easement on lands adjacent to FWP's conservation easement; affording Native American Tribes the opportunity to monitor any ground disturbing activities, revising seed mixtures (Table 26), modifying revegetation success criteria, implementing measures to protect visual resources, and revising weed control) would be implemented in Alternative D-R.

2.11 Alternative E-R—West Fisher Creek Transmission Line Alternative

2.11.1 Issues Addressed

This alternative includes modifications to MMC's transmission line proposal regarding H-frame structures, helicopter use, road construction and post-construction management, line stringing, operations, maintenance, and reclamation, and seed mixtures described in Alternative C-R. Some steel monopoles would be used in the steep section 2 miles west of US 2 (Figure 44). This alternative could be selected with any of the mine alternatives. For analysis purposes, the lead agencies assumed this alternative would terminate at the Libby Plant Site. This alignment was modified between the Draft EIS and the Supplemental Draft EIS, and further modified between the Supplemental Draft EIS and the Final EIS. Both modifications were in response to public comment to reduce effect on private property. The alignment was modified between the Supplemental Draft EIS and the Final EIS so a 2-mile segment would cross the Fisher River about 800 feet north of the alignment presented in the Supplemental Draft EIS.

Like the Modified North Miller Creek Alternative, this alternative modifies MMC's proposed North Miller Creek Alternative by routing the line on an east-facing ridge immediately north of the Sedlak Park Substation. This modification would address issues associated with water quality (Issue 2) by crossing less area with soils that are highly erosive soils and those with potential for high sediment delivery. The issue of scenic quality (Issue 4) was addressed by this modification by reducing the visibility of the line from US 2. Fewer residences would be within 0.5 mile of the line.

The primary difference between the West Fisher Creek Alternative (Alternative E-R) and the North Miller Creek Alternative (Alternative B) is routing the line on the north side of West Fisher Creek and not up the Miller Creek drainage to minimize effects on core grizzly bear habitat. As in Alternative D-R, this alternative would use an alignment about 0.5 mile east of Howard Lake, a popular recreation facility in the project area; H-frame structures would minimize visibility from the lake.

Wooden H-frame structures, which generally allow for longer spans and require fewer structures and access roads, would be used on this alternative in most locations to minimize the visibility of the line from Howard Lake (Issue 4). In some locations, a helicopter would be used for vegetation clearing and structure construction. New access roads on National Forest System lands would be managed in the same manner as Alternative C-R. These modifications would address issues associated with water quality, aquatic life, threatened and endangered species, and wildlife (Issues 2, 3, 5, and 6) by reducing clearing and wildlife displacement associated with new access roads. The issues addressed by the modifications and mitigation measures are summarized in Table 43. Chapter 3 contains a more detailed discussion of how the modifications and mitigating measures would reduce or eliminate environmental impacts.

Table 43. Response of Alternative E-R Modifications and Mitigations to Issues.

Key Issue	Alignment	Structure Type	Construction Techniques
Issue 1-Acid Rock Drainage and Metal Leaching			
Issue 2-Water Quality and Quantity	✓	✓	✓
Issue 3-Aquatic Life	✓	✓	✓
Issue 4-Visual Resources	✓	✓	✓
Issue 5-Threatened or Endangered Wildlife Species	✓	✓	✓
Issue 6-Wildlife	✓	✓	✓
Issue 7-Wetlands and Streams			

2.11.2 Alignment and Structure Type

The substation would be as proposed by BPA at Sedlak Park. From the substation, the alignment would follow the same alignment as Alternative C-R until just north of Hunter Creek (Figure 44). After departing from the Modified North Miller Creek alignment, this alternative would cross the Fisher River and West Fisher Creek and follow West Fisher Creek until its confluence with Standard Creek. It would follow a small tributary to West Fisher Creek, and would eventually be the same as the Miller Creek alignment.

The lead agencies selected wooden H-frame structures to reduce structure height along most of the West Fisher Creek alignment. H-frame structures also provide for longer span lengths and consequently fewer structures and access roads (Table 35). Using H-frame structures would require more right-of-way and tree clearing (Figure 43). Some steel monopoles would be used in steep areas 2 miles west of US 2. To minimize the need to use or construct roads that may affect core grizzly bear habitat, 32 structures along West Fisher Creek would be constructed using a helicopter (Figure 44). Other mitigations described in Alternative C-R would be incorporated into Alternative E-R.

The centerline of the alignment for Alternative E-R would be near existing residences at four locations: near the Fisher River and US 2 crossing north of Hunter Creek (Section 32, Township 27N, R. 29 West), along West Fisher Creek (Section 2, Township 26N, R. 30 West), in the Standard Creek drainage (Section 29, Township 27N, R. 30 West), and southeast of Howard Lake (Section 19, Township 27 N., Range 30 West). Montana regulations allow the final centerline to vary by up to 250 feet of the centerline (ARM 17.20.301 (21)) unless there is a compelling reason to increase or decrease this distance. During final design, MMC would minimize effects on private land by keeping the centerline at least 200 feet from these residences, unless no practicable alternative existed, to be determined in cooperation with the agencies, and implementing the measures for sensitive areas described in the Environmental Specifications for the 230-kV transmission line (Appendix D).

After a more detailed topographic survey was completed, MMC would complete a detailed visual assessment of the alignment at these locations, plus at the locations east and southeast of Howard Lake. Based on the assessment, MMC would locate the transmission line through existing open areas in the forest, where feasible, and incorporate into the Vegetation Removal and Disposition

Plan measures to minimize vegetation clearing and clearing visibility from residences and Howard Lake through modification of pole height, span length, and vegetation growth factor. The quantity and location of poles to be installed by helicopter would be modified as necessary to minimize access roads visible from private property and Howard Lake.

Based on a preliminary design, eight structures would be in a RHCA on National Forest System lands and nine structures would be in a riparian area on private or State lands. During final design, MMC would locate these structures outside of riparian areas if the agencies determined alternative locations were technically and economically feasible.

2.11.3 Line and Road Construction Methods

2.11.3.1 Access Road Construction and Use

New roads would be constructed, and currently gated roads would be upgraded, similar to Alternative B. Estimated access road requirements are shown on Figure 44. MMC would develop and implement a final Road Management Plan. New access roads on National Forest System, State, and Plum Creek lands in Alternative E would be managed in the same manner as Alternative C-R. Alternative E-R would require the use of roads currently barriered with no administrative use. Table 44 lists those existing restricted roads used for construction access in Alternative E-R.

2.11.3.2 Vegetation Clearing

Vegetation would be cleared in the same manner as Alternative B with the modifications of Alternative C-R incorporated. A helicopter would be used to remove timber from 4.3 miles of line in core grizzly bear habitat. A helicopter also may be used to remove timber from steep areas, such as north of West Fisher Creek. BPA's plans for the Sedlak Park Substation Site would be the same as Alternative B. Most construction activity would be contained in the 150-foot right-of-way with major exceptions being access road construction. For analysis purposes, the lead agencies have assumed the proposed line would require a maximum of 200 feet of clearing along most of the alignment (Figure 43). The right-of-way would be 100 feet and the clearing width would be 150 feet in steep areas 2 miles west of US 2 where steel monopoles would be used. In areas adjacent to core grizzly bear habitat, MMC would use a helicopter to clear timber, reducing the need for access roads (Figure 44). Helicopter landing sites would generally be on roads (Figure 44).

Ground disturbance necessary for some pulling and tensioning sites may extend up to 100 feet beyond the right-of-way boundary where the line makes a significant angle. These sites usually require an area up to 40 feet by 150 feet. Alternative E-R would require 18 of these sites.

As discussed for Alternative C-R, MMC would convey title or a conservation easement to FWP to 94 acres of private land adjacent to the FWP conservation easement.

2.11.3.3 Line Stringing

A helicopter would be used for line stringing in Alternative E-R.

Table 44. Existing Restricted Roads used for Construction Access in Alternative E-R.

Road #	Road Name	Location	Existing Closure Device	Length (miles)
231A	Libby Creek Fisher River A	North of West Fisher Creek	Barriered	0.4
231B	Libby Creek Fisher River B	North of West Fisher Creek	Gated	0.9
4724	South Fork Miller Creek	Miller Creek and South Fork Miller Creek	Barriered	0.2
4782	Standard Creek - Miller Creek	East of Standard Creek	Gated	1.4
4782A	Standard Creek - Miller Creek A	East of Standard Creek	Impassable	0.5
4782A	Standard Creek - Miller Creek A	East of Standard Creek	Gated	0.9
5326	Standard Creek - Miller Creek Oldie	East of Standard Creek	Barriered	0.7
6210	Libby Ramsey	Libby Creek	Gated 12/1-3/31	0.9
8770	4W Ranch (Cactus Wade)	East of Fisher River	Gated	0.4
8773	Wade’s Back Entry	East of Fisher River	Gated	0.2
99760	Brulee-Hunter 99760	Hunter Creek (Plum Creek land)	Gated	1.1
99806	Wade-Kenelty D 99806	Fisher River (Plum Creek land)	Gated	3.1
99806D	Wade-Kenelty D 99806D	Fisher River (Plum Creek land)	Gated	0.3
99844	West Fisher 99844	West Fisher Creek (Plum Creek land)	Gated	0.2
99845	West Fisher 99845	West Fisher Creek (Plum Creek land)	Gated	0.2

2.11.4 Other Modifications and Mitigation

Modifications described in Alternative 3 for the mine or Alternative C-R for the transmission line (*e.g.*, conducting cultural resources, wildlife, plant, and wetland surveys; implementing wildlife mitigation; conveying land or conservation easement on lands adjacent to FWP’s conservation easement; affording Native American Tribes the opportunity to monitor any ground disturbing activities, revising seed mixtures (Table 26), modifying revegetation success criteria, implementing measures to protect visual resources, and revising weed control) would be implemented in Alternative E-R.

2.12 Forest Plan Amendments

The 2015 KFP became effective on February 17, 2015. The KNF identified the need to amend the 2015 KFP to provide project-specific variances for the following direction in the agencies’ preferred alternatives (Mine Alternative 3 and Transmission Line Alternative D-R).

FW-GDL-WL-08 Big Game: Management activities should avoid or minimize disturbance to native ungulates on winter range between December 1 and April 30, with exception of routes identified on MVUM as open to motor vehicle use. Management activities that occur on winter range during the winter period should concentrate activities to reduce impacts to native ungulates. (2015 KFP, page 31-32)

FW-GDL-WL-09 Big Game: Management activities should be avoided on native ungulate winter range areas during the critical mid-winter period (January and February) when snow depths most likely influence movement and availability of forage. (2015 KFP, page 32)

FW-GDL-AR-01: Management activities should be consistent with the mapped scenic integrity objective, see Plan set of documents. The scenic integrity objective is High to Very High for scenic travel routes, including Pacific Northwest National Scenic Trail, designated Scenic Byways, and National Recreation Trails. (2015 KFP, page 35)

FW-STD-RIP-01: When RHCAs are intact and functioning at desired condition, then management activities shall maintain or improve that condition. Short-term effects from activities in the RHCAs may be acceptable when those activities support long-term benefits to the RHCAs and aquatic resources. (2015 KFP, page 25)

FW-STD-RIP-02: When RHCAs are not intact and not functioning at desired condition, management activities shall include restoration components that compensate for project effects to promote a trend toward desired conditions. Large-scale restoration plans or projects that address other cumulative effects within the same watershed may be considered as compensatory components and shall be described during site-specific project analyses. (2015 KFP, page 25).

FW-GDL-VEG-02: Road construction (permanent or temporary) or other developments should generally be avoided in old growth stands unless access is needed to implement vegetation management activities for the purpose of increasing the resistance and resilience of the stands to disturbances. (2015 KFP, page 19).

These amendments to the 2015 KFP would be needed if any of the action alternatives are selected. Additional amendments would be needed if MMC's proposed alternatives were selected in the ROD. Should MMC's proposed alternatives be selected in the ROD, additional amendments will be discussed in the ROD.

The need for the amendments are discussed in four applicable sections:

- FW-GDL-WL-08 and FW-GDL-WL-09—Wildlife
- FW-GDL-AR-01—Scenery
- FW-STD-RIP-01 and FW-STD-RIP-02—Aquatic Life and Fisheries
- FW-GDL-VEG-02—Vegetation

A significance determination of the amendments will be in the ROD and is available in the project record.

2.13 Alternatives Analysis and Rationale for Alternatives Considered but Eliminated

2.13.1 Development of Alternatives

The alternatives development process was designed to identify a reasonable range of alternatives for detailed analysis in the EIS. The agencies developed alternatives in accordance with the requirements of NEPA, MEPA, MFSA, and Section 404 of the Clean Water Act. To develop a reasonable range of alternatives, the lead agencies separated the proposed Montanore Project into components. *Components* are discrete activities or facilities (*e.g*., plant site or tailings impoundment) that, when combined with other components, form an alternative. The agencies identified options for each component. An *option* is an alternative way of completing an activity, or an alternative geographic location for a facility (component), such as alternative geographic locations for a tailings impoundment or transmission line, or an alternative method of tailings disposal, such as paste tailings. Options generate the differences among alternatives. An alternative is a complete project that has all the components necessary to fulfill the project purpose and need. The lead agencies considered options for the following project components:

- Underground mine
- Tailings disposal, including backfilling and surface disposal
- Plant site and adits
- LAD Areas
- Access road
- Transmission line

The Corps and the EPA must follow the 404(b)(1) Guidelines (40 CFR 230) (Guidelines) in permitting the discharge of dredged and fill material into wetlands and waters of the U.S. The Montanore mineral deposit itself is not located within regulated waters of the United States. The deposit would be mined by underground mining methods, and the mine would not result in the discharge of dredged or fill material into waters of the U.S. It is the location of the ancillary surface facilities, such as the tailings impoundment, that would result in a regulated discharge. The Corps requested that the lead agencies address the Guidelines in their alternatives analysis. A 404(b)(1) analysis is in Appendix L. MMC is responsible for demonstrating compliance with the Guidelines. An alternative is practicable under the Guidelines if “it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes” [40 CFR 230.3(q), 230.10(a)(2)]. According to the Guidelines, an alternative can be eliminated if it:

- Does not meet the project purpose and need
- Is not available
- Is not capable of being done because of cost
- Is not capable of being done because of existing technology
- Is not capable of being done because of logistics

The analysis of underground mine, tailings disposal, and plant site and adit alternatives is described in detail in the *Tailings Disposal Alternatives Analysis* (ERO Resources Corp. 2011a) and summarized in the following sections. Also described in the following sections is the agencies' analysis of LAD Areas, access road, and transmission line options and an evaluation of alternatives consistent with the 2015 KFP.

2.13.2 Regulatory Changes

The agencies' analysis of alternative component options incorporated a number of regulatory changes that occurred since the 1992 Montanore Project Final EIS was issued. The lead agencies' alternatives analysis conducted for MMC's proposal incorporated these changes. The lead agencies evaluated potential sites for a tailings impoundment within a 10-mile radius of a plant site in either Ramsey Creek or Libby Creek. Sites outside a 10-mile radius were not considered practicable because of long tailings transport distances, large elevational differences between the mill and the impoundment, and potential crossing of perennial streams. The resources affected by the regulatory changes within a 10-mile radius of a plant site in either Ramsey Creek or Libby Creek for purposes of siting an impoundment are discussed briefly in the following sections.

2.13.2.1 Inland Native Fish Strategy

The Inland Native Fish Strategy (INFS) (USDA Forest Service 1995a) established stream, wetland, and landslide-prone area protection zones called RHCAs, and set standards and guidelines for managing activities that potentially affect conditions within the RHCAs. Default widths for defining RHCAs were based on four categories of streams. For example, for fish-bearing streams, which comprise nearly all the streams in the Montanore Project analysis area, the RHCAs consist of the outer edge of the 100-year floodplain, the outer edge of riparian vegetation, the distance equal to the height of two site-potential trees, or 600 feet, including both sides of the stream channel, whichever is greater. INFS also established RMOs that provide guidance with respect to key habitat variables. The 2015 KFP integrates INFS through standard FW-STD-RIP-03. This standard also clarified that INFS priority watersheds have been added to adapted as Conservation and Restoration Watersheds, standardized the default RHCA buffers for all category 4 streams, describes where default widths may be varied, and clarifies INFS standard and guideline component definitions. Section 3.6, *Aquatic Life and Fisheries* discusses INFS and RHCAs in greater detail. RHCAs in a 10-mile radius of a plant site in either Ramsey Creek or Libby Creek for purposes of siting an impoundment are shown in Figure 45. Although RHCAs were not established when the 1992 Final EIS was completed, both the MAC Report and the 1992 Final EIS analysis considered effects on streams and their associated habitats as important resources in facility siting.

2.13.2.2 Grizzly Bear

The Montanore Project analysis area is within the Cabinet-Yaak Grizzly Bear Recovery Zone. The 2015 KFP incorporated direction established in the 2011 Motorized Access Management within the Selkirk and Cabinet-Yaak Grizzly Bear Recovery Zones (Access Amendment) (USDA Forest Service 2015b). Specific motorized access and habitat security guidelines and standards applicable to the impact analysis are explained in section 3.25.5, *Threatened and Endangered Species*.

Standards for core grizzly bear habitat were established in the Access Amendment as incorporated into the 2015 KFP. Core grizzly bear habitat is defined as an area of secure habitat within a BMU that contains no motorized travel routes or high-use trails during the non-denning season and is more than 0.31 miles (500 meters) from a drivable road. Core areas do not include any gated roads but may contain roads that are impassible due to vegetation or constructed barriers. Core areas strive to contain the full range of seasonal habitats that are available in the BMU. All revisions to core grizzly bear habitat have been incorporated into the alternatives analysis. Section 3.25.5.2, *Threatened and Endangered Species* discusses core grizzly bear habitat in greater detail. Core grizzly bear habitat in a 10-mile radius of a plant site in either Ramsey Creek or Libby Creek for the purposes of siting an impoundment was considered during the evaluation of alternatives, along with lynx (Figure 45). Grizzly bear habitat is shown on Figure 92. The USFWS has not designated grizzly bear critical habitat.

2.13.2.3 Lynx

In 2000, the USFWS listed the lynx as a threatened species. The 2015 KFP incorporated standards and guidelines for lynx management established in the Northern Rockies Lynx Management Direction adopted in 2007. Section 3.25.5.3, *Threatened and Endangered Species* discusses lynx habitat in greater detail. Lynx habitat in a 10-mile radius of a plant site in either Ramsey Creek or Libby Creek for the purposes of siting an impoundment was considered during the evaluation of alternatives (Figure 45). Lynx habitat is shown on Figure 95. The analysis area does not contain any lynx critical habitat.

2.13.2.4 Bull Trout

In 1998, the USFWS listed the bull trout as a threatened species and in 2005 designated critical habitat in five streams in the project area: Libby Creek, Poorman Creek, Ramsey Creek, Rock Creek, and West Fisher Creek. In 2010, the USFWS designated as critical bull trout habitat additional segments of Libby Creek, Rock Creek, and West Fisher Creek, and designated some segments of Bear Creek, East Fork Bull River, and Fisher River. The 2010 designation removed the short segments of critical habitat in Ramsey Creek and Poorman Creek designated in 2005. Segments in Libby Creek, West Fisher Creek, and Fisher River covered by the Plum Creek Native Fish Habitat Conservation Plan are considered essential excluded habitat. Section 3.6, *Aquatic Life and Fisheries* discusses bull trout in greater detail. Bull trout are found in Libby, Ramsey, Poorman, Midas, Bear, East Fork Rock, and Rock creeks and East Fork Bull River in the mine area, and in the Fisher River and West Fisher and Standard creeks along the transmission line alternative corridors (Figure 45).

2.13.2.5 Roadless Areas

Inventoried roadless areas (IRAs) have attributes similar to designated wilderness, such as natural integrity and appearance, opportunities for solitude, and primitive recreation opportunities. IRAs are areas identified in a set of inventoried roadless area maps, contained in the Forest Service Roadless Area Conservation, Final Environmental Impact Statement, Volume 2, dated November 2000, and any subsequent update or revision of those maps through the land management planning process. The 2000 Roadless Area Conservation Final EIS identified the Barren Peak Inventoried Roadless Area, which is within a 10-mile radius of a plant site in either Ramsey Creek or Libby Creek for purposes of siting an impoundment. Inventoried roadless areas are discussed in section 3.24.2, *Roadless Areas*. Other land use restrictions in the Montanore Project analysis area are CMW and the Cabinet Face East Roadless Area (Figure 45), which were considered in the 1992 analysis.

2.13.2.6 Old Growth Ecosystems

Old growth is recognized for its unique ecological characteristics that serve as important habitat for both wildlife and some species of rare plants on the KNF. Old growth in the analysis area is described in section 3.22.2, *Old Growth Ecosystems*.

2.13.3 Alternative Mine Location or Combined Mine Operations

2.13.3.1 Mine Location

To address 404(b)(1) Guidelines, the Corps requested that the lead agencies consider alternative locations that could reasonably be obtained for the underground mine not presently owned by MMC. The location of the underground mine is determined by the location of mineralized copper-silver resources. The lead agencies' evaluation of alternative copper-silver resources in northwest Montana, consistent with the Corps' purpose and need described in Chapter 1, is summarized in the following paragraphs.

The U.S. Geological Survey (USGS) recently completed a review of copper-silver deposits in western Montana and eastern Idaho (Boleneus *et al*. 2005). A stratabound deposit is a mineral deposit that occurs within a specific stratigraphic bed or horizon, but which does not comprise the entire bed. Worldwide, stratabound copper-silver deposits contain 23 percent of all known copper resources and are the second most important source of the metal. These deposits typically consist of disseminated copper sulfide minerals restricted to a narrow range of mineralized layers within a sedimentary sequence. The Rock Creek, Montanore, and Troy deposits, which are currently the most significant undeveloped resources identified in the western Montana copper belt, are also among the largest stratabound copper-silver deposits in North America and contain about 15 percent of the copper in such deposits in North America (Boleneus *et al*. 2005).

The USGS used the term "world class deposit" to provide the relationship of the Rock Creek and Montanore deposits to other known stratabound copper-silver deposits in North America. World-class deposits are significant because production from any of them would affect the world's supply-demand relation for the metal. World-class deposits are those that exceed the 90th percentile of discovered metal, and contain more than 2.2 million tons of copper. Only three world-class stratabound copper-silver deposits are found in North America: the Rock Creek and Montanore deposit; the Kona deposit and the White Pine deposit in Michigan (Boleneus *et al*. 2005).

According to Boleneus *et al*. (2005), mineral deposits in the Revett Formation are unusual because they are also rich in silver, a characteristic that sets them apart from many other stratabound copper deposits. Individually, the Rock Creek and Montanore deposits are considered world-class silver deposits, and collectively they contain 680 million troy ounces of silver. Such deposits represent a "supergiant" silver deposit, which Singer (1995 as cited in Boleneus *et al*. 2005) defined as the largest 1 percent of the world's silver deposits. The right to mine the Rock Creek deposit is owned by another mining company, and could not be reasonably obtained, used, or managed by MMC. Consequently, the lead agencies did not identify any alternative mineralized resources in northwest Montana that MMC could reasonably obtain.

2.13.3.2 Combined Mining Operations (Rock Creek Project and Montanore Project)

In the 1992 Montanore Project Final EIS, the agencies evaluated a potential alternative of combining the Rock Creek Project with the Montanore Project (USDA Forest Service *et al*.

1992). A similar analysis was conducted and disclosed in the Rock Creek Project Final EIS (USDA Forest Service and DEQ 2001). In 1992, the Rock Creek Project was proposed by ASARCO, Inc.; it is now proposed by RCR.

2.13.3.2.1 Rock Creek Project Final EIS Analysis of Joint Operation

The agencies' analysis of joint operation in the Rock Creek Project Final EIS was based on Sterling (now RC Resources, Inc.) and NMC (now MMC) operating their projects essentially as a joint venture, using one operator, and using those elements of the Montanore Project that were permitted in 1993. The agencies also would use elements of the Rock Creek proposal that would be necessary to make a logical and efficient mine operation. The agencies assumed that the two companies would mine their ore bodies through the then-approved Montanore adits and use the Montanore plant site in the Ramsey Creek drainage. The analysis focused on two scenarios for combined Rock Creek and Montanore operations: 1) the companies would either mine the two ore deposits sequentially, thus extending the mine life over a 45-year period, or 2) they would mine the two ore bodies simultaneously over a 15- to 30-year life. In the Rock Creek Project Final EIS, the agencies indicated that potential disadvantages of a joint operation outweighed the potential advantages. Under both scenarios, a second tailings impoundment (assumed to be in Midas Creek in the Rock Creek Project Final EIS) would be necessary. Simultaneous joint operation would require two additional adits and an additional or expanded mill to achieve the proposed production rates. Sequential joint operations would impact about 80 more acres than two separate operations, would require two diversion channels at the Midas Creek impoundment, and affect significantly more old growth ecosystem. In the Rock Creek Project Final EIS (USDA Forest Service and DEQ 2001), the agencies determined that simultaneous joint operations would not offer any significant environmental advantages over the agencies' preferred alternative and would have more impacts than those under the sequential operation alternative. In addition to the environmental and engineering reasons for dismissing a combined operations alternative, significant timing and legal issues are associated with requiring two corporations to work together. For these reasons, the combined operations alternative was dismissed from detailed analysis in the Rock Creek Project Final EIS.

2.13.3.2.2 KNF's Supplemental Information Report

In 2006, MMI, MMC's parent company, provided the KNF with three internal mining company reports that evaluated the possibility of forming a joint venture to combine the Rock Creek and Montanore projects. In accordance with NEPA and Forest Service policy, the KNF conducted a review of the information in the reports to determine its importance and whether a correction, supplement, or revision to the Rock Creek Project Final EIS was necessary, or if the ROD needed to be amended. The KNF prepared a Supplemental Information Report that described its review (KNF 2007b).

The reports focused primarily on the financial advantages and disadvantages to the companies involved should they decide to enter into a joint venture and combine the projects, not on the environmental impacts of the projects or their combination. Due perhaps to the reports' preliminary nature, they provided little or no foundation for many of the assumptions and estimations regarding the design and engineering of a combined operation. The Supplemental Information Report concluded the reports provided by MMI did not provide any new information that proved the analysis disclosed in the Rock Creek Project Final EIS to be in error or incomplete in analyzing the combination of the Rock Creek and Montanore projects. The range of alternatives in the Rock Creek Project Final EIS adequately considered the issues and information included in the three internal industry reports and they did not affect the disclosure of environmental impacts on resources in the Rock Creek area.

2.13.3.2.3 Montanore Project EIS Analysis of Joint Operation

Both MMI and RCR would have to develop a joint operating agreement before the agencies could consider a joint operation. Such an agreement has not been developed jointly by MMI and RCR. The agencies determined that they did not have authority to require RCR and MMI to join their proposals into one operation, and joint operation is not a reasonable alternative.

2.13.4 Tailings Backfill Options

Backfilling at Montanore was considered primarily because of the potential reduction of the surface tailings disposal area. The placement of backfill underground would, at a placement rate of 6,000 tpd, reduce the volume of tailings requiring surface disposal by 33 percent to 40 percent. Backfill methods considered were dry placement, pneumatic placement, hydraulic placement, and thick slurry or paste placement. These backfill placement methods and their requirements are described in the *Tailings Disposal Alternatives Analysis* (ERO Resources Corp. 2011a). Room-and-pillar mining with delayed paste backfill is the only technically feasible method of underground tailings disposal at Montanore. An above-ground paste plant, outside the CMW, is the only feasible backfill plant location.

If the volume of tailings requiring surface disposal could be reduced by 33 to 40 percent, effects on wetlands and streams would be reduced. The use of thickened tailings at the Poorman site would affect 8.3 acres of wetlands. Backfilling 40 percent of the tailings along with paste tailings would reduce impacts on wetlands by an estimated 1.8 acres (Table 45). Based on a preliminary, assessment-level economic analysis, which could vary by more than 30 percent, the agencies' analysis found that backfilling at Montanore would result in significantly greater capital and operating costs than would normally be associated with room-and-pillar mining projects.

Table 45. Estimated Wetlands Effects within the Footprint of Various Conceptual Impoundment Layouts at the Poorman Site.

Conceptual Poorman Impoundment Tailings Density and Additive Scenario	Jurisdictional Wetlands (acres)	Streams (linear feet)	Non-Jurisdictional Wetlands (acres)
Thickened Tailings	8.3	11,110	1.1
Paste Tailings	8.1	10,370	0.5
Paste Tailings with Additive	8.1	10,170	0.4
Paste Tailings, 40% Backfill	6.5	9,940	0.4
Paste Tailings with Additive, 40% Backfill	3.0	8,210	0.2

The jurisdictional status of the wetlands and streams is preliminary and impacts may change during the 404 permitting process.
Source: GIS analysis by ERO Resources Corp.

2.13.5 Tailings Impoundment Location Options

2.13.5.1 Analysis Overview

In the 1992 Montanore Project Final EIS, the agencies reviewed NMC's alternatives analysis and completed an analysis independent of NMC's. The agencies considered numerous engineering factors, such as impoundment capacity, dam volume and height, surface water control, pipeline considerations, and environmental resources, such as fisheries, wetlands and streams, diversion of perennial streams, and threatened and endangered species. In the 1992 Final EIS, impoundment sites in Midas Creek, Standard Creek, and Little Cherry Creek were evaluated. The agencies did not identify an alternative tailings impoundment site that would avoid discharge of dredged or fill materials into waters of the U.S. Considering both environmental and engineering factors, the agencies determined that the Little Cherry Creek site was the preferred impoundment alternative. The Corps issued a 404 permit to NMC in 1993 for the Little Cherry Creek site.

During an interdisciplinary team meeting for the Montanore Project EIS in 2006, the agencies identified the possibility of locating the impoundment north of Poorman Creek to avoid diversion of Little Cherry Creek, a perennial stream. To evaluate this option, the agencies developed six options for an impoundment site between Little Cherry Creek and Poorman Creek (Poulter 2007). Three Poorman Creek options were eliminated because the dam was sited on private land that was not owned by MMC, and that could not be reasonably obtained. Two options were eliminated because they did not have adequate capacity or required large dam volumes, and one option was retained for further analysis. During the preparation of the Draft EIS, the agencies modified MMC's proposed Little Cherry Creek impoundment to reduce resource impacts; this option was also retained for detailed analysis in the Supplemental Draft and Final EISs.

After a preliminary review of the Little Cherry Creek and Poorman impoundment options, the Corps requested the agencies re-evaluate the impoundment sites evaluated in prior alternatives analyses in accordance with the 404(b)(1) Guidelines. Evaluation criteria differed among the prior analyses and did not address all current issues associated with regulatory changes. To address the 404(b)(1) Guidelines, the agencies completed an alternatives analysis of all impoundment sites previously evaluated in KNF's Mineral Activity Coordination (MAC) Report (KNF 1986), analyses conducted by prior project owners during project planning (Morrison-Knudsen Engineers, Inc. 1988; 1989a, 1989b; NMC 1989), the 1992 Montanore Project Final EIS analysis (USDA Forest Service *et al*. 1992), and the 2001 Rock Creek Project Final EIS analysis (USDA Forest Service and DEQ 2001). The agency-modified Little Cherry Creek site and the Poorman option developed by the agencies were included in the analysis.

The agencies used three successive levels of screening to narrow the range of tailings impoundment options analyzed in detail in the EIS: Level I screening eliminated projects based on availability and logistical criteria described below in section 2.13.5.2, *Level I Screening*. Alternatives remaining after Level I screening were further evaluated in Level II screening based on environmental criteria described in section 2.13.5.3, *Level II Screening*. A third, more detailed level of screening (Level III screening) was conducted on remaining alternatives based on engineering, geotechnical, and environmental criteria. Level I, II, and II screening analyses are described in the following subsections.

2.13.5.2 Level I Screening

The impoundment sites evaluated in the Level I screening analysis were the conceptual layouts developed for the Poorman and agency modified Little Cherry Creek impoundment sites and 20 impoundment sites developed for the MAC Report or the Morrison-Knudsen Engineers analysis (Figure 46). The disturbance area for the agencies' proposed Little Cherry Creek and Poorman impoundments, which include ancillary facilities, is between 1,500 and 2,000 acres. To standardize disturbance areas for the impoundment sites during screening, the area around each impoundment footprint developed for the MAC Report or the Morrison-Knudsen Engineers analysis except the Little Cherry Creek and Poorman sites was enlarged by 2,000 feet. Morrison-Knudsen Engineers' Little Cherry site was replaced by the agency-modified Little Cherry Creek impoundment for the alternatives analysis, due to considerable overlap between the two sites. For the same reason, Morrison-Knudsen Engineers' Poorman site and Site 19 from the MAC Report were replaced with the agencies' Poorman tailings impoundment option for the alternatives screening analysis. The disturbance area around Little Cherry Creek and Poorman sites was not enlarged during the Level I screening because the agencies had already established a disturbance area around each impoundment that would be adequate to accommodate each impoundment and all associated disturbances.

Tailings impoundment site evaluations in prior alternatives analyses were completed using lower impoundment capacity requirements than currently necessary for the Montanore Project. For Level I screening, the agencies used a capacity requirement of 120 million tons. At the current project life of 16 years, the Little Cherry Creek Tailings Impoundment has an excess capacity of an additional 3 years of mine production, or 22 million tons. Tailings impoundment capacity at each potential site was determined on a preliminary basis based on capacities provided in the MAC report (KNF 1986) or Morrison-Knudsen Engineers (1988) and potential for expansion. A more detailed evaluation of tailings storage capacity was conducted during Level III screening.

Site availability was used as criterion to comply with the 404(b)(1) Guidelines. The Guidelines indicate if a site is otherwise a practicable alternative, an area not presently owned by the applicant that could reasonably be obtained, utilized, expanded, or managed in order to fulfill the basic purpose of the proposed activity may be considered (40 CFR 230.10(a)(2)). At some sites, private land was owned by RCR on the west side of the Cabinet Mountains, or by Plum Creek on the east of the mountains. Based on correspondence from RCR available in the project record regarding the Montanore Project, private land owned by RCR could not be reasonably obtained for tailings disposal for the Montanore Project.

All but five sites were retained for Level II analysis. Two sites near the confluence of Rock Creek and the Clark Fork River were eliminated because they are owned by RCR and MMC could not reasonably obtain, utilize, expand, or manage them for tailings disposal purposes. Three other sites were eliminated because they did not have sufficient tailings storage capacity, would need excessive borrow material for dam construction, and would not fulfill the project's purpose and need.

2.13.5.3 Level II Screening

Level II screening focused on potential effects of impoundment alternatives on environmental resources. Criteria used in the Level II screening analysis were impacts on RHCAs, occupied bull trout habitat, grizzly bear core habitat, lynx habitat, IRAs, old growth, and grizzly bear habitat security; the amount of perennial stream that would be filled; and watershed area. Criteria were considered in the following order of priority: aquatic resource criteria, grizzly bear and lynx habitat, old growth, and IRAs. The same disturbance areas used for Level I screening were used for the Level II screening analysis.

Sites in Lower Hoodoo, Cable, Libby, Lower Bear, Lower Midas, Lower Standard, Ramsey, Upper Bear, and Upper Standard creeks would affect occupied bull trout habitat and were eliminated from further consideration because sites that would not affect such habitat were available. In addition, all sites that would affect occupied bull trout habitat would have a watershed area of over 2,100 acres, requiring large diversion structures, and would fill over 1.1 miles of perennial stream. Three sites in Upper Midas and Smearl creeks and near the confluence of Libby and Howard creeks were eliminated because of effects on grizzly bear habitat (grizzly bear core habitat and secure habitat) and reasonable alternatives with less effect on grizzly bear were available. The McKay Creek site was eliminated because it would affect 854 acres of secure grizzly bear habitat, require diversion of two perennial streams, fill 2.4 miles of perennial streams, and affect at least 43 acres of wetlands, based on information from the Rock Creek Final EIS (USDA Forest Service and DEQ 2001).

2.13.5.4 Level III Screening

The agencies analyzed in greater detail four impoundment sites after the Level II screening: the agency-modified Little Cherry Creek, Poorman, Crazyman Creek, and Upper Hoodoo Creek sites (Figure 47). The agencies developed conceptual impoundment layouts for the Crazyman and Upper Hoodoo creek sites based on a 120-million-ton tailings storage capacity.

For the Level III screening analysis, engineering and geotechnical factors were considered in addition to environmental resources. The six engineering and geotechnical criteria were: impoundment and dam area, dam height, dam crest length, watershed area, stream crossings by tailings pipelines, and tailings pipeline length. Five criteria were used to evaluate effects on aquatic resources: impacts on RHCAs, perennial stream diverted, perennial stream filled, impacts on bull trout habitat, and impacts on designated critical bull trout habitat. Effects on wildlife were evaluated by considering important grizzly bear habitat, lynx habitat, and old growth forest. Effects on IRAs were also considered.

The agencies retained the Little Cherry Creek and Poorman sites for detailed analysis, and eliminated the Crazyman and Upper Hoodoo creek sites. The Crazyman and Upper Hoodoo creek sites would have a greater effect on perennial streams than the Poorman site and would require more stream crossings by longer tailings pipelines than the Poorman and Little Cherry Creek sites. Also, the Crazyman Creek and Upper Hoodoo Creek dams would be nearly twice as high as the Poorman or Little Cherry Creek dams, potentially posing design and construction problems that could be avoided by better siting (EPA 1994a). Overall, the Crazyman Creek and Upper Hoodoo Creek sites would have substantially greater impacts on aquatic resources than the Poorman site and would not offer environmental advantages over the Poorman site.

2.13.5.5 MMC Analyses

MMC submitted a Section 404 permit application to the Corps for the agencies' preferred alternatives (Mine Alternative 3 and Transmission Line Alternative D-R) in 2011 (MMC 2011a). MMC prepared several reports on tailings disposal to assist the Corps in a 404(b)(1) compliance determination on MMC's 404 permit application for the Montanore Project (MMC 2012b, 2012c, 2012d). The analyses were not intended to represent the Corps' conclusions or their final

404(b)(1) determination. MMC's analyses considered cost, logistics, existing technology, and environmental consequences. MMC's analysis indicated the Poorman site had the least effect on waters of the U.S., which was consistent with the agencies' analysis described in the previous section and in the agencies' 404(b)(1) analysis.

2.13.6 Plant Site and Adit Location Options

2.13.6.1 Prior Analyses

The agencies reviewed prior analyses of plant and adit sites, specifically KNF's MAC Report, analyses conducted by prior project owners (Morrison-Knudsen Engineers, Inc. 1988; Morrison-Knudsen Engineers, Inc. 1989b; NMC 1989), the 1992 Montanore Project Final EIS analysis, and the 2001 Rock Creek Project Final EIS analysis. Methods, criteria, and conclusions of prior analyses are summarized in section 5.3.1 of the *Tailings Disposal Alternatives Analysis* (ERO Resources Corp. 2011a).

2.13.6.2 Updated Agencies' Analysis

The agencies used an iterative process to evaluate plant site and adit options. The agencies focused on plant sites on the east side of the Cabinet Mountains. Following their evaluation of prior alternatives analyses, the agencies concluded that plant sites on the west side of Cabinet Mountains were not available, or did not offer any environmental advantages over plant sites on the east side of Cabinet Mountains. In addition, plant sites on the west side of the Cabinet Mountains were eliminated because they would be over ten miles from the Little Cherry Creek and Poorman Impoundment Sites selected for detailed analysis in the EIS. MMC's proposed plant site location is in upper Ramsey Creek near the CMW boundary. The agencies considered seven sites along Libby Creek upstream of the confluence of Libby and Howard creeks: 1) one site on private land at the existing Libby Adit Site, 2) two sites upstream of the Libby Adit Site on National Forest System land but outside of the CMW, 3) two sites adjacent to the Libby Adit Site on the north and south sides of Libby Creek and 4) two sites downstream of the Libby Adit Site on National Forest System land (Figure 48). Six sites were eliminated because they did not provide sufficient room to locate the required plant facilities; would affect old growth, wetlands and RHCAs, or IRAs; or were within several avalanche paths. One site downstream of the Libby Adit Site was retained for detailed analysis because it would accommodate all necessary facilities and would not affect wetlands, RHCAs or an IRA. The agencies' analysis is described in a letter report by Agapito Associates, Inc. (2007a) and summarized in section 5.3.2 of the *Tailings Disposal Alternatives Analysis* (ERO Resources Corp. 2011a).

2.13.7 Surface Tailings Disposal Method Options

The agencies' analysis of surface tailings deposition methods is described in section 6.0 of the *Tailings Disposal Alternatives Analysis* (ERO Resources Corp. 2011a) and summarized below.

2.13.7.1 Overview of Deposition Methods

In mining projects that use milling to separate metals from rock, as proposed at Montanore, tailings are discharged from a mill as slurry, which is a mixture of water and solids. The amount of solids in the slurry, referred to as the slurry density, is reported as the percentage of the dry weight of solids (tailings) to the total weight of the slurry (dry weight of tailings plus the water weight) as follows:

Slurry density (%) = (dry weight of tailings)/(dry weight of tailings + weight of water)
Example: 100 lbs. tailings/(100 lbs. tailings + 81.8 lbs. water) = 55% slurry density
The mining industry has adopted descriptive categories, based on the consistency of the tailings slurry, that characterize the slurry over typical ranges of densities. The descriptive categories common to surface tailings deposition are slurry, thickened, paste, and filter or cake tailings deposition. Below is general description of each deposition “method” (or type of slurry) and typical slurry density values associated with each one.

2.13.7.1.1 Slurry Deposition

Slurry deposition occurs when the water content is sufficiently high such that the water component of the slurry mix controls the behavior of the tailings. Slurry densities are typically 55 percent or less in this category but can be as high as 60 percent for some tailings. The high water content results in little or no internal strength and solid particles segregate out from the slurry upon deposition. Tailings surfaces under these conditions generally have an average slope of about 1 percent, but can be as flat as 0.5 percent. In areas near the discharge location, sand-size particles tend to segregate out first and create slightly steeper tailings surfaces (1 to 2 percent), depending upon the sand content and flow velocity at the discharge location.

2.13.7.1.2 Thickened Deposition

Thickened tailings represent an intermediate step between the slurry tailings with high water content and the more viscous paste tailings. What differentiates this category from the others are the water content and deposition behavior of the tailings mass. The slurry density range is typically 60 percent to 75 percent. Thickened tailings can be transported with centrifugal pumps for the lower slurry densities but require positive displacement pumps as the slurry density increases. The slurry density is sufficiently thick such that the solid particles behave in a paste-like manner and do not segregate upon deposition. There is sufficient excess water in the slurry mix that upon deposition the tailings solids readily flow out from the discharge location and any excess water separates to create a water pool. Surface slopes from thickened tailings deposition tend to be slightly steeper (3 percent to 4 percent on average) than slurry tailings.

2.13.7.1.3 Paste Deposition

Paste deposition occurs when the water content is sufficiently low such that the slurry mass exhibits some internal strength and the tailings solid does not segregate out of the slurry upon deposition or as the tailings mass flows away from the discharge location. The slurry flows as a thick heavy fluid and exhibits a consistency varying from soft toothpaste to a thick stiff paste. Typical paste tailings require transport using positive displacement pumps, although the lower range of slurry densities may be pumped using centrifugal pumps. The range of slurry density for paste tailings is about 60 percent to 85 percent. Paste tailings with lower slurry densities would exhibit a bleed-off of excess water and, in sufficient quantity, form a small pool of water. These paste tailings are often categorized as thickened or highly thickened tailings. As the slurry density increases in paste tailings, the bleed-off water discharge is reduced to little or no discharge flow. In the higher range of slurry density for paste tailings, the water content is relatively low and the behavior and flow characteristics are like a stiff plastic material. This range of paste tailings is sometimes referred to as dewatered tailings.

2.13.7.1.4 Filter or Cake Deposition

Filter or cake tailings occur once the slurry density is sufficiently high (*i.e.,* low water content) that the mix begins to behave as a semi-solid material. The slurry mass exhibits soil-like characteristics and requires mechanical means, such as belts, to transport for discharge and distribution. The slurry density is typically greater than 85 percent.

Deposition of tailings slurries at thicker densities can offer several advantages over slurry tailings at 55 percent or less. The primary advantage is that water recovery increases as part of the process in preparing the thicker slurry densities, thus reducing make-up water requirements and the amount of excess water stored in the impoundment. In addition, high-density tailings and dewatered/filter tailings are generally more dense at deposition, consolidate to a higher density more rapidly than slurry tailings, and can be used to create a more stable tailings embankment. As a result of the lower water content and increased density, the shear strength generally increases over slurry tailings. Tailings surface slopes are generally steeper and more stable than the slurry tailings. In some cases, this allows for the tailings to be deposited from up gradient slopes at an elevation above the level surface of the tailings. Depending upon the native ground slope, and the impoundment geometry, high-density to dewatered and filtered tailings can be discharged from a higher elevation to create a slope of tailings above the normal impoundment level. Such deposition along with increased density in the placed tailings can be used to develop a deposition plan to reduce the required impoundment capacity, lower the dam crest, and possibly reduce the impoundment footprint.

2.13.7.2 Analysis of Alternative Deposition Methods

In comparing the different methods for use at a project, slurry deposition is often the preferred method with respect to infrastructure, operation, and capital cost. The description and evaluation of slurry deposition was the basis for comparison of the other methods of tailings deposition. Based on the agencies' conceptual impoundment layout at the Poorman site, the agencies found that slurry deposition was not a preferred method to store 120 million tons of tailings, primarily because of the projected shortage of cyclone sand available for dam construction. Effects on wetlands from a slurry deposition impoundment at the Poorman site were not specifically determined, but they would be similar to effects from an impoundment using of thickened tailings deposition (Table 45). Based on conceptual studies completed by the agencies to evaluate the feasibility of developing the Poorman site for tailings disposal, thickened tailings deposition is likely necessary at the Poorman tailings impoundment site to achieve the design capacity for the disposal of 120 million tons of tailings. Compared to thickened tailings deposition, paste or filter tailings deposition would not likely reduce the impoundment footprint enough to substantially decrease the acreage of wetlands affected at the site (Table 45). Reductions in the volume of tailings deposited at the surface due to the use of paste or filter tailings would not be directly proportional to reductions in the required surface area, due to the convex topography at the Poorman site.

2.13.8 LAD Areas

MMC's proposal in Alternative 2 is to have two LAD Areas, one along the north side of Ramsey Creek (LAD Area 1) and another between Ramsey and Poorman creeks (LAD Area 2) (Figure 7). In Alternatives 3 and 4, all mine and adit water would be treated and discharged at the Water Treatment Plant and LAD Areas would not be used.

2.13.9 Access Road

In the 1992 Montanore Project Final EIS, the lead agencies eliminated NFS road #231 from detailed analysis because it would have more stream crossings and have steeper grades than NFS road #278. MMC is proposing to use NFS road #278 for access and to convey concentrate to the Libby Loadout. Four routes are possible to provide access to the Libby Creek and Ramsey Creek drainages: NFS road #278 south from US 2 about 10 miles along Big Cherry Creek, NFS road #231 (Libby Creek Road) west from US 2 about 12 miles along West Fisher Creek, NFS road #231 along Libby Creek, and NFS roads #385, #4724, #4780, and #231 up Miller Creek and then into the Libby Creek drainage. The lead agencies eliminated NFS road #231 west from US 2 along West Fisher Creek because it had more stream crossings and would be much longer than the proposed alignment. NFS road #231 along Libby Creek would have more stream crossings and steeper grades than NFS road #278. Greater disturbance than that needed on NFS road #278 would be necessary to make NFS road #231 suitable for access. In addition, two major bridges spanning Libby Creek along NFS road #231 would have to be rebuilt and widened. A segment of this road was moved out of the Libby Creek floodplain several years ago and placed on a steep hillside to prevent the road from flooding and bridges from being washed out. Widening NFS road #231 to accommodate traffic on the steep hillside would cause a major surface disturbance. The steep hillside alignment has only recently started to stabilize and currently experiences large amounts of rock fall and soil movement during storm events. The use of NFS roads #385, #4724, #4780, and #231 was eliminated because of the length and steep slopes that NFS roads #4724 and #4780 traverse.

2.13.10 Transmission Line Alignment Options

The agencies' alternatives analysis included the evaluation of several transmission line alignments. The following sections summarize the 1992 Montanore Project Final EIS analysis, MMC's MFSA analysis, and the updated agencies' analysis of transmission line alignment alternatives. In addition, the agencies analyzed constructing the line underground and reducing the transmission line voltage.

2.13.10.1 Prior Analyses

2.13.10.1.1 1992 Montanore Project Final EIS

In 1992, the KNF and the DNRC considered several sources of power and different transmission line designs, construction methods, and locations. Two alternatives were eliminated from consideration initially due to their excessive costs and infeasibility. Four other alternatives were evaluated further by the lead agencies, but were ultimately eliminated because they were more costly and did not offer any environmental advantages over the alternatives analyzed in detail in the 1992 Final EIS. In 1992, as well as currently, the laws governing siting a major facility such as the proposed 230-kV transmission line allowed the consideration of cost in assessing impacts (75-20-301(1)(c)).

The KNF and the DNRC eliminated on-site generation because of high capital costs and the likelihood of additional costs to address environmental concerns, such as air quality. The agencies' estimate the capital cost of on-site generation to be $37 million. It would increase concentrations of priority air pollutants, such as nitrogen and sulfur oxides. Although on-site generation was not modeled, it is uncertain that on-site generation could comply with the Clean Air Act or the Montana Clean Air Act. Once the power was available from a transmission line (either the buried 34.5-kV line or the overhead 230-kV line), the operation of emergency generators at the mill would be limited to 16 hours during any rolling 12-month period.

Several power sources on the east side of the Cabinet Mountains were considered to serve the mine. One source would require a new 230-kV line to the mine from an existing substation located just north of the town of Libby. The KNF and the DNRC eliminated the Libby Creek alignment from detailed analysis. The major disadvantages of the Libby Creek alignment were that construction costs would be nearly twice that of several other alignments, operating costs would be substantially higher than several other alignments, and all potential alignments would pass through or adjacent to a much higher population density, affecting substantially more private land than other alignments.

The KNF and the DNRC evaluated a number of options for tapping the area's 230-kV system (USDA Forest Service *et al.* 1992). The lead agencies considered a tap on BPA's Noxon-Libby 230-kV transmission line 7 miles southwest of Pleasant Valley, Montana. This alternative, referred to as Trail Creek, would have required a substation tap on the BPA line in a remote area near the junction of Iron Meadow Creek and the Silver Butte Fisher River. In 1992, this option was not retained by the lead agencies for further detailed study because of its remote location, and environmental concerns about crossing an unroaded area.

The KNF and DNRC evaluated alternatives for the proposed transmission line from a proposed tap site on BPA's Noxon-Libby 230-kV transmission line at Sedlak Park west of Pleasant Valley. Three alignments, Miller Creek, North Miller Creek, and Swamp Creek, were analyzed in detail in the 1992 Final EIS. Two additional alternatives, the West Fisher Creek and Miller Creek/Midas Creek options, were eliminated from detailed consideration in 1992 because they offered no advantages in cost or environmental impact over the alternatives carried forward for detailed analysis.

The West Fisher Creek alignment was eliminated from detailed study because it would be longer than other alignments. The West Fisher Creek alternative would affect more private landowners than other 230-kV alternatives analyzed in detail in the 1992 Final EIS. It also would affect more recreational users due to its location along a major forest access road. The Miller Creek/Midas Creek alignment was eliminated from detailed study because of its greater length and the lack of environmental advantages over other alternatives. In the 1992 Final EIS, the KNF and the DNRC recommended the North Miller Creek alternative as providing the best balance for an alignment, considering the factors used in the 1992 analysis (USDA Forest Service *et al.* 1992).

In the 1992 analysis, the lead agencies considered the use of helicopters to erect the transmission line structures as an alternative to conventional construction methods (USDA Forest Service *et al.* 1992). The lead agencies determined that general use of helicopters in line construction would have little environmental advantage because conventional equipment, such as augers, would be required to excavate foundations for the transmission line structures. Disturbance associated with the access required to move this equipment to each pole location could not be avoided unless more expensive and time-consuming methods (such as hand digging of pole foundation holes) were done. Line maintenance costs also would be increased without ground access to each tower. For these reasons, the lead agencies dismissed this method as a recommended line construction alternative.

2.13.10.1.2 Major Facility Siting Analysis by MMC

In 2005, MMC submitted an application to the DEQ (DNRC's successor under the MFSA) for a MFSA certificate to construct a 230-kV transmission line using the North Miller Creek alignment approved in 1993 by DNRC. A transmission line alignment analysis was conducted (Power

Engineers 2005b). The alignment analysis report discussed all the alternatives considered in the 1992 Final EIS, those analyzed in detail and those eliminated from detailed analysis. The alignment analysis report updated the comparison of the three alignments that were carried forward for detailed analysis: North Miller Creek, Miller Creek, and Swamp Creek. Twenty criteria in six broad categories were used in the comparison of these three alternatives. As discussed in MMC's alignment analysis report, MMC considered the North Miller Creek alternative to be the best of the three alternatives using the report's evaluation criteria. Additional discussion of MMC's evaluation criteria and the alternatives comparison is found in the alignment analysis report (Power Engineers 2005b).

2.13.10.2 Updated Agencies' Analysis

The KNF and the DEQ eliminated on-site generation because of high capital costs and the likelihood of other environmental concerns, such as air quality. The agencies' estimate the capital cost of on-site generation to be $37 million. It would increase concentrations of priority air pollutants, such as nitrogen and sulfur oxides. Although on-site generation was not modeled, it is uncertain that on-site generation could comply with the Clean Air Act or the Montana Clean Air Act. A condition of DEQ's draft permit is that once the power was available from a transmission line (either the buried 34.5-kV line or the overhead 230-kV line), operation of emergency generators at the mill would be limited to 16 hours during any rolling 12-month period. The analysis of underground installation is discussed in the next section.

The KNF and the DEQ used an iterative process to develop alternative alignments for the transmission line and to define the criteria with which to evaluate the alternatives. As part of the initial process, the lead agencies mapped and reviewed numerous transmission line alignments. The alignments reviewed were those identified by MMC, modifications of alignments analyzed by MMC, as well as new alignments identified by the lead agencies. The lead agencies also developed criteria with which to evaluate each alternative.

The lead agencies began the screening analysis with the three alignments analyzed in the 1992 Final EIS, as well as the West Fisher Creek alignment. Subsequently, the alignments were slightly modified to improve the alignment. In response to public scoping comments, the lead agencies identified an alternative alignment of a segment immediately north of the proposed Sedlak Park Substation through Plum Creek land. The alignment would locate the line east of MMC's proposed alignment to address visibility of the line from US 2 and area residences, create a buffer between residences and the line, create a buffer between the Fisher River and the line, and establish a more direct alignment north of the Sedlak Park Substation. The lead agencies also considered two alternatives that avoided Plum Creek lands along US 2 encumbered by a conservation easement held by the FWP. The following alternatives were evaluated using a number of technical and environmental criteria (Figure 49):

- North Miller Creek (MMC's Proposal)
- Modified North Miller Creek
- Modified Miller Creek
- Modified West Fisher Creek-1
- Modified Swamp Creek
- Olson Creek
- Porcupine Creek
- Modified West Fisher Creek-2

The Modified Swamp Creek alternative was eliminated due to the greater effects on old growth. The Modified West Fisher Creek 1 was eliminated because it would be longer and would cross more old growth. Because one MFSA siting criterion prefers the use of public lands over private lands, the crossing of more private land by this alignment was also a factor. Although the Olson Creek and Porcupine Creek alternatives would be shorter and cross less private land, these two alternatives were eliminated because they would cross the Barren Peak IRA. The remaining four alternatives were retained for detailed analysis in the Draft EIS. The lead agencies' analysis of possible transmission line alternatives is described in greater detail in the *Transmission Line Screening Report* (ERO Resources Corp. 2006b).

In 2009, the lead agencies released a Draft EIS for public comment. Several owners of private land potentially affected by one or more of the transmission line alignments submitted comments. The lead agencies met with the property owners in the summer 2009. Based on public comment, the agencies alternative alignments, Alternatives C-R, D-R, and E-R, were modified to reduce effects on private land. One of MFSA's requirements is that the DEQ determine that the use of public lands for location of the facility was evaluated and public lands were selected whenever their use is as economically practicable as the use of private lands. The most substantial change in alignment was in Alternatives C-R and D-R. In the Draft EIS, the alignment for Alternatives C and D would traverse an east-facing ridge immediately north-northwest of the Sedlak Park Substation, and would cross Hunter Creek 2 miles north northwest of the substation. The alignment would continue north northwest for 2.5 miles and head west to cross the Fisher River and US 2 a few hundred feet north of MMC's proposed alignment. The alignment would then turn west, generally following the Miller Creek drainage for 2.5 miles, and then traverse up a tributary to Miller Creek. About 7 miles of the alignment was on private land owned by one property owner.

2.13.11 Analysis of Underground Installation of Transmission Line

The lead agencies considered locating the transmission line underground. Underground transmission lines typically have less clearing and do not have the visual impact of the transmission lines and structures. Underground transmission lines typically have significantly fewer faults, fewer voltage sags, and fewer short- and long-duration interruptions. Traditional overhead circuits typically fault about 90 times per 100 miles per year; underground circuits fail less than 10 or 20 times per 100 miles per year. Because overhead circuits have more faults, they cause more voltage sags, more momentary interruptions, and more long-duration interruptions (Electric Power Research Institute 2006).

The agencies reconsidered underground installation after modifying transmission line Alternatives C, D, and E. Locating the line underground would require proximity to an access road for the entire length of the line. Consequently, the agencies based their analysis of underground line installation on the route of Alternative E-R, West Fisher Creek. The underground line would not follow the overhead line route exactly, but would be adjacent to US 2 and NFS road #231. This alignment would allow easy access for construction and maintenance. The line would start at the Sedlak Park Substation.

Two voltages would be feasible for an underground line, 230 kV and 115 kV. Both voltages would be solid dielectric, cross-linked polyethylene, insulated cable in duct banks encased in concrete. Multiple underground cable splicing vaults with access manholes would be required along the route. Generally, the vaults would be required every 1,000 feet. Aboveground to overhead line termination points would be necessary at the Sedlak Park Substation and at the Plant Site Substation. The duct bank would have four 5-inch to 8-inch conduits with a cable in each conduit. One conduit would be a spare conduit and cable for reliability of service in case of a cable failure.

Considerable disturbance would be necessary for construction due to the size of the cable trench and the cable splicing vaults. Trenches are 5 feet deep and vaults are 8 feet high, 10 feet wide, and 20 to 30 feet long. The line length would be about 20 miles.

For the 230-kV option, the proposed BPA Sedlak Substation would stay essentially the same except for the addition of a cable termination system. This could increase the substation cost by 15 percent. The construction cost for the installation would be $3 million per mile or $60 million total. For the 115-kV option, the proposed BPA Sedlak Substation would require a voltage step-down transformer, which would increase the substation construction area and require additional facilities and equipment. It also would require a termination system. The substation costs would increase by about 60 percent for the 115-kV cable option. The construction cost for the cable installation would be $2 million per mile or $40 million total. The agencies eliminated underground installation as a reasonable alternative because of the cost.

2.13.12 Analysis of Change in Transmission Line Voltage

The proposed transmission line voltage to the mine facilities is 230 kV, since the existing voltage of the BPA transmission line being accessed is 230-kV. The substation size is about 2 acres and is located in a narrow land area between US 2 and a wetland area. Any voltage other than 230 kV would require a voltage step down transformer at the substation. A substation with a transformer would require a larger construction area of an additional 1 to 2 acres, which may not be achievable due the land constraints of the area. The cost would also increase between $2,000,000 and $3,000,000 over the proposed substation cost due to the additional facilities and equipment required.

Energy losses would increase with this voltage transformation, both in the transformer and in the lower voltage transmission line to the mine facilities. For example, if the line current is 125 amps at 230-kV, the line current would be 250 amps at 115-kV. Decreasing the line voltage by half would double the amperage of the line current. Power losses on a transmission line are expressed as the current squared times the resistance of the conductor. Doubling of the line current quadruples the line power loss (because 2 squared equals 4).

Based on the 2009 average cost of power for industrial customers from Flathead Electric Cooperative, Inc., the annual transmission line losses at 230 kV would cost $49,000 and the annual transmission line losses at 115 kV would cost $199,000, which is an annual difference of $150,000. If the transmission line were in operation between 20 and 30 years, total increased cost would be $3,000,000 to $4,500,000.

The proposed transmission line conductor size is 795 Drake ACSR, which has a maximum load current rating of five times the anticipated load current for a 50-megawatt power requirement at the mine. This conductor was chosen for the 230-kV line because it is the generally accepted minimum size to be installed on a 230-kV line. This conductor meets the required voltage drop and conductor loss requirements to serve the mine facilities adequately. The 795 Drake ACSR conductor also has the strength requirements needed for the span lengths being proposed. As the conductor size is reduced, the resistance is increased, which increases voltage drop to the mine facilities and increases transmission line losses. Reducing conductor size also would decrease strength, which would reduce the desired span lengths that could be achieved.

If the voltage were 115 kV for the transmission line, the conductor would remain the same due to the increased losses previously discussed, similar span lengths being desired, and to meet the voltage drop requirements for the mine facility 50-megawatt power load. Additional studies would be required to verify the 795 Drake ACSR conductor size was adequate at 115 kV.

The construction cost difference between 230-kV transmission and 115-kV transmission would be minimal because structure heights would be almost identical and additional 115-kV structures would be required in the long span areas to meet the design requirements. In general, additional 115-kV structures would be required throughout the length of the line because of the reduced span length allowed due to reduced structure strength. Increased costs would be incurred for access roads to these additional structures and/or increased costs for additional structures required to be helicopter constructed. Right-of-way clearing widths would be reduced only slightly since the conductor blowout condition would dictate the clearing width.

Reliability of a 230-kV system would be superior to a 115-kV system. The basic design strength of 115-kV structures would be less than the design strength of the 230-kV structures. Any other voltage other than 230 kV or 115 kV would not be sufficient to serve the proposed mine facility power requirement. The lead agencies eliminated a 115-kV system because of increased disturbance and cost, and decreased reliability.

2.13.13 Forest Plan Consistency

2.13.13.1 Mine Facilities

As discussed in section 2.2, *Development of Alternatives,* the lead agencies did not identify an alternative that would comply with all 2015 KFP direction. Although the 1987 KFP was amended with management area changes in 1992 to accommodate the Montanore Project as then approved, the amendment did not accommodate all proposed updates for disturbance at the Ramsey Plant Site and the Little Cherry Creek Impoundment Site. As discussed in the Montanore Project Draft EIS, the lead agencies did not identify alternative locations for mine facilities that would avoid amending the 1987 KFP to accommodate the proposed operating permit areas of plant site and the tailings impoundment.

After the publication of the 2009 Draft EIS and the 2011 Supplemental Draft EIS, and just prior to the release of the 2015 Draft KNF ROD, the 2015 revision of the 2015 KFP was completed. Although the 2015 KFP does not require amendments to management area allocations to accommodate the proposed activities, project-specific variances from two standards and four guidelines required for forest plan consistency were identified during the objection period. As disclosed in the Draft ROD, the final decision would include any amendments to the 2015 KFP necessary to align the project and the 2015 KFP.

One of the issues discussed in section 2.13.2, *Regulatory Changes* is the KNF's incorporation and modification of the INFS standards and guidelines. One of the INFS guidelines, Minerals Management 3 (MM-3), prohibits solid and sanitary waste facilities in RHCAs, unless no alternative exists. Section 2.13.5, *Tailings Impoundment Location Options* and section 2.13.7, *Surface Tailings Disposal Method Options* discuss the lead agencies' analysis of alternative tailings disposal methods and locations. Compliance with INFS was a key criterion in the alternatives analysis. To be consistent with INFS standard MM-3, the lead agencies developed Alternatives 3 and 4 to minimize the extent to which RHCAs would be affected. Alternatives that would eliminate all effects on RHCAs were not practicable.

2.13.13.2 Transmission Line Facilities

In the 1992 Final EIS, on-site generation of power was considered in lieu of a transmission line. On-site generation would avoid the need to amend the 2015 KFP scenic integrity objective guideline to accommodate the transmission line. The lead agencies eliminated on-site generation because of high capital costs and the likelihood of additional costs to address environmental concerns, such as air quality (USDA Forest Service *et al.* 1992). On-site generation was eliminated in the current alternatives analysis for the same reasons. The agencies' estimate the capital cost of on-site generation to be $37 million. It would increase concentrations of priority air pollutants, such as nitrogen and sulfur oxides. Although on-site generation was not modeled, it is uncertain that on-site generation could comply with the Clean Air Act or the Montana Clean Air Act. A condition of DEQ's draft permit is that once the power was available from a transmission line (either the buried 34.5-kV line or the overhead 230-kV line), operation of emergency generators at the mill would be limited to 16 hours during any rolling 12-month period. Although alternative transmission line locations were evaluated to reduce visual impacts, none would be fully consistent with 2015 KFP scenic integrity objectives.

The lead agencies considered a power source other than BPA's Noxon-Libby 230-kV transmission line. One source would require a new line to the mine from a substation located just north of the town of Libby. The primary advantage of the Libby Creek alignment was that it would follow existing transportation and transmission line corridors over much of its length. The major disadvantages of the Libby Creek alignment were that construction costs would be nearly twice that of several other alignments; operating costs would be substantially higher than several other alignments; and all potential alignments would pass through and adjacent to a much higher population density, affecting substantially more private land than other alignments. It would also require an amendment to the 2015 KFP to be consistent with 2015 KFP scenic integrity objectives.

2.14 Comparison of Alternatives

The alternatives analyzed in this EIS were developed in response to the significant issues identified during scoping. The lead agencies identified seven significant environmental issues to drive development of alternatives and evaluation of impacts (see section 2.1.2, *Issues*). These alternatives are described in detail in this chapter. A detailed discussion of the alternatives' impacts is contained in Chapter 3. The effects of the alternatives are summarized in the *Summary* section of this EIS.

2.15 Rationale for Preferred Alternatives

The KNF Supervisor and the DEQ Director have identified Mine Alternative 3 (the Agency Mitigated Poorman Impoundment Alternative) and Transmission Line Alternative D-R (the Miller Creek Transmission Line Alternative) as the preferred mine and transmission line alternatives. The KNF Supervisor and the DEQ Director based their preferred alternatives on a thorough review of the effects analysis in the EIS, review of public and agency concerns received on this project, consultation with cooperating and regulatory agencies, consultation with interested tribes, and the project record.

Mine Alternative 3 and Transmission Line Alternative D-R are the most environmentally preferable of the action alternatives and fulfill the project's purpose, need, and benefit (section 1.5, *Purpose and Need*). The agencies' specific RODs approval of Alternatives 3 and D-R will comply with federal and state laws and/or regulation and policy mandates applicable to each agency (section 1.6, *Agency Roles, Responsibilities, and Decisions*). As discussed below, Mine Alternative 3 and Transmission Line Alternative D-R address the seven key issues identified during scoping (section 2.1.2, *Issues*).

2.15.1 Preferred Mine Alternative

Alternative 3, which would use the Poorman Tailings Impoundment Site instead of the Little Cherry Creek Tailings Impoundment Site, would avoid the diversion of a perennial stream, which would have been necessary under both Alternative 2 (Proposed Action) and Alternative 4 (Issue 2). Mine Alternative 3 also would modify MMC's proposed water management plan to address the uncertainties about the quality of the mine and adit inflows, the effectiveness of LAD for primary treatment (LAD would not be used), the quantity of water that the LAD Areas would be capable of receiving, and the effect on surface water and groundwater quality.

Alternative 3 would incorporate additional feasible and practicable measures to minimize adverse environmental impacts on groundwater and surface water resources. The measures include refining the three-dimensional groundwater model to assess effects, increasing mining buffer zones, installing multiple, site-specifically designed adit plugs at closure, grouting, and (if necessary) leaving mine void barriers. Using thickened tailings would reduce MMC's appropriation from the Libby Creek and minimize effects on Libby Creek streamflow. To avoid adversely affecting senior water rights, MMC would cease diversions from Libby Creek and discharge treated water to Libby Creek from the Water Treatment Plant during low flows. Discharges to Ramsey Creek from the Water Treatment Plant at low flows also may be needed for the same reason. All discharges of wastewater would be subject to MPDES permitted effluent limits.

Alternative 3 would minimize wetland effects by using the Poorman Impoundment Site, rather than the Little Cherry Creek Impoundment Site (Alternatives 2 and 4) (Issue 7). All unavoidable effects to wetlands (jurisdictional and isolated) would be mitigated through implementation of the alternative's mitigation measures, which would more effectively replace lost functions than the Alternative 2 Wetland Mitigation Plan.

Alternative 3 would address the need for more comprehensive analyses of metals, at appropriate detection limits, through the development and implementation of a Geochemical Sampling and Analysis Plan (Issue 1). The alternative also would avoid the use of waste rock in plant site construction, require that waste rock be stored either at the Libby Adit Site or within the footprint of the Poorman Impoundment Site before use, and mandate that any waste rock not used in construction would be either placed back underground or used in regrading the tailings impoundment at the end of operations.

Alternative 3 would minimize effects on core grizzly bear habitat and lynx by concentrating disturbance from plant facilities and adits in the Libby Creek drainage (Issue 5). Alternative 3 would require MMC to secure or protect replacement grizzly bear habitat on about 5,500 acres of private lands in the CYE to be managed in perpetuity for the grizzly bear. As compared to other action alternatives, Alternative 3 would incorporate additional feasible and practicable measures to minimize adverse environmental impacts on wildlife habitat (Issue 6). The mitigation and monitoring requirements of the alternative would minimize impacts on wildlife and their habitats.

The grizzly bear lands may improve connectivity for wildlife and provide additional habitat for all wildlife species and their prey.

By locating the mine plant (mill and other mine facilities) between Libby and Ramsey creeks (the Libby Plant Site) rather than in the upper Ramsey Creek drainage (the Proposed Action), Mine Alternative 3 would minimize effects on RHCAs (Issue 3). This alternative also would minimize effects on bull trout and sensitive species and includes a bull trout mitigation plan. Mine Alternative 3 would minimize visual effects by reducing the acres that would be disturbed (1,542 acres) and includes a number of measures to harmonize operations with scenic values, such as requiring vegetation clearing methods that maintain scenic quality, painting of structures, and modifying the reclamation plan for the tailings impoundment (Issue 4).

2.15.2 Preferred Transmission Line Alternative

Transmission Line Alternative D-R would avoid an alignment near the Fisher River (Proposed Action) and would minimize the crossing of areas with highly erosive soils and those that are subject to high sediment deliver (Issues 2 and 3). This alternative also would use a helicopter for vegetation clearing and structure construction in some locations, reducing the number and length of new access roads that would be needed. A Vegetation Removal and Disposition Plan would minimize vegetation clearing, particularly in riparian areas.

Transmission Line Alternative D-R would reduce the visibility of the transmission line from US 2 and the CMW, and fewer residences would be within 0.5 mile of the line than under the Proposed Action (Issue 4). Although the alignment would be visible from Howard Lake, the use of H-frame structures, which are shorter than steel monopoles, would mitigate some of these visual impacts above the tree line.

Transmission Line Alternative D-R would minimize effects on threatened or endangered species by routing the alignment along Miller Creek to avoid core grizzly bear and lynx habitat in Miller Creek and the unnamed tributary of Miller Creek (Issue 5). Use of a helicopter for vegetation clearing and structure construction (reducing the number of access roads and displacement effects), as well as limiting construction to between June 16 and October 14 would also mitigate effects on threatened or endangered species and other wildlife species (Issue 6). The mitigation and monitoring requirements of Transmission Line Alternative D-R minimize effects on wildlife and their habitats (Issues 5 and 6). Road closures for wildlife mitigation are maximized in Transmission Line Alternative D-R (as compared to other action alternatives), and the alternative incorporates additional feasible and practicable measures to minimize adverse environmental impacts on wildlife habitat (Issue 6).

Transmission Line Alternative D-R would minimize effects to wetlands (jurisdictional and isolated) and other waters of the U.S. (Issue 7). Direct effects to wetlands would be avoided by the placement of transmission line facilities and roads, and indirect effects would be minimized through BMPs and appropriate stream crossings.

Chapter 3. Affected Environment and Environmental Consequences

This chapter describes the environment (including its human elements) in the analysis area and discusses the environmental consequences by resource that may result from implementation of each alternative. It provides the scientific and analytic basis for the comparison of alternatives presented in the *Summary* section of this EIS.

3.1 Terms Used in this EIS

3.1.1 Direct, Indirect, and Cumulative Effects

Environmental effects can be direct, indirect, or cumulative and long or short in duration. Direct effects are those that are caused by the action and occur at the same time and place. Indirect effects are those that are caused by the action and are later in time or further removed in distance, but are still reasonably foreseeable (40 CFR 1508.8). The short-term impacts and uses for the mining related aspects of the project are those that would occur during the life of the project. Short-term impacts associated with the transmission line are those that would occur during construction and the 5 years that the DEQ would hold the bond for reclamation of transmission line construction-related disturbances. The KNF and the DEQ would hold a separate bond for transmission line decommissioning. Long-term impacts of the project are those that would persist beyond mine closure and final reclamation.

The project would consist of five main phases – evaluation, construction, operations, closure, and post-closure. In general, the Evaluation Phase is estimated at 2 years, Construction Phase at 3 years and potentially up through a fourth year, Operations Phase from 16 to 20 years, and the mine Closure and Post-Closure Phases up to 20 years (or longer if water quality monitoring still indicated a need for treatment). An Operations Phase of 16 to 20 years is predicated on recovering 120 million tons of ore using production rates shown in Table 11, which are of up to 20,000 tons per day. MMC's Preliminary Economic Assessment used a recoverable resource of 58.8 million tons and a production rate of 12,500 tons per day in the assessment (Mine and Quarry Engineering Services 2011). A recoverable resource of 58.8 million tons at a production rate of 12,500 tons per day would take 13 years to mine. A recoverable resource of 120 million tons at a production rate of 12,500 tons per day would take 26 years to mine. Because the recoverable resource and production rate are estimates, the agencies used a 20-year duration for operations in their analyses. The duration of any particular phase may vary and be longer or shorter from that analyzed. A change in production rate would reduce mill water requirements, water appropriations, and wastewater discharges and associated effects on surface water and aquatic resources. A change in project duration would not affect the severity or geographical scope of other effects.

After mining and milling operations ceased, reclamation and closure activities would consist generally of two phases. The first phase would involve the removal of underground and surface facilities, closure of underground workings, and reclamation of surface disturbances in accordance with the approved operating plan. Included in this would be the dewatering and capping of the tailings impoundment as described in section 2.4.3.1.6, *Tailings Impoundment and*

Borrow Areas. The agencies estimate that the dewatering of the tailings impoundment may last from 5 to 20 years, and this timeframe is assessed in the impact analysis that follows in this chapter.

The second phase would involve long-term operations and maintenance of specific facilities, such as the Water Treatment Plant or the seepage collection system at the tailings impoundment. MMC would maintain and operate these facilities until BHES Order limits or applicable nondegradation criteria were met in all receiving waters from any specific discharge. MMC also would continue water monitoring as long as the MPDES permit was in effect. As long as post-closure water treatment operated, the agencies would require a bond for the operation and maintenance of the Water Treatment Plant. The level of human activity associated with facility operation, maintenance, and monitoring is unknown, but has the potential of being a daily requirement and year-round in duration. The length of time that the second phase of closure activities would occur is not known, but may be decades or more.

Cumulative effects are those that result from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions (40 CFR 1508.7). Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Past and current activities and natural events have contributed to creating the existing conditions and trends. The agencies used scoping to determine whether, and to what extent, information about the effects of a past action was useful for the effects analysis of the Montanore Project. The agencies conducted the cumulative effects analysis by focusing on the current aggregate effects of past actions (Council on Environmental Quality 2005), as described in the *Affected Environment* sections of this chapter. Additionally, some of these activities may continue to produce environmental effects on issues or resources relevant to the proposal. The list of activities considered in the cumulative effects analysis was taken from the KNF's Schedule of Proposed Actions and from KNF program managers. Figure 50 shows activities considered in the cumulative effects analysis.

Activities on public and private lands have been considered in the cumulative effects analysis and are described in the cumulative effects section for each resource. Data on private lands are the best available information derived from landowners and field verification, and are generally more limited than data on public lands. The types of actions (past and current or reasonably foreseeable) analyzed in the cumulative effects analysis are grouped into four categories:

- Mining Activities
- KNF Land Management Activities
- Private Land Activities
- Other Government Agency Activities

3.1.2 Irreversible or Irretrievable Commitment of Resources

As required by NEPA, this section also includes a discussion by resource of any irreversible or irretrievable commitment of resources that would result from implementing the alternatives. An irreversible commitment of resources means that non-renewable resources are consumed or destroyed. These resources are permanently lost due to project implementation. An irretrievable commitment of resources is the loss of resources or resource production, or use of renewable resources, during project construction and during the period of time that the project is in place.

3.1.3 Incomplete or Unavailable Information

Underground mine development occurs in rock formations that are hundreds to thousands of feet in the subsurface, hidden from view, and inaccessible other than through mine development or extensive drillholes. This limits the amount of data initially available and means there is a degree of uncertainty inherent in evaluating the specific impacts to groundwater and its connected resources such as GDEs and surface water. While models and estimates have been developed based on the best available information, actual knowledge of underground conditions may not be known or knowable until underground operations are underway.

NEPA regulations describe how Federal agencies must handle instances where information relevant to evaluating reasonably foreseeable adverse impacts of the alternatives is incomplete or unavailable (40 CFR 1502.22). "Incomplete information" refers to information which the agency cannot obtain because the overall costs of doing so are exorbitant. The term "unavailable information" refers to information which cannot be obtained because the means to obtain it are not known. "Overall costs" encompasses financial costs and other costs such as costs in terms of time (delay) and personnel (51 Federal Register 15621). As a Federal agency, the KNF is to obtain information for an EIS if: 1) it is needed for evaluating reasonably foreseeable significant adverse effects; 2) it is essential to a make reasoned choice among alternatives; and 3) the overall costs of obtaining it are not exorbitant. In following resource sections, the EIS discloses the adequacy of the baseline information, additional data collection that would occur in the future, and its relevance to making a reasoned choice among alternatives.

3.2 Past and Current Actions

3.2.1 Mining Activities

3.2.1.1 Troy Mine

ASARCO leased the Troy Project from Kennecott in 1973 with plans to build a mine. Underground production began in 1981 and lasted for a period of 12 years ending in 1993. The mine was subsequently in care and maintenance status. Revett Mining Co., Inc. (Revett) acquired the Troy Mine, operated by Troy Mine, Inc., a wholly owned subsidiary of Revett in 1999. In late 2004, the Troy Mine was brought back into production. In December 2012, Revett suspended all underground mining activities following back and pillar failures in both the north and south ore bodies in the Middle Quartzite of the Revett Formation that manifested as surface cracking and shallow subsidence (Call & Nicholas 2014). This failure cut off the access to the active mining areas located in the C and I beds. As a result, Revett developed two parallel drifts to re-gain access to the C bed first, and then to the I bed as part of a new mine planned development. In late 2014, Revett had regained access to C bed and resumed operation of the mill with limited production. In early 2015, Revett ceased operations because of poor global metal prices and unfavorable market conditions. In the same year, Hecla Mining Company (Hecla), purchased Revett, including the Troy Mine. Hecla currently has no plans to re-open the Troy Mine and intends to fully reclaim the site. Currently, the Troy Mine is in care and maintenance status.

In 1978, the KNF and the DSL issued a Draft and Final EIS that addressed potential impacts from both the operation and reclamation of the Troy Mine. In 1999, the agencies initiated a review of the Troy Mine reclamation bond. The agencies notified the mining company that the approved 1978 Reclamation Plan needed to be revised and a substantial bond increase would be required, as the approved 1978 Reclamation Plan does not meet state or federal requirements for mine water discharge. In 2006, Troy Mine, Inc. submitted a revised reclamation plan to the agencies for approval that updates the approved 1978 plan in anticipation of future mine reclamation. The agencies issued a Final EIS and a ROD on the revised reclamation plan in 2012. Currently, Hecla is working with the agencies to obtain an approved final reclamation plan.

3.2.1.2 Other Minerals Activities

Numerous placer and lode mining claims exist within the Treasure, Crazy, Silverfish, and Rock PSUs. Some of these claims are the site of active mines, and several plans of operations have been approved for in-stream suction dredging and exploratory digging in these PSUs. Other claims show evidence of having been mined in the past, and are currently inactive. In some cases the mines are abandoned and the mineral rights are not currently under claim. Closure of abandoned mines, and in some cases inactive mines, for safety purposes is ongoing on the Forest. Use of grates, which allow bat ingress and egress, are the most common and preferred closure type. Common variety type mineral material resources include numerous gravel pits on National Forest System lands which provide mineral material for Forest Service road projects.

3.2.2 KNF Management Activities

Past and current KNF management actions are listed in Appendix E. One outfitter holds a permit for hunting and trail rides within the Silverfish PSU. A hunting camp is permitted near but outside the CMW. This camp is accessed by a trail using foot or saddle and pack stock.

3.2.3 Private Land Activities

3.2.3.1 Libby Creek Placer Timber Harvest

Libby Creek Placer Company has removed 50,000 to 100,000 board feet of timber annually (except in 2007) on the Libby Placer property. About 20 loads or less were removed from the property per year for 3 years beginning in 2007.

3.2.3.2 Avista-funded Bull Trout Recovery Activities

Avista Corp. is funding ongoing fish trapping/monitoring activities in Rock Creek and East Fork Bull River. Both drainages have screw traps and weirs for capturing out-migrating juvenile trout. In addition, adult bull trout are being captured below Cabinet Gorge Dam, and based on their genetic assignment are transported above and afforded access to both Rock Creek and East Fork Bull River. In the East Fork Bull River, Avista and FWP are implementing a non-native suppression program that involves active and passive methods to remove and exclude non-native fish from the river. Fish greater than 151 mm in length are being moved to other areas of the Bull River. In cooperation with FWP, annual bull trout spawning surveys are conducted annually, and overall fish population surveys are conducted on a predetermined schedule. The most recent channel restoration in the East Fork Bull River occurred in 2007. Avista and others funded the KNF to complete 1,100 feet of channel restoration to route the stream back into a historical channel to avoid a newly created chronic sediment source. Most of the work occurred on National Forest System land.

3.2.4 Other Government Agency Activities

3.2.4.1 DNRC Habitat Conservation Plan

The DNRC Trust Land Management Division developed a voluntary multi-species habitat conservation plan (HCP) with technical assistance from the USFWS (DNRC 2011). The HCP intends to sustain DNRC management practices over time while conserving habitat for five fish and wildlife species, three of which are listed under the ESA. The HCP was prepared to meet regulatory compliance with Section 10(a)(1)(B) of the ESA. Section 10 provides a regulatory mechanism to allow for the incidental take of federally endangered and threatened species of wildlife by private interests and non-federal government agencies during lawful land practices. The HCP permit period extends 50 years and covers forest management activities on classified forested State trust lands that provide habitat for species currently listed or having the potential to be listed under the ESA. Those species are: grizzly bear, Canada lynx, bull trout, westslope cutthroat trout, and redband trout. Activities covered by the HCP are timber management activities, road construction, reconstruction, maintenance, and use and associated gravel quarrying for forest road surface materials, and grazing. One State land parcel subject to the HCP is found along the agencies' transmission line alternatives. Another State land parcel subject to the HCP is along Libby Creek Road. State lands along US 2 managed for transportation purposes are not covered by the HCP.

3.2.4.2 FWP-Plum Creek Conservation Easement

In 2003, Plum Creek initiated a 7-year transaction to sell a conservation easement to the FWP on 142,000 acres in northwest Montana. The Plum Creek Conservation Easement in the analysis area is discussed in section 3.15, *Land Use* and shown on Figure 78.

3.3 Reasonably Foreseeable Future Actions or Conditions

3.3.1 Climate Change

Climate change is not a reasonably foreseeable future action, but may represent a reasonably foreseeable future affected environment. Information on the effects of the project on greenhouse gas emissions is discussed in section 3.4, *Air Quality*. The potential project effects associated with climate change are described in section 3.6, *Aquatic Life and Fisheries*, section 3.10, *Groundwater Hydrology*, section 3.11, *Surface Water Hydrology*, section 3.13, *Water Quality*, and, for those wildlife species potentially affected, in section 3.25, *Wildlife*.

The USDA Forest Service issued the Kootenai-Idaho Panhandle Plan Revision Zone (KIPZ) Climate Change Report in 2010 (USDA Forest Service 2010a). The report was prepared for revision of the forest plans of the Kootenai and Idaho Panhandle National Forests and provided a synthesis of the best available scientific information on climate change and its potential impacts on the resources and ecosystems of northern Idaho and northwest Montana. It summarized available information on climate changes that have been observed over the last 100 years and the amount of change projected in the coming decades. Global climate models are the principal tool for evaluating future changes and trends in climate. Models are run with different scenarios of global socioeconomic change. The different scenarios lead to different levels of greenhouse gas and sulfate emissions. The KIPZ Climate Change Report provided an evaluation of the potential implications for those trends for resources and ecosystems of the Kootenai and Idaho Panhandle

National Forests. It described key areas of uncertainty associated with climate change trends and model results.

The Department of the Interior, Bureau of Reclamation issued three reports on climate change in 2011 (Reclamation 2011a, 2011b, 2011c). One report (Reclamation 2011a) provided a region-specific summary of recent literature on the past and projected effects of climate change on hydrology and water resources and then summarized implications for key resources in the 17 Western States. The report's narratives were meant for potential use in environmental documents, such as EISs and BAs (Reclamation 2011a). A second report (Reclamation 2011b) described Reclamation's assessments that involved developing hydrologic projections associated with a large collection of global climate projections featured in the Intergovernmental Panel on Climate Change Fourth Assessment (Intergovernmental Panel on Climate Change 2007) and developed as part of the World Climate Research Program's Coupled Model Intercomparison Project phase 3 (CMIP3). CMIP3 projections are regarded as the best available information for describing future global climate possibilities (Reclamation 2011b). A third report (Reclamation 2011c) summarized Reclamation's analysis in a report to the U.S. Congress. The following discussion is based on these reports, and focuses on the Pacific Northwest. Where available, this discussion includes projections for northern and eastern subbasins in which the Montanore Project analysis area occurs. Two of the cited reports (Reclamation 2011b, 2011c) describe the uncertainties associated with the projections in detail, such as uncertainties about future greenhouse emissions pathways and physical processes that affect climate. The Bureau of Reclamation (2011c) stated that "the projected changes have geographic variation; they vary through time, and the progression of change through time varies among climate projection ensemble members" and that "some geographic complexities of climate change emerge over the Columbia River Basin when climate projections are inspected location by location."

3.3.2 Mining Activities

3.3.2.1 Rock Creek Project

The Rock Creek Project is a proposed underground copper and silver mine and mill/concentrator complex near Noxon, in Sanders County, Montana. RCR would be the mine operator. The KNF and the DEQ issued a joint ROD on the project in 2001 (USDA Forest Service and DEQ 2001) and the KNF issued a new ROD in 2003 (USDA Forest Service 2003a) following a revised USFWS Biological Opinion (USFWS 2003a). The Final Biological Opinion on the project was issued in 2006 (USFWS 2006). A supplement to the Final Biological Opinion was issued in 2007 (USFWS 2007a). The Forest Service is responding to the United States District Court Opinion in Rock Creek Alliance *et al*. v. USDA Forest Service that found deficiencies in the 2001 Rock Creek Project Final EIS. The 2010 court order vacated the Forest Service's ROD approving the Rock Creek Project, and remanded the 2001 Final EIS to the Forest Service for further action consistent with the Court's Opinion. Based on the court ruling, the Forest Service will issue a Supplemental EIS and a new ROD.

The Rock Creek Project is approved by the DEQ. RCR has not posted a reclamation bond for the operating permit and the DEQ has not issued an operating permit. The DEQ issued Exploration License 00663 in 2009 for construction of an evaluation adit. RCR initiated activities approved on private land. RCR posted a portion of a reclamation bond with the DEQ before implementing approved activities.

The Rock Creek Project would include relocation of the lower portion of NFS road #150, and the construction of a mill/concentrator for ore processing, mine waste disposal facilities, various pipelines and access roads, a 230-kV transmission line and associated substation, a rail loading area for transportation of concentrate, and water treatment facilities. The operating permit area for the agencies' preferred alternative identified in the 2001 RODs (Alternative V) would be 1,560 acres (749 acres of private and 811 acres of National Forest System lands). The project would disturb 482 acres, of which 140 acres would be National Forest System lands, and reduce grizzly bear habitat effectiveness on an estimated 7,044 acres during construction and 6,428 acres during operations. The life of the Rock Creek Project is anticipated to be 35 years. The Rock Creek ore deposit is located beneath and adjacent to the CMW. The ore deposit, mill, and other facilities would be located in the Kaniksu National Forest, which is administered by the KNF in Montana. Access to the proposed project site would be via MT 200 and NFS road #150, or the Rock Creek Road.

An evaluation adit would be constructed above the West Fork Rock Creek off of NFS road #2741 near the CMW to gather additional data and to provide ventilation during mining. Support facilities would be constructed, including a wastewater treatment facility to handle water from the evaluation adit before discharge to infiltration ponds on private land in the proposed tailings storage facility.

The underground mining operation would use a room-and-pillar mining method. The mineralized zone under the CMW would be accessed through twin adits driven from outside the CMW. A fourth adit may be constructed for ventilation intake with a portal in the CMW if needed. Ore concentrate produced during the milling process would be transported from the mill to the rail loading area via pipeline and then shipped to a smelter by rail. The tailings would be deposited as a paste in an impoundment behind an embankment.

Mine water would be stored seasonally in underground workings; excess water would be discharged to the Clark Fork River after treatment. The water treatment system would include semi-passive biotreatment and a reverse osmosis system. At the end of operations, all remaining surface area disturbances and facilities except for the Water Treatment Plant and associated pipelines would be reclaimed. Water treatment of mine water and tailings seepage would continue as long as necessary until each water source met appropriate water quality standards or limits without treatment. The mine adits would either be a) plugged with concrete bulkheads and sealed once the mine water met groundwater or surface water quality standards, and the mine workings flooded with mine water, or b) sealed against unauthorized access and the mine water drained or pumped, after treatment, if necessary, to the Clark Fork River in perpetuity.

Development of the evaluation adit would take 18 to 24 months. Work would start with 23 employees in the first quarter and increase to a maximum of 73 workers in the fourth quarter. Mine construction might immediately follow the adit work, or a period of inactivity could last months, or even years, between the two phases. Mine construction and production startup would take about 3.5 years. During the initial phase of mine construction, the entire workforce would consist of an estimated 72 employees, then it is estimated 275 contract construction personnel would be brought onto the project for 18 months. Employment of company and contract workers would peak at 348 during mine construction, with the minimum employment of 180 mine workers following this peak at about year 4 of construction. Permanent operating employment is projected to stabilize at 340. The project would operate 24 hours per day, 7 days per week, and 354 days per year. At the end of production, there would be a 2-year shutdown and reclamation period employing 35 workers. Limited employment would continue as long as water treatment was necessary.

Project mitigation would include the following grizzly bear mitigation measures:

- RCR would acquire perpetual conservation easements or purchase replacement grizzly bear habitat (2,350 acres). Of this, 53 acres would be acquired before evaluation adit construction, an additional 1,721 acres before mine construction, 10 acres before the air-intake ventilation adit, and 566 acres before mine operation.
- RCR would secure or protect from development and use 100 acres of replacement habitat.
- The KNF would place an earthen barrier on NFS road #4784 within 1 year of issuing approval for the evaluation adit.
- Before construction, the KNF would place an earthen barrier on 1.6 miles of NFS road #2285, 0.18 miles of NFS road #2741X, and gate 0.5 mile of NFS road #2741A and 2.92 miles of NFS road #150 year-long.
- RCR would fund two local FWP grizzly bear management specialist positions (with focus on public information and education) and a local FWP law enforcement position.
- RCR would defer the construction phase of the mine until at least six female grizzly bears have been augmented into the Cabinet Mountains portion of the Recovery Zone (south of US 2); this requirement has been fulfilled.

Among the monitoring and mitigation measures implemented by RCR are completing a collection agreement with FWP for grizzly bear mitigation, providing $468,603 to FWP toward funding of the grizzly bear management specialist and initial funding of other grizzly bear mitigation items, and acquiring 928 acres of grizzly bear habitat to be conveyed to the Forest Service or placed in a permanent conservation easement.

3.3.2.2 Libby Creek Ventures Drilling Plan

Libby Creek Ventures proposed the drilling of three borings adjacent to the Upper Libby Creek Road (NFS road #2316) on its two claims located in Section 15, Township 27N, Range 31 West. A 20-ton rotary-hammer type truck-mounted drill rig with a trailer and two pick-up trucks will be used to drill the holes and the active drilling will take place during 3 days. Mobilization and equipment maintenance may increase the total active time to 1 week. The KNF's approved Plan of Operations expired on October 18, 2011 (USDA Forest Service 2007b). To date, Libby Creek Ventures has not implemented the project, but it is reasonably foreseeable that the action will occur. About 1 acre of surface disturbance would be associated with the drilling project.

3.3.3 KNF Management Activities

3.3.3.1 Wayup Mine/Fourth of July Road Access

The KNF completed an EIS and issued a ROD for the Wayup Mine and Fourth of July Road Access. The proposed action will permit access across National Forest System lands to private property located in the upper West Fisher Creek drainage. The Wayup Mine is located in the headwaters of West Fisher Creek and the Fourth of July is located near Lower Geiger Lake (USDA Forest Service 2000a, 2000b). The Wayup Mine proposal will involve reconstruction, maintenance, spot reconstruction, and use of two existing roads. These roads will provide the proponent access across National Forest System lands to about 40 acres of private property known as the Wayup Mine. The first road is an existing non-system road and the second road is NFS road #6746. The Fourth of July proposal will involve reconstruction of 0.72 mile of road and will begin at the end of NFS road #6748 at the Lake Creek trailhead and proceed southwest on the non-system Irish Boy Mine road to a proposed bridge site on Lake Creek. Reconstruction will consist of clearing trees, brush, and stumps from the existing road corridor. It will also include removing slumps, outsloping and installing surface drainage structures, and slash disposal. New construction of 1.8 miles of road would begin at the proposed bridge site and extend to the Fourth of July parcel. Construction would consist of clearing trees, brush, and stumps for a road corridor up to 60 feet wide on steep slopes, earthmoving to create a 12- to 16-foot surface, installation of road surface drainage structures and culverts, construction of one bridge, and slash disposal. USFWS consultation would be necessary before implementation of the Wayup Mine/Fourth of July Road Access project, along with possible further analysis and public involvement.

3.3.3.2 Miller-West Fisher Vegetation Management Project

The KNF prepared an EIS to disclose the environmental effects of vegetation management through commercial timber harvest, precommercial thinning, and prescribed fire; access management changes; trail construction and improvement; treatment of fuels in campgrounds; and watershed rehabilitation activities. The project area is 20 miles south of Libby, Montana in the Silverfish PSU on the KNF’s Libby Ranger District and contains Miller, West Fisher, and Silver Butte watersheds. A ROD was signed in 2009. Alternative 6-Modified of the Miller-West Fisher Vegetation Management Project EIS was the KNF’s selected alternative and is used in the cumulative effects analysis. This decision was remanded to the KNF by the Montana District Court. Additional analysis for the project was required. During this additional analysis, the KNF dropped helicopter logging from the project due to long-term economic infeasibility. These changes are detailed in the Miller-West Fisher Supplemental EIS and modified ROD. With these changes, the project would consist of:

- Vegetation treatments on about 1,898 acres, including commercial timber harvest and associated fuel treatments including 1,206 acres of intermediate harvest and regeneration harvest on 692 acres, precommercial thinning on 351 acres, and prescribed burning without associated timber harvest on 2,830 acres.
- Road and access management, including access changes on 1.92 miles of road; 3.29 miles of new temporary road construction, and 19.2 miles of road storage, and 1.43 miles of road decommissioning; improvement, construction; reconstruction of 5.9 miles of trail tread; and removal of 17 culverts.
- Fuels and hazardous tree removal in Lake Creek Campground.
- Watershed condition improvement in the form of BMP implementation, including installation of ditch relief culverts, culvert replacement, surface water deflectors, and cleaning ditches is proposed for all haul routes. Additional BMP work on roads not used for timber removal is proposed and will be performed as funding becomes available.
- Trail and trailhead improvements.
- Creation of in-stream pools in Miller Creek and stabilization of streambanks in West Fisher Creek.

- Design features and mitigations to maintain and protect resource values.

Alternative 6-Modified activities would occur in two sequential phases (Phase I and Phase II) to maintain current levels of grizzly bear core habitat. In Phase I, vegetation would be treated in the North Fork Miller Creek. After North Fork Miller Creek vegetation treatments were complete, NFS road #4725 would be barriered and placed into intermittent stored service, creating core habitat. During Phase II, vegetation would be treated in the Teeters Peak area, which currently provides grizzly bear core habitat. To access the Teeters Peak area, the earthen barrier on the currently closed NFS road #6743 would be replaced with a gate that would remain closed during temporary road construction, logging, and road storage work. The gate on NFS road #6743 would be replaced by a new earthen barrier when activities in the Teeters Peak area were complete.

Mitigation for the Montanore Project also includes replacing the existing gate on NFS road #4725 with an earthen barrier to restrict motorized access year round and create grizzly bear core habitat. Because the access change on NFS road #4725 was first proposed for the Montanore Project, the Montanore Project Final EIS analysis assumes the road would be barriered before initiation of the Construction Phase as part of the Montanore Project mitigation.

3.3.3.3 Flower Creek Vegetation Management Project

The KNF prepared an EIS to disclose the environmental effects of vegetation management on 990 acres. The project area is 3 miles south of Libby, Montana in the Flower Creek watershed, which is the municipal water source for Libby. Vegetation treatments will include commercial timber harvest and associated fuel reduction, fuel reduction in stands that are not economically viable for commercial harvest, pre-commercial thinning, yarding tops to the landing in commercial harvest units, grinding landing piles and spot fuel grinding or mastication with and without associated timber harvest. The project also will include 1.81 miles of road storage, 1 mile of temporary road construction, and 0.23 miles of trail construction. The project is in the Treasure PSU but outside of the mine and transmission line disturbance areas.

3.3.3.4 Bear Lakes Access

In the decision issued following an EA, the KNF allowed the owners of the Bear Lakes Ranch reasonable access to a cabin on Bear Lakes Ranch. The action permits the owners to use either the Bear Lakes Trail #178 or the Divide Cut-off Trail #63 via the Iron Meadow Trail #113 for horse and pack stock access to the cabin on Bear Lakes Ranch. Through a special use permit, the owners of the ranch may use a portion of the non-system trail into Big Bear Lake Basin and construct a new trail to the cabin as designated by the KNF. About 1,000 feet of new trail will be constructed to access the private land. The new construction will involve a limited amount of blasting (*i.e.*, one day involving four to six blasts) and will occur in the CMW (USDA Forest Service 2005a).

3.3.3.5 Other Projects

Other projects include the KNF's Libby Ranger District granting of an easement for access to private land on Allen Peak using NFS road #2301. Access currently occurs, and would continue to occur on a limited basis using this road. No road construction or reconstruction is planned.

The Coyote Improvement vegetation management project, currently in the planning stage, is on the KNF's Libby Ranger District in Sections 13 and 18, Township 27N, Range 30 West. The proposed project involves harvest of 240 acres to increase stand resiliency to mountain pine beetles. No new road construction is planned. The project is currently on hold.

A communication site, consisting of a small utility building, and towers not to exceed 80 feet in height, within and area of less than 1 acre, is planned for Horse Mountain on the KNF's Libby Ranger District. The proposed site is within the Crazy PSU, outside of the BMU. No new road construction is planned. A site would be administered under a Special Use permit.

The KNF's Libby Ranger District is conducting an environmental analysis on the Silverbutte Bugs project in the area of the Miller-West Fisher Vegetation Management Project. The project purpose is to control the spread of mountain pine beetle infestation along portions of Silver Butte Road, improve public safety, and control resource damage. Vegetation treatments will include commercial timber harvest and associated fuel treatments on 250 acres. The project is in the Silverfish PSU but outside of the 1-mile transmission line corridor.

3.3.4 Private Lands Activities

3.3.4.1 Poker Hill Rock Quarry

Plum Creek permitted a quarry called the Poker Hill site located in sections 3, 4, 9, and 10 in Township 28N, Range 30 West. The quarry site has a 123-acre permit area and will disturb up to 38 acres for the quarry and staging area. The quarry will produce decorative rock used for landscaping, retaining walls, and masonry. Riprap and gravel may be used for road BMP upgrades and maintenance. Rock tumblers, splitters, crushers, and blasting may be used on the quarry site to help create the desired products. The quarry and associated glacial deposits may also be used as a source for US 2 aggregates for future highway improvements.

Reclamation will include recontouring slopes where needed, grass seeding, weed spraying, reshaping high walls and pit areas where possible as described in the general plan of operations. All access roads, which are needed for future timber management, will be left unreclaimed and maintained up to forestry BMP standards. Access to the quarry will use existing Plum Creek roads. The access road to US 2 would be realigned for safety if a major highway construction contract is awarded that would use the aggregates from the quarry.

3.3.4.2 MDT Road Projects

MDT has multiple projects within the area of US 2 that may be affected by traffic or construction of the power line or roadway improvements for the Montanore Mine. One MDT roadway and one wetland project are currently under construction and two additional roadway construction projects are anticipated for the next 5 years.

3.3.4.3 Other Actions on Private Lands

Continued development of private lands within the analysis area is expected. Development is expected to include commercial timber harvest, land clearing, home construction, road construction, septic field installation, water well drilling, livestock grazing, and stabilization of streambanks.

3.4 Air Quality

3.4.1 Regulatory Framework

3.4.1.1 Clean Air Act and Clean Air Act of Montana

Under the federal Clean Air Act, the EPA sets National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. The EPA has set NAAQS for six criteria pollutants: carbon monoxide (CO); lead; nitrogen dioxide (NO_2); particulate matter with an aerodynamic diameter less than or equal to 10 and 2.5 microns (PM_{10} and $PM_{2.5}$, respectively); ozone; and sulfur dioxide (SO_2). The federal Clean Air Act established two types of standards for criteria pollutants. Primary standards set limits to protect public health, including the health of sensitive populations, such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings (EPA 2006a). Under Montana's implementation of the Clean Air Act, Montana established Montana Ambient Air Quality Standards (MAAQS) for criteria and other ambient air pollutants. NAAQS and MAAQS are presented in Table 46. In 2012, the EPA reduced the annual $PM_{2.5}$ standard to 12 $\mu g/m^3$. Unlike most new NAAQS, the EPA allowed grandfathering of pending preconstruction permitting applications if the application was deemed complete by December 14, 2012. This grandfathering would apply to the Montanore Project, and MMC would not need to demonstrate compliance with the new annual $PM_{2.5}$ standard.

An area is designated as attainment for particular criteria pollutant when existing concentration are below the NAAQS. Likewise, an area is designated as nonattainment when existing concentrations of one or more regulated pollutants are above the NAAQS. The Montanore mine production and processing facilities would be in an area designated as "attainment/unclassifiable" for all regulated pollutants. The city of Libby and surrounding area has been designated a nonattainment area for both $PM_{2.5}$ and PM_{10}. The closest boundary of the PM_{10} nonattainment area is 8.9 miles north of the proposed Little Cherry Creek Tailings Impoundment. The closest boundary of the $PM_{2.5}$ nonattainment area is 1.5 miles north of the tailings impoundment. The Libby Loadout and segments of the Bear Creek access road would be within the Libby PM_{10} and $PM_{2.5}$ nonattainment areas.

The Montanore Project would be required to obtain a Montana Air Quality Permit (MAQP) because the facility has the potential to emit more than 25 tons per year of one or more criteria air pollutants. The Montanore Project's permit application number is MAQP #3788-00; DEQ issued a revised Preliminary Determination on the permit application on August 28, 2015 (DEQ 2015a). MAQP #3788-00 is intended to cover all phases of the project that have the potential to emit more than 25 tpy of one or more criteria air pollutants. In Alternative 2, MMC anticipates the need for more power than currently on-site for drift development and drilling. A contractor, Cummins USA, would provide three portable 800-kW Tier 2 diesel generators under an "intent to transfer" notification for temporary power. These three generators are not specifically covered under the draft Montanore air quality permit. They have been permitted under a portable permit identified as Cummins USA MAQP #4063-00.

Table 46. National and Montana Ambient Air Quality Standards.

Pollutant	Averaging Time	Primary Standards		Secondary Standards	
		Federal – NAAQS	Montana – MAAQS	Level	Averaging Time
CO	8-hour	9 ppm [a]	9 ppm [b]	None	
	1-hour	35 ppm [a]	23 ppm [b]	None	
Pb	Rolling 3-month average	0.15 µg/m^3 [c]	—	Same as Primary	
	Quarterly	—	1.5 µg/m^3 [c]	—	
NO_2	Annual (arithmetic avg.)	53 ppb [e]	0.05 ppm [f]	Same as Primary	
	1-hour	100 ppb [d] (188.679 µg/m^3)	0.30 ppm [b] (567 µg/m^3)	None	
PM_{10}	24-hour	150 µg/m^3 [i]	150 µg/m^3 [i]	Same as Primary	
	Annual	—	50 µg/m^3 [j]	Same as Primary	
$PM_{2.5}$	Annual (arithmetic avg.)	12.0 µg/m^3 [l]	—	15.0 µg/m^3 [m]	
	24-hour	35 µg/m^3 [k]	—	Same as Primary	
O_3	8-hour	0.070 ppm [h]	—	Same as Primary	
	1-hour	—	0.10 ppm [b]	Same as Primary	
SO_2	1-hour	75 ppb [m] (195 µg/m^3)	0.50 ppm [n] (1,300 µg/m^3)	None	
	3-hour	—	—	0.5 ppm (1,300 µg/m^3) (NAAQS)	
	24-hour	—	0.10 ppm [b] (262 µg/m^3)	None	
	Annual	—	0.02 ppm [f] (52 µg/m^3)	None	

ppm = parts per million; ppb = parts per billion; µg/m^3 = micrograms per cubic meter; mg/m^3 = milligrams per cubic meter; "—" = No applicable standard.
[a] Federal violation when exceeded more than once per calendar year.
[b] State violation when exceeded more than once over any 12 consecutive months.
[c] Not to be exceeded (ever) for the averaging time period as described in either state or federal regulation. Pb is a 3-year assessment period for attainment.
[d] Federal violation when the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitoring site exceeds the standard.
[e] Federal violation when the annual arithmetic mean concentration for a calendar year exceeds the standard.
[f] State violation when the arithmetic average over any four consecutive quarters exceeds the standard.
[g] Applies only to NA areas designated before the 8-hour standard was approved in July 1997. Montana has none.
[h] Federal violation when the 3-year average of the annual 4th-highest daily maximum 8-hour concentration exceeds the standard.
[i] State and federal violation when more than one expected exceedance per calendar year at each monitoring site exceeds the standard.
[j] State violation when the 3-year average of the arithmetic means over a calendar year at each monitoring site exceed the standard.
[k] Federal violation when the 3-year average of the 98th percentile 24-hour concentrations at each monitoring site exceeds the standard.
[l] Federal violation when the 3-year average of the annual mean at each monitoring site exceeds the standard.
[m] Federal violation when the 3-year average of the 99th percentile of the daily maximum 1-hour average at each monitoring site exceeds the standard.
[n] State violation when exceeded more than 18 times in any 12 consecutive months.
Source: EPA 2014; DEQ 2013.

The mine and mill (plant) facility would be considered a minor source under the Title V and Prevention of Significant Deterioration (PSD) regulations because total potential emissions from point sources underground and on the surface would be less than 250 tpy for any criteria pollutant. The Project would be considered a minor source and would not require a Title V operating permit under ARM 17.8.1204 because the potential emissions are less than 100 tpy for any criteria pollutant, less than 10 tpy for any single hazardous air pollutant (HAP), and less than 25 tpy for total HAPs (TRC Environmental Corp. 2006a).

The PSD program is implemented primarily through the use of pollutant increments and area classifications. An increment is the maximum increase (above a baseline concentration) in the ambient concentration of PM_{10}, $PM_{2.5}$, SO_2, and NO_2 that would be allowed in an area. The area classification scheme establishes three classes of geographic areas (Class I, Class II and Class III; currently, there are no Class III areas). The most stringent increments are applied to Class I areas, which are recognized as having special national or regional natural, scenic, recreational, or historic value. Under PSD regulations, the mine facilities would be located in an area designated as Class II and the CMW is designated as Class I. Mine exhaust adits, which would be the source of emissions, and would be about 0.5 mile from the CMW boundary in Mine Alternatives 2, 3, and 4.

The USDA Forest Service, National Park Service, and U.S. Fish and Wildlife Service, collectively called the Federal Land Managers (FLMs) issued interagency guidance for nitrogen and sulfur deposition analysis in 2011 summarizing current and emerging deposition analysis tools applicable to Class I and Class II areas for evaluating the effect of increased nitrogen or sulfur deposition on air quality related values (AQRVs) (USDA Forest Service *et al*. 2011). The FLMs established deposition analysis thresholds to use as screening level values for the additional modeled amount of sulfur and nitrogen deposition within areas from new or modified major sources. A deposition analysis threshold is defined as the additional amount of nitrogen or sulfur deposition within an area, below which estimated impacts from a proposed new or modified source are considered negligible. The deposition analysis threshold established for both nitrogen and sulfur in the KNF and CMW is 0.005 kilograms/hectare/year (USDA Forest Service *et al*. 2011). Under the Clean Air Act, the FLM formal ”affirmative responsibility” role in the permitting process is limited to the extent a proposed new or modified major source may affect AQRVs in a Class I area. The Montanore Project is not a major source.

The Forest Service provides guidance to evaluate the potential impact of sulfur (S) and nitrogen (N) deposition, calculated from sources of SO_2 and NO_x operating during Montanore Mine production. The Forest Service resource concern thresholds for CMW lakes with different acid-neutralizing capability (ANC) are (USDA Forest Service 2013d):

10%:	Lakes with ANC 10-100 microequivalents/liter (μeq/L)
No change:	Lakes with ANC < 10 μeq/L

3.4.1.2 Other Federal Requirements

3.4.1.2.1 Organic Administration Act and Forest Service Locatable Minerals Regulations

The Organic Administration Act authorizes the Forest Service to regulate the occupancy and use of National Forest System lands. The Forest Service’s locatable minerals regulations are promulgated at 36 CFR 228, Subpart A. The regulations apply to operations conducted under the U.S. mining laws as they affect surface resources on National Forest System lands under the jurisdiction of the Secretary of Agriculture. One of these regulations (36 CFR 228.8) requires that mining activity be conducted, where feasible, to minimize adverse environmental impacts on National Forest surface resources. 36 CFR 228.8(a) also requires that mining operators comply with applicable state and federal air quality standards including the Clean Air Act. 36 CFR

228.8(h) states that “certification or other approval issued by state agencies or other federal agencies of compliance with laws and regulations relating to mining operations will be accepted as compliance with similar or parallel requirements of these regulations.”

3.4.1.2.2 Wilderness Act

The Wilderness Act allows mineral exploration and development under the General Mining Law to occur in wilderness to the same extent as before the Wilderness Act until December 31, 1983, when the Wilderness Act withdrew the CMW from mineral entry, subject to valid and existing rights. 36 CFR 228.15 provides direction for operations within the National Forest Wilderness. Holders of validly existing mining claims within the National Forest Wilderness are accorded the rights provided by the U.S. mining laws and must comply with the Forest Service Locatable Minerals Regulations (36 CFR 228, Subpart A). Mineral operations in the National Forest Wilderness are to be conducted to protect the surface resources in accordance with the general purpose of maintaining the wilderness unimpaired for future use and enjoyment as wilderness and to preserve the wilderness character consistent with the use of the land for mineral development and production.

3.4.1.2.3 Kootenai Forest Plan

The 2015 KFP includes the desired condition to “meet applicable federal state, or tribal air quality standards” (FW-DC-AQ-01) and a guideline that “the forest should cooperate with federal, state, tribal, and local air quality agencies as appropriate in meeting applicable air quality requirements. The KNF will cooperate with the DEQ in meeting the State Implementation Plan and the Smoke Management Plan” (FW-GDL-AQ-01).

3.4.2 Analysis Area and Methods

3.4.2.1 Analysis Area

The analysis area for direct and indirect effects is the area around proposed and alternative project facilities where air emissions would occur. The facilities are the Ramsey and Libby Plant sites, the Ramsey and Libby Adit sites, the Little Cherry Creek and Poorman tailings impoundment areas, LAD Areas, all access roads, alternate transmission line alignments, Sedlak Park Substation, and the Libby Loadout. The Libby Loadout is included in the analysis area because the loadout would be covered by DEQ’s Operating Permit.

All past and current actions in the analysis area (the general vicinity of the Montanore Project in Lincoln and Sanders counties), described in detail in section 3.2, as well as all reasonably foreseeable actions in the analysis area, described in detail in section 3.3, were considered qualitatively in the cumulative effects analysis. The list of activities considered in the cumulative effects analysis was taken from the KNF’s Schedule of Proposed Actions and from KNF program managers. Figure 50 shows the location of activities considered in the cumulative effects analysis.

Two mines with current air quality permits, Troy Mine and the Rock Creek Project, were modeled to assess cumulative effects. The analysis area for this quantitative analysis was determined by the geographic limits of the modeling software: the geographic distance of emission sources can be considered out to 50 kilometers, the effective distance of the air dispersion model. The Montanore mine emissions (Construction and Operations Phases) were evaluated together with the emissions from both the Rock Creek Project (MAQP #2414-03) and the Troy Mine (MAQP #1690-03). While the Rock Creek Mine is not yet operating, it is possible that both the Montanore and Rock Creek Mines may operate simultaneously in the future. Additionally, while the Troy Mine is currently not in production, and planned for the reclamation phase, the Troy Mine permit is currently active, and therefore was also included in the evaluation of emissions from all three mines.

3.4.2.2 Baseline Data Adequacy

The available data and methods described in the following section are adequate to evaluate and disclose reasonably foreseeable significant adverse effects on air quality in the analysis area and to enable the decision makers to make a reasoned choice among alternatives. The agencies did not identify any incomplete or unavailable information, as described in section 3.1.3, *Incomplete and Unavailable Information*.

3.4.2.3 Methods

Air modeling was used to analyze effects of the Montanore Mine and as a basis for DEQ's decision on the air quality permit. Baseline data for meteorological conditions and air quality parameters, as described in section 3.4.2.3.1, were used as inputs in the modeling efforts, which are described below in section 3.4.2.3.2. The project would consist of five main phases – evaluation, construction, operations, closure, and post-closure. In general, the Evaluation Phase is estimated at 2 years, Construction Phase at 3 years and potentially up through a fourth year, Operations Phase from 16 to 20 years, and the mine Closure and Post-Closure Phases up to 20 years (or longer if water quality monitoring still indicated a need for treatment).

3.4.2.3.1 Existing Conditions

Meteorological conditions and air quality parameters were monitored between July 1, 1988 and June 30, 1989 at two sites—the Ramsey Creek Air Monitoring Site in the upper Ramsey Creek drainage at the Ramsey Plant Site and the Little Cherry Creek Air Monitoring Site south of the Little Cherry Creek Tailings Impoundment (meteorological data only) (Woodward-Clyde Consultants 1989b). The monitoring locations are shown on Figure 2.3 in the MAQP Application (TRC Environmental Corp. 2006a). The monitoring results were used in the air quality and visibility analyses for both the 1992 EIS (USDA Forest Service *et al.* 1992) and this EIS. Only data from the Ramsey Creek Air Monitoring Site were used because the data recovery at the Little Cherry Creek Air Monitoring Site was not as complete and because Ramsey Creek Air Monitoring Site meteorological data are more representative of the conditions where a majority of pollutant emissions would be emitted (the Ramsey and Libby adits). The Ramsey Creek Air Monitoring Site meteorological data were combined with twice-daily upper air mixing height data from Spokane, Washington, the closest upper air meteorological site to the mine area (TRC Environmental Corp. 2006a). The baseline meteorological and air quality measurements made during the 1988-1989 baseline year are considered to be representative of 1 year at this site, with the exception of precipitation, which was much lower than normal during this period (see *Affected Environment* section below). Since collection of the data, there has been little development in the area, and baseline measurements are assumed to be representative of current conditions.

Maximum hourly and/or daily and annual average emission rates of PM_{10}, $PM_{2.5}$, total suspended particulates (TSP), NO_x, CO, SO_2, and trace metals including antimony, arsenic, cadmium, chromium, and lead were calculated for all sources. Copper and silver were not included because they are not regulated in air. This differentiation between short-term (hourly and daily) and long-term averages applies most specifically to emission sources for which annual operating limits are proposed, but have the potential to operate at maximum load on an hourly and/or 24-hour basis. For modeling purposes, it was assumed mine construction would commence and the mine would phase in production, reaching full production in operating year 4. Operations for year 4, the first year of maximum production, were considered the worst-case production emissions scenario and were used for emission calculations (TRC Environmental Corp. 2006a).

Ambient air quality background concentrations were established using monitoring and other available data. Background concentrations were added to modeled concentrations predicted to be emitted from the Montanore Mine to obtain total concentrations for comparison to NAAQS and MAAQS. Modeled annual NO_x concentrations were adjusted using the Ambient Ratio Method. Hourly NO_x concentrations were adjusted using the Ozone Limiting Method (OLM) as described in the Draft Montana Modeling Guideline for Air Quality Permit Applications (DEQ 2007a). The ozone ambient standard of 196 micrograms per cubic meter ($\mu g/m^3$) was assumed to be ambient background for the OLM calculation (TRC Environmental Corp. 2006a).

3.4.2.3.2 Air Modeling

Air dispersion models inherently produce conservative concentration estimates limited by mathematical equations. The meteorological information used in the air models for the Montanore Project was constant for one-hour periods, and the emissions were assumed constant during the modeled periods.

Two different air dispersion models were used in the analyses. The first modeling effort, which was completed in 2006, was for the Proposed Action (Alternative 2). The second modeling effort, which was completed in 2011, included the locations for project components described in Alternative 3. The limitations of the dispersion model used for Alternative 2 led to results that overstate the effects (except for visibility and deposition analyses) compared to the more advanced model (better characterization of the atmosphere) used for Alternatives 3. The DEQ did additional modeling in 2015 (based on the 2011 modeling) to evaluate cumulative effects from nearby mines and to analyze the proposed use of two generators under a portable permit in Alternative 2 during the Evaluation Phase. The air models used to evaluate the project are described in the sections below. Additional detail is in DEQ's Supplemental Preliminary Determination (DEQ 2015a). The effects analysis based on this modeling is disclosed in section 3.4.4.

1992 EIS Modeling

None of the modeling done for the 1992 EIS was used in this EIS. All modeling and analyses are new. The most current up-to-date models were used and the new data generated by the modeling have been analyzed in this EIS.

2006 Modeling for Alternative 2 (MMC's Proposed Action)

MMI submitted an application for a MAQP in 2006 (TRC Environmental Corp. 2006a) for the proposed action (Alternative 2). The application was revised and resubmitted later in 2006 to incorporate additional information and analyses requested by the DEQ AQB, and the application was deemed complete in 2006. The application included an air dispersion modeling analysis updated from the 1992 EIS analysis, which was conducted to demonstrate compliance with ambient air quality standards following guidance in the Draft Montana Modeling Guideline for Air Quality Permits (DEQ 2007a) and in accordance with EPA guidance. The analysis quantified PM_{10}, $PM_{2.5}$, NO_2, SO_2, and lead emissions and their impacts. The modeling evaluated emission sources during the Construction and Operations Phases; the Evaluation Phase was not considered a separate phase when the 2006 modeling was completed. On-road mobile exhaust emissions are not evaluated in the Montana air quality permitting process; all emissions, however, including mobile emissions, were considered in the analysis because the project would be near the Class I CMW. All mobile exhaust emissions were based on equipment engine horsepower ratings and distributed into three areas of the mine: mill, tailings impoundment, and Libby Adit portal.

2011 Modeling

MMC and the DEQ completed new dispersion modeling in 2011. Two separate analyses were completed: 1) a compliance demonstration for Alternative 2 with the 1-hour NO_2 and SO_2 NAAQS, and 2) a compliance demonstration for project components described in Alternative 3 (Chapter 2, section 2.1.5), which was identified as the KNF's preferred alternative in the 2009 Draft EIS. Modeling of MMC's Proposed Action initially assumed Tier 2 diesel generators for use at the Ramsey Adit Site. To meet new 1-hour NO_2 and SO_2 NAAQS finalized in 2010, MMC proposed the use of generators with emissions that would be equivalent to Tier 3 emissions. Although Alternative 4 was not specifically modeled, the results would be similar to those for Alternative 3. Differences, if any, would be associated with the tailings impoundment emissions, which would likely be less for Alternative 4 than those for Alternative 3 due to the moisture content of the tailings at the time of deposition. For Alternatives 3 and 4, the Libby Plant Site would be northeast of the Libby Adit Site, and two adits would be constructed at the Libby Adit Site and one adit at the Upper Libby Adit Site.

Alternative 2 1-hour NO_2 and SO_2 Compliance Demonstration

The EPA finalized the 1-hour NO_2 and SO_2 NAAQS in 2010 after the 2006 modeling was completed and the Draft EIS was issued in 2009. The 2011 modeling included the same sources and locations as the 2006 modeling with the exception of the generators. For the generators, NO_x emissions would meet the equivalent of the Tier 3 NO_x emission standard for engines 750 horsepower or less and SO_2 emissions were based on using ultra-low sulfur diesel fuel with the equivalent of 15 ppm sulfur. The 2011 modeling of 1-hour NO_2 and SO_2 was based on generator use for 1 year during the Construction Phase of 24 hours per day for 365 days (Carter Lake Consulting, LLC 2011). The agencies assumed the Evaluation Phase of Alternatives 3 and 4 would have the same generator use and emissions. During the Operations Phase, the transmission line would provide power and the generators would be used no more than 16 hours per year. The EPA's adopted dispersion model, AERMOD, was used in the 2011 modeling.

Alternative 3 Compliance Demonstration

Because the Alternative 3 mining facilities would be different than for Alternative 2, most of the 2011 modeling emission rates and stack parameters were different from the 2006 rates and model parameters. For example, an overland conveyor would convey ore from the Libby Adit to the mill at the Libby Plant Site in Alternatives 3 and 4 instead of 40-ton trucks used in Alternative 2. In addition, certain underground equipment was modeled with Tier 4 engine emission standards because Tier 4 would likely be available at the time production commenced and may be mandated by the MSHA. Other minor changes from Alternative 2 that would be included in Alternative 3 were modeled. As during the 2006 modeling, on-road mobile exhaust emissions were considered in the analysis because the project would be near the Class I CMW.

The 2011 emission inventory (Table 49) had lower total emissions than the 2006 emission inventory (Table 48) for all criteria pollutants except PM_{10} (DEQ 2015a). The increased PM_{10} emissions were due to three enclosed transfer points that would be on Alternative 3's overland ore conveyor. (Carter Lake Consulting, LLC 2011). The 2011 modeling analyzed daily and annual $PM_{2.5}$ and PM_{10} emissions because of the updated emissions inventory and because the 2006 modeling analyses (Table 50) showed these emissions had the greatest impact on their respective NAAQS. The 2011 modeling evaluated emission sources during the Construction and Operations Phases (DEQ 2015a). The agencies assumed the Evaluation Phase of Alternatives 3 and 4 would have the same generator use and emissions.

Two ventilation scenarios were modeled for the two Libby Adits. One modeled scenario assumed all underground emissions exited through one of the two Libby Adits. In this scenario, the Upper Libby Adit would be used for intake. Libby Adit dimensions were assumed to be the same in all alternatives. All other mine emissions sources were modeled as they were for Alternative 2 (Sage Environmental Consulting 2007). In another modeled scenario (Alternatives 3), the assumptions were the same as the first scenario except underground emissions would be split between one of the two Libby Adits and the Upper Libby Upper Adit. The other Libby Adit would be used for intake (Sage Environmental Consulting 2007). The DEQ issued a Supplemental Preliminary Determination that incorporated the new modeling (DEQ 2011a).

2015 Modeling (Cumulative Effects and Portable Generators)

In 2015, the DEQ issued a Supplemental Preliminary Determination that evaluated the cumulative effect of the Montanore, Rock Creek, and Troy Mines and addressed Tier 2 diesel generators that would be used for power in Alternative 2 during the Evaluation Phase under an existing portable permit (DEQ 2015a). These two changes are summarized below.

Cumulative Effects Modeling

To evaluate cumulative effects, the DEQ modeled emissions from the two mines near the Montanore Project with valid air quality permits (the proposed Rock Creek Mine (RC Resources Inc.; MAQP #2414-03) and the existing Troy Mine (Troy Mine, Inc.; MAQP #1690-03)) and included other emission sources that would contribute to cumulative effects, such as nearby timber harvesting, in the background concentrations. Modeling focused on the areas where the Montanore Mine would have the greatest impacts based on the 2011 1-hour NO_2 NAAQS modeling after initially evaluating the impacts out to 50 km, the effective distance of the air dispersion model.

For the 2015 cumulative effects modeling, the DEQ used its 2002 modeling for the Troy Mine, the emissions listed in the 2014 MAQP #2414-03 application for the Rock Creek Mine, and the 2011 modeling done for the Construction and Operations phases of the Montanore Project under Alternatives 3 or 4. The pollutants of interest were NO_2, PM_{10}, and $PM_{2.5}$. The compliance demonstration addressed the 1-hour NO_2 NAAQS, 24-hour PM_{10} NAAQS/MAAQS, annual PM_{10} MAAQS, 24-hour and annual $PM_{2.5}$ NAAQS; Montana currently does not have 24-hour or annual $PM_{2.5}$ standards (Cain 2015; DEQ 2015a). The cumulative effect during the Evaluation Phase in all alternatives was considered qualitatively based on the incremental cumulative effect modeled for the Construction and Operations phases.

Modeling for Portable Generators

The DEQ also updated the draft permit to reflect modeling analysis completed for two temporary portable diesel generators that would be used in Alternative 2 during the Evaluation Phase under a portable permit, MAQP #4063-00, held by Cummins USA. These generators were not covered specifically under the draft Montanore air quality permit because they are covered by the portable permit. As part of the updated Montanore modeling analysis, MMC modeled two Tier 2 generators (as proposed under Alternative 2 and permitted under MAQP #4063-00) along with adit emissions to demonstrate compliance with the 1-hr NO_2 NAAQS (Carter Lake Consulting LLC 2015), and the DEQ confirmed the modeling results (DEQ 2015a). Only NO_x emissions (converted to NO_2) were analyzed because NO_x would be emitted in the largest quantity and because NO_x concentrations in the 2011 modeling (Table 57) were the closest to their respective standards. Under the terms of the portable permit, the generators are expected to be used for up to 12 months during the Alternative 2 Evaluation Phase, depending on the following: the transmission line construction schedule, whether Tier 3 units (permitted under the Montanore air quality permit) move to the site during the Construction Phase, or whether a buried 34.5-kV transmission line along Bear Creek Road and the Libby Plant Access Road was installed to replace the Tier 3 generators prior to the installation of the overhead 230-kV transmission line (during the Construction Phase).

Additional Modeling for NEPA Compliance

Although not required by current regulations and permit requirements, DEQ requested that MMC conduct additional modeling, including:

- An analysis of impacts on air quality related values (AQRV) in the CMW Class I Area completed in 2006
- An assessment of impacts on Libby PM_{10} and $PM_{2.5}$ nonattainment areas complete in 2006 and 2011
- A determination of potential effects of terrain-induced downwash (a sudden drop in terrain causing turbulence on the downwind side which results in mixing and dispersion of air pollutants) evaluated in 2006
- An assessment of human health risk for trace metals (see discussion below) conducted in 2006
- A visibility plume analysis completed in 2006 (see discussion below)
- A nitrogen and sulfur deposition analysis completed in 2006 and updated in 2011 (see discussion below).

Human Health Risk Assessment for Trace Metals

In 2006, MMC also submitted modeling of the impacts from trace metals released during ore, tailings, and concentration mining handling and processing. Montana does not have air toxics impact regulations, and MMC is not required to assess human health risks from metals emissions. MMC provided a screening-type human health risk assessment for trace metals classified as HAPs to provide a full disclosure of potential HAP impacts (DEQ 2015a).

Visibility Analysis – Plume Impairment

Potential plume impairment was evaluated generally following guidance established by the Federal Land Managers' Air Quality Related Values Workgroup (FLAG) (FLAG 2000). This guidance was updated in 2010, and uses essentially the same approach (USDA Forest Service, National Park Service, and U.S. Fish and Wildlife Service 2011). In 2011, the USDA Forest Service, National Park Service, and U.S. Fish and Wildlife Service issued supplemental guidance that addresses the use of deposition analysis thresholds and critical loads when evaluating deposition impacts (USDA Forest Service, National Park Service, and U.S. Fish and Wildlife Service 2011). The mine would be located within 7,000 feet of the CMW, and as prescribed in the

FLAG document, visibility analyses were limited to plume impairment. Potential plume impairment from the largest mine sources were modeled following FLAG guidance. The FLAG guidance describes three levels of analysis for plume impairment assessments. Levels one and two are screening level analyses that use the VISCREEN model for assessing plume impairment impacts, and level three is a refined analysis using the PLUVUE II model. (Citations for all models mentioned in this section are available from the DEQ-AQB.) If a screening analysis demonstrates that visibility impacts from plume impairment are below threshold values, then no further analysis is required.

For the Montanore mine emission sources, screening level impacts using VISCREEN were predicted to be greater than threshold values. As a next step, the PLUVUE II model was used for plume impairment analyses (TRC Environmental Corp. 2006b). The PLUVUE II model estimates plume perceptibility in terms of change in color difference (ΔE) and contrast ($|C|$). The threshold values for plume perceptibility are contrast ($|C| = 0.02$) and change in color difference ($\Delta E = 1.0$) (USDA Forest Service, National Park Service, and U.S. Fish and Wildlife Service 2011).

The PLUVUE II analysis was performed for the largest Montanore mine emissions sources that have the potential to form discrete plumes and impact the CMW. These sources would be the Ramsey portal, the Libby portal, and the emergency generator for Alternative 2. The Ramsey and Libby portal emissions included all fugitive and mobile source emissions that would occur within the underground mine. The Ramsey and Libby portals and the emergency generator would be located within about 1 mile of the CMW. An individual PLUVUE II analysis was performed for each of these three sources separately because their distinct, separated locations limit the potential to form one contiguous plume that would impact the CMW. Because once the electric transmission line (either the 34.5-kV underground line or the 230-kV overhead line) was operational at the mine site and the emergency generator at the mill would operate only 16 hours per any rolling 12-month time period, meteorological conditions are less likely to occur that would create a contiguous plume from the generator and portal combined. A single viewpoint, or observer location, for each analyzed source was selected by determining the location with the most viewing angles from within the Class I area that an observer could see a plume generated by each source. Each viewpoint was evaluated for views for each wind direction sector, which could advect a plume toward the CMW.

Nitrogen and Sulfur Deposition Analysis

The interagency guidance on nitrogen and sulfur deposition analysis (USDA Forest Service *et al.* 2011) provides a four-step process to determine if a deposition impact analysis is needed and, if so, to determine if the predicted impacts are potentially adverse.

> Step 1: Are the source's impacts negligible? A source located greater than 50 km from an FLM area is considered to have negligible impacts for AQRVs if its total annual emissions of SO_2, NO_x, PM_{10}, and H_2SO_4 (in tpy) divided by the distance (Q/D) is 10 or less. If that is the case, no further AQRV analysis is needed.
>
> Step 2: If Q/D is more than 10, is the source's predicted contribution to deposition less than the deposition analysis threshold of 0.005 kilogram/hectare/year? If so, the source's impacts on AQRV are considered to be negligible.

> Step 3: Does the refined/contextual analysis alleviate concerns? Does the analysis show that the source's impacts would not cause harm to an AQRV? If so, the impacts are considered to be not adverse.
>
> Step 4: Are there mitigation strategies that could reduce the potential adverse impact?

Maximum sulfur and nitrogen deposition predicted for Alternative 2 at three sensitive water bodies, Lower Libby Lake, Upper Libby Lake, and Rock Lake, were calculated from sources of SO_2 and NO_x operating during Montanore Mine production using emission estimates from the 2006 modeling (TRC Environmental Corp. 2006). The CALPUFF model was used to model all emission sources in Alternative 2. In 2013, nitric acid (HNO_3) 1-hour AERMOD modeling was completed using the same assumptions as the nitrogen dioxide modeling. Results were reported as nitrogen. The emissions from the operation of the emergency generator during the Operations Phase at 16 hours per year were modeled using an annualized rate (Klepfer Mining Services 2013a, 2013b). The assumptions associated with the modeling nitrogen and sulfur deposition rates are described in the modeling report (TRC Environmental Corp. 2006a, 2006b; Klepfer Mining Services 2013a, 2013b) and the Montana DEQ's 2015 Supplemental Preliminary Determination on MMC's air quality permit application (DEQ 2015a).

Accuracy and Uncertainty of Air Quality Models

The EPA's Guideline on Air Quality Models addresses the regulatory application of air quality models for assessing criteria pollutants under the Clean Air Act. When the EPA adopted in 2005 the current dispersion model, AERMOD, for inclusion in the guideline, the final rule in the Federal Register contained a discussion of the accuracy and uncertainty of air quality models (EPA 2005). The EPA indicated that 1) models are more reliable for estimating longer time-averaged concentrations than for estimating short-term concentrations at specific locations; and 2) the models are reasonably reliable in estimating the magnitude of highest concentrations occurring sometime, somewhere within an area. A typical range of variation in concentrations of as much as ±50 percent (EPA 2005). The EPA's remaining discussion of the accuracy and uncertainty of air quality models is incorporated into this EIS by reference.

3.4.3 Affected Environment

3.4.3.1 Climate

3.4.3.1.1 Regional Climate

The region has a "modified continental maritime" type of climate. The regional climate is influenced and modified by Pacific Ocean maritime air masses. Summers are warm and dry, and winters are cold. The Pacific Ocean influences development of coastal storms, which occasionally track across the State of Washington, and east into northern Idaho and Montana. The relatively high mountain ranges to the west and north tend to reduce the effects of these storms, so that more rain or snow occurs on the west or north side of the Cabinet Mountains than the south or east sides. In winter, cold Canadian air masses can cause periods of extremely cold temperatures. Cold air movement into the region forms temperature conditions that may trap pollutants near the land surface. More frequently, dry continental air masses from Canada or the east influence the region. In summer, these air masses create conditions of warm temperatures and low humidity.

3.4.3.1.2 Analysis Area Climate

Although similar to the regional climate, the climate of the analysis area is highly influenced by local terrain and elevation. The analysis area's mountainous terrain produces significant precipitation and temperature variations. Analysis area elevations range from 2,600 feet along US 2 to almost 8,000 feet at Elephant Peak in the Cabinet Mountains. Elevation in the City of Libby is 2,062 feet. The terrain in the immediate vicinity of the proposed facilities is mountainous with large changes in elevation over short distances (Mines Management, Inc. 2005a).

Wind velocities vary according to terrain features, with higher wind speeds at ridge tops and lower wind speeds in protected valleys. The upper level winds above 10,000 feet come predominantly from the northwest, and surface winds follow topographic relief (valley flow) in times of stable weather activity. Based on wind data collected in 1988-1989, over 50 percent of the winds at the Ramsey Creek Air Monitoring Site and nearly 90 percent of the winds at the Little Cherry Creek Air Monitoring Site were less than 3.5 miles per hour (mph). The average wind speed at Ramsey Creek was 5 mph. The highest wind speed recorded was 28.4 mph at the Ramsey Creek Air Monitoring Site. Wind speed averaged 2.4 mph at the Little Cherry Creek Air Monitoring Site (Woodward-Clyde Consultants 1989b).

Predominant wind directions are from the southwest-to-southeast sectors (Woodward-Clyde Consultants, Inc. 1989b). The measured predominant wind direction at the Ramsey Creek Air Monitoring Site is south-southeast. Maximum wind speeds are also associated with south-southeast winds. This is in contrast to the tendency for upper level winds to be from the northwest. The predominant wind direction is also inconsistent with the orientation of the creek drainage (southwest-to-northeast), although winds from the southwest and south-southwest were measured about 30 percent of the time. Maximum wind speeds at the Ramsey Creek Air Monitoring Site were associated with south-southeast winds, and with south-southwest winds at the Little Cherry Creek Air Monitoring Site. Valleys in western Montana have a strong potential for the formation of temperature inversions (stable atmospheric conditions with little air mixing).

According to the National Weather Service (2011), "normal" precipitation is derived from PRISM climate data, which uses a 4 km by 4 km grid size. The PRISM gridded climate maps are considered the most detailed, highest-quality spatial climate datasets currently available (National Weather Service 2011). The 30- year PRISM normal from 1971-2000 was used for precipitation analysis. Available precipitation estimates are discussed in more detailed in section 3.8.3.1, *Definitions and Comparisons of Peak Flow, Annual Flow, Baseflow and 7Q2 and 7Q10 Flows.* Based on PRISM estimates, average annual precipitation at the impoundment sites is 30 inches. The estimated average annual precipitation at the Libby Plant Site is 35 inches and 68 inches at the Ramsey Plant Site. Precipitation data for the analysis area are available from a monitoring site in upper Poorman Creek, about 1 mile north of the proposed Ramsey Plant Site. Precipitation increases with increasing elevation, and can reach 90 inches in the highest Cabinet Mountains. About 35 percent of precipitation is snow that generally falls between October and May. Rain-on-snow also may occur in mid-winter and early spring, which can result in large runoff events (Geomatrix 2006b). Temperatures in the analysis area are cold in the winter and mild in the summer. The annual average temperature is about 41°F with a range between -26°F and 95°F (hourly average).

3.4.3.2 Particulate Matter and Gaseous Ambient Air Pollutants

3.4.3.2.1 Airborne Particulate Matter

Concentrations of TSP and PM_{10} are typical of remote, mountainous sites. At the Ramsey Creek Air Monitoring Site, the annual average PM_{10} was 14 µg/m^3 and the maximum 24-hour concentration was 35 µg/m^3 (Table 47). PM_{10} concentrations are in compliance with the MAAQS and NAAQS (Table 50). MAAQS and NAAQS for TSP have been rescinded since the time the data were collected. The maximum measured PM_{10} and TSP values each exceeded their respective standards on one occasion in the fall of 1988, likely due to the numerous forest fires in the region, and do not represent normal background conditions. At the Little Cherry Monitoring Site, the arithmetic mean PM_{10} concentration was 14 µg/m^3 and the geometric mean for the TSP sampler was 33 µg/m^3 (Woodward-Clyde Consultants Inc. 1989a).

Table 47 lists modeling background concentration values for $PM_{2.5}$, PM_{10}, NO_2, SO_2, CO, and lead. The $PM_{2.5}$ background values were obtained from the Forest Service IMPROVE site, about 3 miles south of the CMW southern boundary. The PM_{10} and lead concentrations were collected during 1988-1989 at MMC's air monitoring sites, which the DEQ determined to be representative of PM_{10} concentrations at the mine site. Site conditions since 1989 that would affect 1988-1989 PM_{10} concentrations have not changed. The NO_2, SO_2, and CO values are typical values provided by DEQ for use in permit modeling analyses. The TSP filters at the Little Cherry Creek Air Monitoring Site were analyzed for trace metals including lead.

Table 47. Measured or DEQ Default Background Concentrations Used in the Air Quality Modeling.

Pollutant	Averaging Period			
	Annual	24-Hour	3-Hour	1-Hour
PM_{10}	14	35	NA	NA
$PM_{2.5}$	3.5	10.4	NA	NA
NO_2	6	NA	NA	40 (NAAQS) 75 (MAAQS)
SO_2	3	11	26	35
CO[1]	NA	1,150	NA	1,725
Lead	0.006	NA	NA	NA

All concentrations are in micrograms per cubic meter (µg/m^3).

NA = Not applicable.

[1]For CO, an 8-hour averaging period was used for the 24-hour value

Source: DEQ 2015a.

Trace metal concentrations measured in the total suspended particulate matter samples were low. None of the values for $PM_{2.5}$, PM_{10}, NO_2, SO_2, CO, and lead exceed any federal ambient standard or Montana guideline concentration (TRC Environmental Corp. 2006a).

In 2011, the EPA determined the Libby nonattainment area for the 24-hour PM_{10} standard attained the standard as of December 31, 1994. In 2008, EPA designated parts of Lincoln County as a nonattainment area for 24-hour $PM_{2.5}$ NAAQS. The nonattainment area for $PM_{2.5}$ extends south of Libby to about 2 miles north of the Little Cherry Creek Impoundment Site. The area includes about 6 miles of the Bear Creek access road and the Libby Loadout facility.

3.4.3.2.2 Gaseous Pollutants

No measurements of other criteria pollutants and their precursors, such as CO, SO_2, ozone, NO_x, or hydrocarbons, were made in the analysis area. Given the remoteness of the analysis area and the lack of air pollution sources and minimal human impact, low background concentrations are expected (Table 47).

3.4.3.3 Visibility and Deposition

Visibility is usually high, except during times of forest fires or controlled burning. In the CMW, the average annual natural standard visual range is 259 kilometers (161 miles) and the annual average 2000-2004 baseline standard visual range is 167 kilometers (104 miles) (USDA Forest Service *et al*. 2011).

The closest atmospheric deposition site to the analysis area is the Priest River Experimental Forest, 61 miles west of the analysis area. Between 2004 and 2013, total annual sulfate deposition averaged 1.74 kg/ha and total annual inorganic nitrogen deposition averaged 1.58 kg/ha. Another atmospheric deposition site is in Glacier National Park, 78 miles northeast of the analysis area. Between 2004 and 2013, total annual sulfate deposition averaged 1.90 kg/ha and total annual inorganic nitrogen deposition averaged 1.38 kg/ha. (National Atmospheric Deposition Program 2014).

3.4.3.4 Acid-neutralizing Capability of Mine Area Lakes

Two types of acidification affect lakes and streams. One is a year-round condition when a lake is acidic all year long, referred to as chronically or critically acidic. The other is seasonal or episodic acidification associated with spring melt and/or rain storm events. A lake is considered insensitive when it is not acidified during any time of the year. Lakes with ANC values below 0 μeq/L are considered to be chronically acidic. Lakes with ANC values between 0 and 50 μeq/L are considered susceptible to episodic acidification (Driscoll *et al.* 2001). In the analysis area, Libby Lakes are the most susceptible to acidification. Samples from the Upper Libby Lake shore had an average ANC value of 4.7 μeq/L and a range of -4.9 μeq/L to 10.54 μeq/L between 1991 and 2009. The ANC of Lower Libby Lake's outlet averaged 18.2 μeq/L and a range of 6.0 μeq/L to 36.5 μeq/L between 1991 and 2009 (Grenon and Story 2009, McMurray, pers. comm. 2013). Rock Lake's ANC ranged from 54.2 to 59.5 μeq/L in two sample events in 1991 and one sample event in 1992 (VIEWS 2013). Concentrations of sulfate decreased in Lower Libby Lake. No significant trends were observed in other Lower Libby Lake measured parameter, or any measured parameter in Upper Libby Lake (Grenon and Story 2009). Gurrieri and Furniss (2004) reported an average ANC of 44 μeq/L in Rock Lake from samples collected after snowmelt runoff (7/22/99 to 10/22/99). In 1991, St. Paul Lake's ANC was 168.4 μeq/L and Wanless Lake's ANC was 73.1 μeq/L (VIEWS 2013).

3.4.4 Environmental Consequences

3.4.4.1 Alternative 1 – No Mine

The increased air emissions from mine construction and operation described under the mine alternatives would not occur. The ambient air quality and visibility in the CMW would not be affected by the proposed mine. Existing trends in air quality of the analysis area would continue.

3.4.4.2 Alternative 2 – MMC's Proposed Mine

3.4.4.2.1 Particulate Matter and Gaseous Pollutants

Libby Adit Dewatering and Evaluation Drilling

The electrical requirements during Libby Adit dewater and evaluation drilling is described in section 2.4.1.7, *Electrical Power*. Electrical power at Libby Adit to dewater the currently flooded segments of the Libby Adit would be provided by three, Tier 3 225-kW electrical generators. Emissions from these generators are below the 25 tons per year that require an air quality permit (TRC Environmental Corp. 2007b). Concentrations of pollutants would be greater than ambient concentrations but below NAAQS and MAAQS.

When drift development began after the adit was dewatered, emissions from the portable Tier 2 generators would be greater and would be above the 25 tons per year that would require an air quality permit. The primary pollutant from each generator would be NO_x, estimated to be 29.98 tons per year (DEQ 2007b). Emissions of PM_{10}, SO_2, and volatile organic compounds from each generator would be less than 1 ton per year. During drift development and drilling, the modeled 8^{th} highest 1-hour NO_x concentration was 154.83 $\mu g/m^3$ along the Libby Adit facility boundary near the generators. Multiplying the unadjusted NO_x concentration by an ambient ratio of 0.80 and adding the 1-hour NO_2 background concentration of 40 $\mu g/m^3$ for NAAQS compliance purposes yielded an 8^{th} highest 1-hour NO_2 concentration of 163.86 $\mu g/m^3$. The NO_2 concentration is 87 percent of the 1-hour NO_2 NAAQS of 188 $\mu g/m^3$ (Carter Lake Consulting LLC 2015). The background concentration for MAAQS compliance purposes is 75 $\mu g/m^3$; the NO_2 concentration is 198.86 $\mu g/m^3$, or 35 percent of the 1-hour NO_2 MAAQS of 564 $\mu g/m^3$.

Construction and Operations

Pollutants emitted by the proposed project would be from fugitive sources such as haul roads, from mobile sources such as earth moving equipment, and from point sources such as propane heaters. PM_{10}, CO, and NO_x would be the primary pollutants. The emission inventory shown in Table 48 was used in the 2006 modeling results shown in Table 50, Table 52, Table 53, and Table 54. The emission inventory shown in Table 49 was used in the 2011 modeling results shown in Table 51, Table 56, Table 58, and Table 59. The basis for the differences between the 2006 and 2011 emission inventories is described in the updated air quality permit application (Carter Lake Consulting, LLC 2011).

Dispersion model results were compared to applicable ambient standards. Ambient background concentrations were added to modeled concentrations to obtain total concentrations for comparison to the NAAQS and MAAQS. The pollutant concentrations predicted by 2006 model shown in Table 50 would comply with all NAAQS and MAAQS in effect at the time of the 2006 modeling. The modeling analysis and results (TRC Environmental Corp. 2006b) are incorporated by reference.

The 1-hour NO_2 and SO_2 modeling was updated in 2011 to demonstrated compliance with the standards promulgated in 2011. Model results from the 2011 analysis for the 8^{th} highest daily maximum 1-hour NO_2 concentration and 4^{th} highest daily maximum 1-hour SO_2 concentration are shown in Table 51. Adding an ambient background value of 35 $\mu g/m^3$ for SO_2 and 40 $\mu g/m^3$ for NO_2, total concentrations are predicted to be less than 1-hour NAAQS. The maximum NO_2 concentrations would occur in the Construction Phase, when generators would operate 24 hours/day for 365 days/year. The maximum SO_2 concentration would occur during the Operations Phase. The modeling analysis and results (DEQ 2015a) are incorporated by reference.

Table 48. 2006 Air Emissions Inventory.

Pollutant	Point Source Emissions (tpy)	Fugitive Emissions (tpy)	Mobile Source Emissions (tpy)
PM_{10}	12.68	137.56	5.07
$PM_{2.5}$	2.62	20.55	5.07
NO_x	3.60	1.33	162.77
SO_2	0.01	0.14	6.32
CO	0.47	64.66	56.57
Volatile organic compounds	0.13	0.00	9.01
Lead	0.0007	0.0014	<0.0001

tpy = tons per year.
Source: DEQ 2015a.

Table 49. 2011 Air Emissions Inventory.

Pollutant	Point Source Emissions (tpy)	Fugitive Emissions (tpy)	Mobile Source Emissions (tpy)
PM_{10}	16.88	137.56	1.49
$PM_{2.5}$	3.46	20.55	1.49
NO_x	3.49	1.33	64.74
SO_x	0.036	0.14	5.48
CO	0.53	64.66	49.99
Volatile organic compounds	0.125	0.00	4.21
Lead	0.00086	0.0014	<0.0001

tpy = tons per year.
Source: DEQ 2015a.

MMC would continue to use the unpaved Libby Creek Road (NFS road #231) and the Upper Libby Creek Road (NFS road #2316) year-round during the 2-year evaluation program and the 1-year period during reconstruction of the Bear Creek Road. The continued and increased use of these two roads for Evaluation Phase and Construction Phase traffic would increase fugitive dust from them. Fugitive dust from mine haul roads typically decreases to background levels within 100 feet of the road. Most of the dust is greater than PM_{10} (Organiscak and Reed 2004).

The Libby Loadout would be completely enclosed; no particulate emissions would occur from transfer, storage, or loading activities at this site (Figure 12). The transfer and loading of concentrate onto rail cars would be conducted within the pressurized load-out building. The concentrate would possess a high moisture content (16 percent to 20 percent), which would inherently control particulate emissions. Any product loss from trucks outside the load-out facility would be swept promptly. The complete enclosure of the handling and transfer operations within the pressurized building, combined with the other product loss control methods, is estimated to completely control emissions from the transfer and loading operations. Loaded rail cars waiting for consolidation into a unit train would be covered to prevent wind losses and water pollution.

Table 50. 2006 Modeled Maximum Concentrations During Operations, Alternative 2.

Pollutant	Averaging Period	Maximum Modeled Concentration ($\mu g/m^3$)	Pollutant Background ($\mu g/m^3$)	Total Concentration (Modeled + Background) ($\mu g/m^3$)	MAAQS$^{\Delta}$ ($\mu g/m^3$)	% of MAAQS	NAAQS$^{\Delta}$ ($\mu g/m^3$)	% of NAAQS
PM_{10}	Annual	4.09	14	18.09	50	36.2	Revoked	—
	24-Hour†	21.66	35	56.66	150	37.8	150	37.8
$PM_{2.5}$	Annual	2.1	3.5	5.60	—	—	12	46.6
	24-Hour†	13.97	10.4	24.37	—	—	35	69.6
NO_x	Annual‡	19.8	6	25.8	94	27.5	100	25.8
	1-Hour§	364	75	439	564	77.8	—	—
SO_2	Annual	1.92	3	4.92	52	9.5	80	6.2
	24-Hour†	12.25	11	23.25	262	8.9	365	6.4
	3-Hour†	42.15	26	68.15	—	—	1,300	5.2
	1-Hour†	51.42	35	86.42	1,300	6.7	—	—
Lead	Quarterly*	0.00026	NA	0.00026	—	—	1.5	0.02
	90-day*	0.00026	NA	0.00026	1.5	0.02	—	—

$^{\Delta}$Standards shown were in effect at the time of the 2006 modeling.

†Concentrations are high second-high values. Certain ambient air quality standards are "not to be exceeded more than once per year." DEQ looks at the highest second high value for maximum modeled concentrations.

‡The ambient ratio method has been applied to this result.

§The ozone limiting method has been applied to this result.

*The 1-month average concentration is used for compliance demonstration.

NA = Not available.

$\mu g/m^3$ = microgram per cubic meter.

Source: DEQ 2015a.

Table 51. 2011 Maximum Modeled 1-Hour NO_2 and SO_2 Concentrations, Alternative 2.

Pollutant and Averaging Period	Modeled Concentration ($\mu g/m^3$)	Tier 2 Ambient Ratio	Modeled Concentration with Ratio Applied ($\mu g/m^3$)	Background Concentration ($\mu g/m^3$)	Total Concentration ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	% of NAAQS
Construction Phase							
NO_2†	91.29	0.80	73.04	40	113.04	188.679	59.9
SO_2§	0.00079	—	—	35	35.00	195.00	18.0
Production Phase							
NO_2†	90.22	0.80	72.18	40	112.18	188.679	59.8
SO_2§	21.19	—	—	35	56.19	195.00	28.8

†8th highest daily maximum 1-hour concentration.
§4th highest daily maximum 1-hour concentration.
Source: Carter Lake Consulting LLC 2011.

Greenhouse Gas Emissions

Anticipated emissions of greenhouse gas emissions (GHGs) from Montanore Project combustion sources are 32,500 metric tons per year CO_2-equivalent, including 250 tons/year from methane (CH_4) and nitrous oxide (N_2O) (combined), and the remainder from CO_2. Forty-one percent of the total GHG emissions would be generated by diesel-fired underground equipment, and 43 percent would be generated by diesel-fired surface mine equipment. Contractor highway haul trucks carrying ore account for 7 percent, and propane-fired mine air heaters 9 percent (Bridges Unlimited 2010). GHG emissions from the mine would substantially decrease when underground mining ceased and would end after the adits were plugged.

The EPA's Region 8 Climate Change Strategic Plan provides details of the 2007 GHG emission inventories in five EPA Region 8 states (EPA 2008). The inventories are based on the region's consumption of electricity, and do not include electricity that is produced for export outside the region. Based on these, and an evaluation of the emissions from North Dakota, the EPA determined:

- The states in EPA Region 8 were responsible for 5.3 percent of the nation's greenhouse gas emissions in 2005 totaling 362.39 million metric tons of CO_2
- The principal sources of the region's emissions vary by state, but include energy use, transportation, the fossil fuel industry, and agriculture

A key objective of EPA's plan includes mitigation, including identifying and implementing goals and prioritized activities that have the highest potential to reduce greenhouse gas emissions. In particular, GHG-emitting projects subject to NEPA should disclose relevant information about the project's GHG emissions.

Anticipated emissions of GHGs from MMC would represent 0.009 percent of 2005 EPA Region 8 emissions. A typical coal-burning power plant emits several million tons of carbon dioxide a year. The 32,500-ton emission level is comparable to the emissions from burning 170 rail cars of coal or the annual energy use of about 2,860 homes. MMC's and the proposed mitigation measures in Alternatives 3 and 4 to minimize GHG emissions are discussed in section 3.4.4.2.7, *Best Available Control Technology Analysis*, DEQ's Supplemental Preliminary Determination (DEQ 2015a), and MMC's air quality permit application (TRC Environmental Corp. 2006a). The DEQ does not have the authority to regulate GHG emissions in minor source permits.

3.4.4.2.2 Clean Air Act General Conformity Analysis

The agencies completed an assessment of all potential PM air emissions within the PM_{10} and the $PM_{2.5}$ nonattainment areas to determine if a general conformity analysis required by 40 CFR 93.153 would be required. A conformity determination is required for each criteria pollutant or precursor where the total of direct and indirect emissions of the criteria pollutant or precursor in a nonattainment or maintenance area caused by a Federal action would equal or exceed any of the rates in paragraphs (b)(1) or (2) of 40 CFR 93.153. The specific activities that may contribute to particulate matter emissions in the PM_{10} and $PM_{2.5}$ nonattainment areas are discussed in the following sections. The only project facilities in the PM_{10} and $PM_{2.5}$ nonattainment areas, including the 10-km buffer to the PM_{10} nonattainment area would be the Libby Loadout and the access road (US 2 and some segments of the NFS road #278 (Bear Creek Road)).

Initial Construction Traffic and Building Construction

Construction of a simple steel building at the Libby Loadout would be short in duration, and would result in negligible air emissions from construction crew light vehicle traffic and limited heavy construction vehicle traffic to the site on existing paved roads. The loadout building would be built on an existing concrete pad. The construction period is expected to last less than 2 months. Temporary dust emissions would be negligible.

Truck Traffic

At peak production, about 420 tons of concentrate, or 21 trucks, would be trucked daily via NFS road #4781, a new access road (the Ramsey Plant Site Access Road), NFS road #278 (Bear Creek Road), reconstructed sections of NFS road #278, and US 2 to Libby, and then to a road accessing the Kootenai Business Park to a loadout facility.

The DEQ extends the designated PM_{10} nonattainment area with an additional 10-kilometer buffer. If that additional distance is added to each concentrate truck trip, the maximum potential PM_{10} emissions from truck traffic on the paved road in the PM_{10} nonattainment area plus the buffer zone is 81.8 tons per year (Bridges Unlimited 2010). Potential $PM_{2.5}$ and PM_{10} emission would be well below the 100 tons per year rates of PM_{10} and $PM_{2.5}$ emission that would require a general conformity analysis.

Loadout Activities

Minimal PM emissions would result from loadout activities. Concentrates would be stored at the loadout inside an enclosed building with rail access at the Kootenai Business Park. The facility would be covered to eliminate any precipitation, runoff, or fugitive emission issues. The concentrate would be moist, so minimal fugitive PM emissions are anticipated. The Supplemental Preliminary Determination contains several conditions associated with loadout activities, which would be effective in minimizing emissions.

Rail Service

Rail cars loaded with ore would be consolidated into an existing unit train that was already traveling on the rail route. There would be no additional rail service.

3.4.4.2.3 New Source Performance Standards

The Montanore Mine is subject to 40 CFR 60, Subpart LL, “Standards of Performance for Metallic Mineral Processing Plants.” This subpart limits the emission rate of particulate matter from “affected facilities” at metallic mineral processing plants. Affected facilities are defined as each crusher and screen in open-pit mines; each crusher, screen, bucket elevator, conveyor belt transfer point, thermal dryer, product packaging station, storage bin, enclosed storage area, truck loading station, truck unloading station, railcar loading station, and railcar unloading station at the mill or concentrator. All facilities located underground are exempt from this subpart.

The DEQ’s Supplemental Preliminary Determination includes the following conditions that identify sources subject to New Source Performance Standards:

- Emissions from the baghouses used to control emissions from the surface ore handling activities at the SAG mill and at the Libby Loadout facility. The Supplemental Preliminary Determination limits emissions to 0.05 grams per dry standard cubic meter (g/dscm) or 0.020 grains/dscm.

- Emissions from the wet Venturi scrubber used to control emissions from the coarse ore stockpile transfer to the apron feeders. The Supplemental Preliminary Determination limits emissions to 0.05 g/dscm or 0.020 grains/dscm.
- The Supplemental Preliminary Determination prohibits stack emissions that exhibit 7% opacity or greater averaged over 6 consecutive minutes from the baghouse.
- The Supplemental Preliminary Determination prohibits any fugitive emissions from process equipment that exhibit 10% opacity or greater averaged over 6 consecutive.

3.4.4.2.4 Hazardous Air Pollutant Impact Assessment

Various metals would be present in ore, tailings, waste rock, concentrate, and road dust. Some of the metals are considered hazardous air pollutants (HAPs). The Montanore Mine is not explicitly required by Montana air quality regulations (ARM 17.8 Sub-Chapter 7) to assess human health risks from HAP emissions. A human health risk assessment was performed for the trace metals classified as HAPs to provide a full disclosure of potential HAP impacts (TRC Environmental Corp. 2006a).

The analysis predicted concentrations of arsenic, antimony, cadmium, chromium, and lead. No Montana risk assessment guidance exists for this source type; as a result, maximum modeled concentrations were used to calculate carcinogenic risk based on currently established unit risk factors for lifetime exposure as defined in the Integrated Risk Information System (IRIS) database (IRIS 2005).

The Montanore Mine Operations Phase would last from 16 to 20 years. The total combined cancer risk from three metals (arsenic, cadmium, and chromium) was determined by summing the cancer risk of each metal using a 20-year exposure period and was found to be acceptable when compared with the acceptable total lifetime risk level. Predicted concentrations also were compared to EPA's concentrations for screening risk assessments. Predicted concentrations of all HAPs were below EPA risk screening levels (Table 52). MMC would begin air monitoring arsenic, cadmium, chromium, and lead at the commencement of mill facilities or the tailings impoundment and continue air monitoring for at least 1 year after normal production was achieved. MMC would analyze for metals shown in Table 17 on the PM_{10} filters once the mill facilities and tailings impoundment were operational. At that time, the DEQ would review the air monitoring data and determine if continued monitoring or additional monitoring were warranted. The DEQ may require continued air monitoring to track long-term impacts of emissions and cancer risk, or require additional ambient air monitoring or analyses if any changes took place regarding quality and/or quantity of emissions or the area of impact from the emissions.

Table 52. 2006 Modeled HAP Concentrations.

Pollutant	EPA weight-of-evidence for carcinogenicity‡	Averaging Period	Maximum Modeled Concentration ($\mu g/m^3$)§	IRIS Lifetime Cancer Risk Factor (per $\mu g/m^3$)	Lifetime Exposure Cancer Risk	Chronic Inhalation, Cancer ($\mu g/m^3$)‡	Imminently Dangerous to Life and Health ($\mu g/m^3$)†
Arsenic	A - Human carcinogen	Annual	0.00053	0.0043	0.00000070	0.0043	500
Cadmium	B1 - probable carcinogen, limited human evidence	Annual	0.00005	0.0018	0.00000003	0.0018	900
Chromium	Chromium VI compounds: carcinogenic to humans	Annual	0.00008	0.0120	0.00000030	0.0120	1,500
Antimony		Annual	0.00005	None	—	NA	5,000
Lead	B2 - probably carcinogen, sufficient evidence in animals	Monthly	0.00026	None	—	NA	10,000
Total lifetime cancer risk					0.0000013		

$\mu g/m^3$ = microgram per cubic meter.
Source: ‡EPA 2007b; §TRC Environmental Corp. 2006a; †EPA 2007a.

3.4.4.2.5 Nonattainment Area Boundary Impact Assessment

Minimal PM emissions would result from loadout activities, which would occur in the Libby nonattainment area. The Supplemental Preliminary Determination contains several conditions associated with loadout activities, which would be effective in minimizing emissions. In 2011, the EPA determined the Libby nonattainment area met the 24-hour PM_{10} standard as of December 1994 and has not had an exceedance of the standard since then. Modeled concentrations of $PM_{2.5}$ from mine operations were calculated in 2006 at receptors placed at regular intervals along the nonattainment area boundary (Table 53).

Table 53. 2006 Modeled Nonattainment Area Concentrations to PSD Class II Significance Levels, Alternative 2.

Nonattainment Area	Pollutant and Averaging Period	Maximum Modeled Concentration (μg/m^3)	PSD Class II Significance Level (μg/m^3)†
Libby, MT $PM_{2.5}$	$PM_{2.5}$ Annual $PM_{2.5}$ 24-Hour	0.44 1.75	0.3 1.2

μg/m^3 = microgram per cubic meter.
†Not established in 2006.
Source: DEQ 2015a.

3.4.4.2.6 Cabinet Mountain Wilderness Impact Assessment

An analysis of air quality impacts at and within the PSD Class I Area boundary was completed, and concentrations were compared to PSD Class I Increments that exist for PM_{10}, NO_2, and SO_2. Modeled concentrations were predicted to be less than PSD Class I Increments at all locations at and within the Class I Area boundary (Table 54).

The Air Quality Related Values analysis included dispersion modeling to determine visibility impacts, and nitrogen and sulfur deposition impacts on CMW from mine operations (TRC Environmental Corp. 2006b).

Table 54. 2006 Modeled Concentrations in the CMW Compared to PSD Class I Increments, Alternative 2.

Pollutant	Averaging Period	Maximum Modeled Concentration (μg/m^3)	Class I Increment (μg/m^3)	% of Class I Increment
PM_{10}	Annual	0.25	4	6.4
	24-Hour	4.18	8	52
NO_2	Annual	1.62	2.5	65
SO_2	Annual	0.10	2	5.0
	24-Hour	2.24	5	45
	3-Hour	7.97	25	32

μg/m^3 = microgram per cubic meter.
Source: TRC Environmental Corp. 2006a.

Visibility Impact

Out of 1 year of PLUVUE II analysis hourly analyses, only 3 hours of potential plume impairment were found for each of the Ramsey Plant Site portal and the emergency generator at the Libby Adit. The emergency generator was modeled at maximum hourly emission rates year-round, although it is expected to be permitted to operate a maximum of 16 hours per any rolling 12-month time period. The potential plume impairment hours would be just over the thresholds for color difference.

Contrast parameters were computed to be less than threshold values, indicating that there would be no perceptible contrast change or general haze in the CMW due to the mine. The reduction in visual range also was predicted to be below perceptible levels. Infrequent, episodic events, such as high winds causing erosion of the tailings impoundment surface, may cause minor, short-term visual impacts from dust plumes that could be visible from the CMW and other areas. The results of the FLAG PLUVUE analysis indicated that impacts on visibility at the CMW from mine sources would be minor, precluding the need for any further analyses.

Nitrogen and Sulfur Deposition

Modeled maximum nitrogen deposition rates from the mine were 7 to 10 times greater than the FLM deposition analysis thresholds at Upper Libby Lake, Lower Libby Lake and Rock Lake; maximum sulfur deposition impacts were less than the deposition analysis thresholds at Lower Libby Lake and Rock Lake and greater than the deposition thresholds at Upper Libby Lake (Table 55). Nitrogen and sulfur emissions from the mine would substantially decrease when underground mining ceased and would end after the adits were plugged.

3.4.4.2.7 Best Available Control Technology Analysis

Emission controls to be used at the proposed mine would constitute Best Available Control Technology (BACT), as required by ARM 17.8.752(1)(a). MMC would operate all equipment to provide for maximum air pollution control for which it was designed (TRC Environmental Corp. 2006a). Dust emissions from ore handling activities would be controlled with water sprays, wet Venturi scrubbers, baghouses, and enclosures. Ore grinding operations at the Semi-Autogenous Grinding (SAG) mill would be fully enclosed and wet, with water pumped into the SAG mill at a rate of 7,780 gpm; therefore, the mill would not be a source of air emissions. Water sprays would

Table 55. Maximum Predicted Nitrogen and Sulfur Deposition, Alternative 2.

Pollutant	Site	Deposition Impact (kilograms/ hectare/year)	Deposition Analysis Threshold (kilograms/ hectare/year)
Nitrogen	Lower Libby Lake	0.0498	0.005
	Upper Libby Lake	0.0544	
	Rock Lake	0.0367	
Sulfur	Lower Libby Lake	0.0048	0.005
	Upper Libby Lake	0.0052	
	Rock Lake	0.0036	

Source: TRC Environnemental Corp. 2006b.

be used, as needed, to prevent excess fugitive dust at the Little Cherry Creek Tailings Impoundment. Other proposed controls would comply with BACT (DEQ 2015a).

3.4.4.2.8 Odor and Noise

Odor and noise are not regulated in the ARM. Odor is a potential nuisance, but the project is not expected to increase odors. Noise is discussed in the subsequent *Sound, Electrical and Magnetic Fields, Radio and TV Effect* section.

3.4.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

3.4.4.3.1 Particulate Matter and Gaseous Ambient Pollutants

Modeled Concentrations

In 2011, the DEQ modeled daily and annual $PM_{2.5}$ and PM_{10} emissions were using Alternative 3 facility locations. These pollutants were selected because the 2006 modeling analyses (Table 50) showed these emissions had the greatest impacts on their respective NAAQS. The maximum $PM_{2.5}$ and PM_{10} emission rates did not exceed any standard (Table 56). Based on these results that were lower than the corresponding 2006 results, the emission rates of CO, lead, NO_2, and SO_2 would be below applicable standards.

The DEQ also modeled NO_2 and SO_2 concentrations using Alternative 3 facility locations (Table 57). Adding an ambient background value of 35 $\mu g/m^3$ for SO_2 and 40 $\mu g/m^3$ for NO_2, maximum concentrations would be less than 1-hour ambient air quality standards (DEQ 2015a). The maximum NO_2 concentrations would occur in the Construction Phase and the maximum SO_2 concentration would occur during the Operations Phase. The agencies assumed the Evaluation Phase of Alternatives 3 and 4 would have the same generator use and emissions as the Construction Phase. If Tier 4 engines were available and used in underground mobile equipment and on generators, emissions would be less than shown in Table 57 during all phases of the project.

The Poorman Tailings Impoundment Site is about 1 mile south of the Little Cherry Creek Tailings Impoundment Site. The agencies also modified MMC's tailings dust control measures. The DEQ's Supplement Preliminary Determination (DEQ 2015a) has specific requirements for tailings dust management. One requirement is that MMC would develop a general operating plan for the tailings impoundment site including a fugitive dust control plan to control wind erosion from the tailings impoundment site. The plan would include, at a minimum, the embankment and cell (if any) configurations, a general sprinkler arrangement, and a narrative description of the operation, including tonnage rates, initial area, and timing of future enlargement. Another requirement would be that spigots distributing wet tailings material and water would cover about one-half of the total tailings at any time. The spigots would be moved regularly and would cause wetting of all non-submerged portions of the tailings impoundment to occur each day. This wetting would be supplemented by sprinklers as necessary when weather conditions could exist to cause fugitive dust. MMC would develop a general operating plan for the tailings impoundment site including a final fugitive dust control plan to control wind erosion from the tailings impoundment site. Should these measures not be adequate to control wind erosion from the impoundment, MMC would submit a revised plan to the agencies for approval, incorporating alternative measures, such as a temporary vegetation cover. These measures would be effective in minimizing wind-blown tailings at the tailings impoundment site and would make the effects less than Alternative 2. Construction emissions and effects on air quality in Libby would be the same as Alternative 2.

Table 56. 2011 Modeled Maximum $PM_{2.5}$ and PM_{10} Concentrations During Operations, Alternative 3.

Pollutant	Averaging Period	Maximum Modeled Concen-tration† ($\mu g/m^3$)	Background Concen-tration ($\mu g/m^3$)	Total Concen-tration (Modeled + Background) ($\mu g/m^3$)	MAAQS ($\mu g/m^3$)	% of MAAQS	NAAQS ($\mu g/m^3$)	% of NAAQS
PM_{10}	Annual	6.4	14	20.4	50	40.8	Revoked	—
	24-Hour	45.3	35	80.3	150	53.5	150	53
$PM_{2.5}$	Annual	1.2	3.5	4.7	—	—	15	31.3
	24-Hour	9.7	10.4	20.1	—	—	35	57.4

†Concentrations are high second-high values.
$\mu g/m^3$ = microgram per cubic meter.
The current NAAQS for annual $PM_{2.5}$ is 12 $\mu g/m^3$. The EPA allowed grandfathering of pending preconstruction permitting applications if the application was deemed complete by December 14, 2012; this grandfathering would apply to the Montanore Project, and MMC would not need to demonstrate compliance with the new annual $PM_{2.5}$ standard.
Source: DEQ 2015a.

Table 57. 2011 Maximum Modeled 1-Hour NO_2 and SO_2 Concentrations, Alternative 3.

Pollutant and Averaging Period	Modeled Concentration ($\mu g/m^3$)	Tier 2 Ambient Ratio	Modeled Concentration with Ratio Applied ($\mu g/m^3$)	Background Concentration ($\mu g/m^3$)	Total Concentration ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	% of NAAQS
Construction Phase							
NO_2†	87.07	0.80	69.656	40	109.656	188.679	58.1
SO_2§	0.0004	—	—	35	35.00	195.00	18.0
Production Phase							
NO_2†	73.33	0.80	58.664	40	98.664	188.679	52.3
SO_2§	17.82	—	—	35	52.82	195.00	27.1

†8th highest daily maximum 1-hour concentration.
§4th highest daily maximum 1-hour concentration.
Source: DEQ 2015a.

The DEQ's Supplemental Preliminary Determination on MMC's air quality permit (DEQ 2015a) contains a number of limitations on air emissions summarized in Chapter 2, beginning on p. 163. MMC would treat all unpaved portions of the haul roads, access roads, parking lots, or the general plant area with water, as necessary, to maintain compliance with the reasonable precautions limitations of the draft permit. These limitations would ensure actual concentrations would be equal to or less than modeled concentrations.

Greenhouse Gas Emissions

GHG emissions in Alternative 3 would be similar to Alternative 2 because mobile and stationary combustion sources would be similar (Bridges Unlimited 2010). The mitigation in Alternative 3, such as limiting generator use at the mill after power was available from a transmission line to 16 hours during any rolling 12-month time period and using Tier 4 engines, if available on generators and underground equipment and ultra-low diesel fuel in underground mobile equipment, would substantially reduce nitrogen emissions compared to Alternative 2. Nitrogen and sulfur emissions from the mine would substantially decrease when underground mining ceased and would end after the adits were plugged.

3.4.4.3.2 Nonattainment Area Boundary Impact Assessment

Modeled concentrations of $PM_{2.5}$ from mine operations were calculated at model receptors located at regular intervals along the nonattainment area boundary, and were compared to EPA's PSD Class II significance levels for $PM_{2.5}$ Modeled concentrations were predicted to be less than the significance levels, indicating that mine operations would not significantly affect $PM_{2.5}$ concentrations within Libby's nonattainment area (Table 58).

Table 58. 2011 Modeled Nonattainment Area Concentrations to PSD Class II Significance Levels, Alternative 3.

Nonattainment Area	Pollutant and Averaging Period	Maximum Modeled Concentration ($\mu g/m^3$)	PSD Class II Significance Level ($\mu g/m^3$)
Libby, MT $PM_{2.5}$	$PM_{2.5}$ Annual	0.02	0.3
Libby, MT $PM_{2.5}$	$PM_{2.5}$ 24-Hour	0.36	1.2

$\mu g/m^3$ = microgram per cubic meter.

Source: DEQ 2015a.

The 2006 modeling showed no Class I PSD increment was consumed. Because the greatest increase in the emissions occurred in the NO_x emissions (Table 48 and Table 54), a PSD Class I increment modeling analysis was conducted. Because there is no short-term NO_2 PSD Class I increment, the annual NO_x emissions were modeled and compared to the correspond PSD Class I increment (Table 59). The PSD Class I annual NO_2 increment would not be consumed by the NO_x emissions.

Table 59. 2011 Modeled NO_2 Concentrations in the CMW Compared to PSD Class I Increments, Alternative 3.

Pollutant	Averaging Period	Maximum Modeled Concentration (µg/m³)	Class I Increment (µg/m³)	% of Class I Increment
NO_2	Annual	0.12	2.5	4.8

µg/m³ = microgram per cubic meter.
Source: DEQ 2015a.

3.4.4.3.3 Cabinet Mountain Wilderness Impact Assessment

Modeled maximum nitrogen deposition rates from the mine were less than the FLM deposition analysis threshold at Upper Libby Lake, Lower Libby Lake, and Rock Lake. Modeled rates were highest at Rock Lake, at 0.0011 kilograms/hectare/year (Table 60). Modeled deposition for sulfur dioxide (SO_2) used emissions based on a fuel sulfur content of 50 ppm (0.005%). Since those calculations were performed, federal regulations (40 CFR 80 Subpart I) have become effective that require the use of ultra-low sulfur diesel fuel with the equivalent of 15 ppm sulfur (0.0015%). Using ultra-low sulfur diesel in the modeling, SO_2 emissions from diesel combustion would be 70 percent less than calculated for Alternative 2. Sulfur deposition rates would have a corresponding reduction because 97 percent of SO_2 at the mine would be emitted from diesel fuel combustion sources. Sulfur deposition rates are expected to be below the sulfur deposition analysis threshold (Klepfer Mining Services 2013a). The mitigation in Alternative 3, such as limiting generator use at the mill after power was available from a transmission line to 16 hours during any rolling 12-month time period and using Tier 4 engines if available on underground mobile equipment and generators and ultra-low diesel fuel during all project phases, would substantially reduce nitrogen and sulfur emissions compared to Alternative 2. Nitrogen and sulfur emissions from the mine would substantially decrease when underground mining ceased and would end after the adits were plugged.

Table 60. Maximum Predicted Nitrogen Deposition, Alternatives 3 and 4.

Pollutant	Site	Deposition Impact (kilograms/ hectare/year)	Deposition Analysis Threshold (kilograms/ hectare/year)
Nitrogen (as NO_2)	Lower Libby Lake	0.0006	0.005
	Upper Libby Lake	0.0006	
	Rock Lake	0.0011	

Source: Klepfer Mining Services 2013b.

In Alternatives 3 and 4, MMC would monitor nitrogen and sulfur emissions at the Libby Adit for a minimum of 2 years. Using the monitoring data, MMC would update the nitrogen and sulfur deposition analysis and compare the updated model results to the current FLM deposition analysis thresholds. MMC would also assess potential effects on lake ANC if appropriate methods were available. If modeled results using the Libby Adit monitoring data were greater than current

FLM deposition analysis thresholds, MMC would develop a plan for agencies' review that evaluated all available control technologies to reduce pollutant emissions.

3.4.4.3.4 Effectiveness of Agencies' Proposed Mitigation

The DEQ's Supplemental Preliminary Determination on MMC's air quality permit (DEQ 2015a) contains a number of limitations on air emissions described in Chapter 2, beginning on p. 163. These limitations would be effective in ensuring actual concentrations would be equal to or less than modeled concentrations.

The reporting requirements described in Appendix C, along with the conditions and reporting requirements in DEQ's Supplemental Preliminary Determination (DEQ 2015a) would be adequate to control emissions. MMC's and the agencies' proposed controls would comply with BACT (see section 3.4.4.2.7, *Best Available Control Technology Analysis*). One requirement is that MMC would develop a general operating plan for the tailings impoundment site including a fugitive dust control plan to control wind erosion from the tailings impoundment site. The plan would include, at a minimum, the embankment and cell (if any) configurations, a general sprinkler arrangement, and a narrative description of the operation, including tonnage rates, initial area, and timing of future enlargement. Should these measures not be adequate to control wind erosion from the impoundment, MMC would submit a revised plan to the agencies for approval, incorporating alternative measures, such as a temporary vegetation cover. These measures would be effective in minimizing wind-blown tailings at the tailings impoundment site.

Alternative 3 mitigation, such as limiting generator use at the mill after power was available from a transmission line to 16 hours during any rolling 12-month time period and using Tier 4 engines if available on underground mobile equipment and generators and ultra-low diesel fuel during all project phases, would be effective in minimizing nitrogen and sulfur deposition on wilderness resources.

3.4.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Alternative 4 would have essentially the same air emissions associated with underground exhaust and milling operations as Alternative 3 (Table 49). Concentrations of all pollutants would be below applicable standards. Effects from the tailings impoundment, road construction, and concentrate shipment would be the same as Alternative 2.

3.4.4.5 Alternative A— No Transmission Line

Air quality would not be directly affected if a transmission line was not built. However, if the transmission line was not constructed, generators would be used to meet the electrical power requirements of the mine. The operation of generators at the site would result in increased air pollutant emissions and subsequent ambient air quality impacts greater than those quantified for Alternative 2 or Alternative 3. MMC would revise its air quality permit application to quantify the effects of the generators.

3.4.4.6 Effects Common to Transmission Line Alternatives B, C-R, D-R, and E-R

Construction of all transmission line alternatives, including BPA's construction and maintenance of the Sedlak Park Substation and loop line, would result in short-term increases in gaseous and particulate emissions. Similar, but lower, emissions would occur at the end of operations when the transmission line is removed. The agencies' transmission line alternatives (Alternatives C-R, D-R, and E-R) would comply with the Environmental Specifications (Appendix D) regarding dust control and slash burning.

3.4.4.7 Cumulative Effects

Past and current actions used in the Montanore Project cumulative effects analysis are described in detail in section 3.2 and reasonably foreseeable are described in detail in section 3.3. The analysis area is described above in section 1.1.2. Cumulative air quality effects occur when a variety of projects or sources contribute to emissions in the area of analysis. All transmission line action alternatives would have similar cumulative impacts to air quality. Mine Alternative 2 would be expected to have greater cumulative impacts to air quality than Alternatives 3 or 4.

3.4.4.7.1 Past and Current Actions

Mining Activities

Troy Mine

The Troy Mine, an existing hard rock mine currently in care and maintenance status, is 18.5 miles from the proposed Montanore mill site. Despite the close proximity, the Montanore Project and Troy Mine do not share common airsheds due to the mountainous terrain (Cain 2015; see Figures 1 and 2 in the reference). The Troy Mine is classified as a minor source under the Title V (40 CFR 70.2) and PSD regulations (40 CFR 52.21). Currently, the air quality classification of the area surrounding the mine is "Unclassifiable/Attainment" for all air quality criteria pollutants (40 CFR 81.327).

Modeled Montanore Project emissions for the Construction and Operations phases (Alternative 3 and 4) plus background concentrations and emissions from the Troy Mine were compared to applicable MAAQS/NAAQS as described above in section 3.4.2.3.2. The incremental cumulative effect of the Troy Mine, the proposed Rock Creek Mine, and the Montanore Mine on NO_2 concentrations was 0.01 µg/m^3 during construction and 0.05 µg/m^3 during operations (Table 61). The cumulative effect of the three projects would not cause or contribute to an exceedance of the 1-hour NO_2 NAAQS. The incremental cumulative effect of the Troy Mine, the proposed Rock Creek Mine, and the Montanore Mine on daily and annual $PM_{2.5}$ and PM_{10} was 0.01 µg/m^3 or less (Table 62). The cumulative effect of the three projects would not exceed the corresponding NAAQS/MAAQS (Table 62). The greatest cumulative effect would be in Alternative 2, which includes the use of portable Tier 2 generators during the Evaluation Phase. Because the incremental cumulative effect is 0.05 µg/m^3 or less for NO_2, $PM_{2.5}$, and PM_{10}, the cumulative effect of the three projects would not cause or contribute to an exceedance of applicable standards in Alternative 2. The incremental cumulative effect of the Montanore, Rock Creek, and Troy projects on all air pollutants would be negligible in all alternatives.

The 2006 and 2011 modeling demonstration conducted for the Montanore Mine predicted compliance with the Class I and Class II increments at the CMW boundary (see section 3.4.4.2.5, *Nonattainment Area Boundary Impact Assessment*). Because Montanore emissions alone were insignificant, the PSD Class I increment and impacts on the Libby PM_{10} nonattainment and $PM_{2.5}$ maintenance areas were not examined in the 2015 modeling (DEQ 2015a).

Other Minerals Activities

Although there are numerous active and inactive mining claims in the vicinity of the Montanore Project, the incremental contribution of emissions from the Montanore Project and the sporadic and small scale working of these claims would not have a considerable cumulative effect on air quality in the analysis area.

KNF Management Activities

Past and current KNF management actions are listed in Appendix E. The incremental contribution of emissions from the Montanore Project and these activities would not have a considerably cumulative effect on air quality in the analysis area.

Private Land Activities

With the exception of the Libby Loadout, past actions on private land in the analysis area, such as the Libby Creek Placer timber harvest and Avista-funded bull trout recovery activities, have had little effect on ambient air quality in the analysis area. Wood burning and other human activity at the Libby Loadout have increased concentrations of particulate matter and other gaseous pollutants. The EPA has designated the area around the proposed Libby Loadout, formerly a mill site industrial area, and currently the Kootenai Business Park, as Operable Unit 5 of the Libby Asbestos National Priorities List Site. EPA sampling and assessment of Operable Unit 5 has indicated that disturbance of wood chips stored on site would not result in detectable fiber emissions. EPA determined that there was no potential human exposure to Libby asbestos at Operable Unit 5 (CDM Smith 2012).

Other Government Agency Activities

Government agency activities include actions such as DNRC's Habitat Conservation Plan and FWP's Plum Creek Conservation Easement. The incremental contribution of emissions from the Montanore Project and these government agency activities would not have a considerable cumulative effect on air quality in the analysis area.

3.4.4.7.2 Reasonably Foreseeable Actions

Climate Change

Greenhouse gas emissions from the Montanore Project are discussed above under section 3.4.4.

Table 61. 2015 1-Hour NO_2 Cumulative Modeling Results.

Phase	Direct or Cumulative	Modeled Concen-tration† ($\mu g/m^3$)	Tier 2 Ambient Ratio	Modeled Concentration with Ratio Applied ($\mu g/m^3$)	Background Concentration ($\mu g/m^3$)	Total Concen-tration (Modeled + Background) ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	% of NAAQS
Construction	Direct	82.78	0.80	66.22	40	106.22	188.679	56.3
	Cumulative	82.79	0.80	66.23	40	106.23	188.679	56.3
Operations	Direct	78.14	0.80	62.51	40	102.51	188.679	54.3
	Cumulative	78.19	0.80	62.55	40	102.55	188.679	54.4

†Concentrations are high second-high values. Modeled concentrations vary slightly from those shown in Table 57 due to slight model changes.
$\mu g/m^3$ = microgram per cubic meter.
Source: DEQ 2015a.

Table 62. 2015 Daily and Annual Cumulative Modeled Production Phase PM_{10} and $PM_{2.5}$ Results.

Pollutant	Averaging Period	Direct or Cumulative	Maximum Modeled Concen-tration† ($\mu g/m^3$)	Background Concentration ($\mu g/m^3$)	Total Concen-tration (Modeled + Background) ($\mu g/m^3$)	MAAQS ($\mu g/m^3$)	% of MAAQS	NAAQS ($\mu g/m^3$)	% of NAAQS
PM_{10}	Annual	Direct	11.57	14	25.57	50	51.1	Revoked	—
	Annual	Cumulative	11.58	14	25.58	50	51.2	Revoked	—
PM_{10}	24-Hour	Direct	45.86	35	80.86	150	53.9	150	53.9
	24-Hour	Cumulative	45.87	35	80.87	150	53.9	150	53.9
$PM_{2.5}$	Annual	Direct	2.10	3.5	5.60	—	—	15	37.3
	Annual	Cumulative	2.11	3.5	5.61	—	—	15	37.4
$PM_{2.5}$	24-Hour	Direct	9.88	10.4	20.28	—	—	35	57.9
	24-Hour	Cumulative	9.88	10.4	20.28	—	—	35	57.9

†Concentrations are high second-high values. Modeled concentrations vary slightly from those shown in Table 56 due to slight model changes.
$\mu g/m^3$ = microgram per cubic meter.
The current NAAQS for annual $PM_{2.5}$ is 12 $\mu g/m^3$. The EPA allowed grandfathering of pending preconstruction permitting applications if the application was deemed complete by December 14, 2012; this grandfathering would apply to the Montanore Project, and MMC would not need to demonstrate compliance with the new annual $PM_{2.5}$ standard.
Source: DEQ 2015a.

Mining Activities

Rock Creek Project

The proposed Rock Creek Project on the west side of the Cabinet Mountains in the Rock Creek drainage would not contribute to the cumulative effect on air quality Although the Rock Creek Mine is only 9 miles from the proposed Montanore Mine mill site, the Cabinet Mountains lie between the two mines with elevations ranging from 2,880 feet to 8,738 feet. Due to this mountain range, the airsheds between these two mines are clearly distinct (DEQ 2015a; Cain 2015 (see Figures 1 and 2 in the reference)). The Rock Creek Project is classified as a minor source under the Title V (40 CFR 70.2) and PSD regulations (40 CFR 52.21). Currently, the air quality classification of the area surrounding the mine is “Unclassifiable/Attainment” for all air quality criteria pollutants (40 CFR 81.327).

The Rock Creek Mine would have similar emissions sources associated with the plant site, tailings impoundment, and other surface disturbances as the Montanore Mine. The project would use diesel equipment in the mine and vent mine exhaust northeast of the plant site. Although Montanore’s intake ventilation adit would be located in the CMW, it would not be a source of emissions.

The cumulative effect of the Rock Creek Project was discussed previously under the Troy Mine discussion. The incremental cumulative effect of the Montanore, Rock Creek, and Troy projects on all air pollutants would be negligible in all alternatives. The 2006 and 2011 modeling demonstration conducted for the Montanore Mine predicted compliance with the Class I and Class II increments at the CMW boundary (see section 3.4.4.2.5, *Nonattainment Area Boundary Impact Assessment*). The Montanore and Rock Creek project have been analyzed and found to have a potential minor and cumulatively insignificant impact on ambient air quality. Because Montanore emissions alone did not exceed NAAQS or MAAQS, the PSD Class I increment and impacts on the Libby PM_{10} nonattainment and $PM_{2.5}$ maintenance areas were not examined in the 2015 modeling (DEQ 2015a).

The Forest Service has monitored Libby Lakes for many years because of their high quality waters and sensitivity to change. There is concern that emissions from regional mining projects could increase acid deposition to the lakes, with acidification of the lake watershed and lake chemistry and associated adverse aquatic effects. The Forest Service conducted a MAGIC (Model of Acidification of Groundwater in Catchments) model screen analysis for CMW watersheds to determine the risk of both projects on Libby Lakes (Story 1997). The modeling results concluded the estimated changes (less than 5 percent of background levels) in acid anions and base cations would not change the pH or alkalinity in Libby Lakes from either project directly, and cumulatively.

Libby Creek Venture Drilling Plan

Libby Creek Ventures proposes to drill three borings adjacent to the Upper Libby Creek Road (NFS road #2316) on its two claims located in Section 15, Township 27N, Range 31 West. A 20-ton rotary-hammer type truck-mounted drill rig with a trailer and two pick-up trucks will be used to drill the holes and the active drilling will take place during 3 days. The incremental contribution of emissions from Libby Creek Ventures would have negligible cumulative effect on air quality in the analysis area.

KNF Management Activities

Future KNF Management Activities include the Wayup Mine/Fourth of July road access, the Miller-West Fisher vegetation management project, the Flower Creek vegetation management project, Silverbutte Bugs project, and the Bear Lakes access. Timber harvesting, thinning, and prescribed burning associated with these projects on unpaved roads would increase particulate emissions for a short duration. Concentrations of criteria pollutants would be well below the NAAQS and MAAQS. The cumulative effects of these projects would not exceed the NAAQS and MAAQS.

Private Land Activities

Other reasonably foreseeable actions in the area, such as the Poker Hill Rock Quarry and MDT road projects, may be expected to contribute localized, short-term, and transient emissions of fugitive dust. The short-term nature of these potential emissions makes it unlikely that they would add measurably to emissions from the Montanore Project.

3.4.4.8 Regulatory/Forest Plan Consistency

All mine alternatives would implement emission controls at the proposed mine that would constitute BACT, as required by ARM 17.8.752(1)(a). 36 CFR 228.8 requires that mining operators minimize, where feasible, adverse environmental impacts on National Forest surface resources; and comply with applicable state and federal air quality standards including the Clean Air Act. Although Mine Alternative 2 and Transmission Line Alternative B would implement BACT, these alternatives would not fully comply with 36 CFR 228.8. In these alternatives, MMC did not propose to implement feasible measures to minimize air emissions. The agencies' alternatives (Mine Alternatives 3 and 4 and Transmission Line Alternatives C-R, D-R, and E-R) would incorporate additional feasible measures to minimize adverse environmental impacts on National Forest surface resources and to comply with applicable state and federal air quality standards. The proposed mitigation in Alternatives 3 and 4, such as limiting generator use at the mill after power was available from a transmission line to 16 hours during any rolling 12-month time period and using Tier 4 engines if available or Tier 3 on underground mobile equipment and generators and ultra-low diesel fuel during all project phases, would substantially reduce nitrogen and sulfur emissions compared to Alternative 2. Other conditions and limitations on air emissions are described in DEQ's Supplemental Preliminary Determination (DEQ 2015a). MMC would develop a general operating plan for the tailings impoundment site including a final fugitive dust control plan to control wind erosion from the tailings impoundment site. Spigots distributing wet tailings material and water would cover about one-half of the total tailings at any time. The spigots would be moved regularly and would cause wetting of all non-submerged portions of the tailings impoundment to occur each day. This wetting would be supplemented by sprinklers as necessary when weather conditions could exist to cause fugitive dust. These measures would minimize wind-blown tailings at the tailings impoundment.

All mine alternatives have the potential to indirectly affect wilderness qualities. Mitigation measures identified in Chapter 2 for Alternatives 3 and 4 and monitoring required for Alternatives 3 and 4 (Appendix C) would be implemented to minimize changes in wilderness character. In Alternative 3 and 4, potential air quality indirect impacts on wilderness lakes and wilderness character would be minimized by mitigation measures such as limiting generator use, and using Tier 4 engines if available on underground mobile equipment and emergency generators instead of Tier 2 during the Evaluation Phase and Tier 3 engines during all other project phases, and using ultra-low sulfur diesel fuel in those engines as compared to Alternative 2. Mitigation measures and monitoring requirements in Alternatives 3 and 4 are reasonable stipulations for protection of the wilderness character and are consistent with the use of the land for mineral development. Alternatives 3 and 4 would be conducted to protect the surface resources in accordance with the general purpose of maintaining the wilderness unimpaired for future use and enjoyment as wilderness, and to preserve the wilderness character consistent with the use of the land for mineral development and production in compliance with 36 CFR 228.15 and the Wilderness Act. The agencies' mine and transmission line alternatives would comply with the Wilderness Act. Alternatives 3 and 4 would minimize adverse environmental impacts on surface resources within the wilderness, and thereby comply with the regulations (36 CFR 228, Subpart A) for locatable mineral operations on National Forest System lands.

All mine and transmission line alternatives would comply with 36 CFR 228.8(a), the 2015 KFP, and the Montana Clean Air Act because construction activities and facility operations in all alternatives would not result in exceedances of any NAAQS or MAAQS. The DEQ's Supplemental Preliminary Determination (DEQ 2015a) discusses compliance with the Montana Clean Air Act in detail. Mine operations would not significantly affect $PM_{2.5}$ concentrations within Libby's nonattainment area and would comply with the State Implementation Plan. 36 CFR 228.8(h) states that "certification or other approval issued by state agencies or other federal agencies of compliance with laws and regulations relating to mining operations will be accepted as compliance with similar or parallel requirements of these regulations." DEQ's permit decision and conditions on the air quality permit would constitute compliance with Clean Air Act requirements.

All alternatives would maintain progress toward the desired condition to meet applicable federal state, or tribal air quality standards (FW-DC-AQ-01). The KNF would cooperate with the DEQ in meeting the State Implementation Plan and the Smoke Management Plan and all alternatives would be designed and implemented in accordance with FW-GDL-AQ-01.

3.4.4.9 Irreversible and Irretrievable Commitments

During construction and operation of the mine, air pollutant concentrations would be higher throughout the analysis area and in the CMW than current levels, but below applicable air quality standards. Following mine closure and successful reclamation, pollutant concentrations would return to pre-mining levels. There would be no long-term irreversible or irretrievable commitment of resources.

3.4.4.10 Short-term Uses and Long-term Productivity

During construction and operation of the mine, air pollutant concentrations would be higher throughout the analysis area and in the CMW than current levels, but below applicable air quality standards. Once mining and reclamation are completed, the pollutant concentrations would return to pre-mining levels, assuming adequate revegetation success.

3.4.4.11 Unavoidable Adverse Environmental Effects

All action alternatives would temporarily increase air pollutant concentrations in the CMW and the analysis area. Standard control practices would minimize emissions.

3.5 American Indian Rights

Federal laws, regulations, and treaties direct the Forest Service to consult with federally-recognized tribes who may have concerns about federal actions that may affect religious practice, traditional cultural uses, and cultural resource sites and remains associated with American Indian ancestors. The analysis area lies within the aboriginal territory of the Kootenai Tribe. The Confederated Salish and Kootenai Tribes (CSKT) and the Kootenai Tribe of Idaho (KTOI) are the federally-recognized tribes representing the modern members of the Kootenai Tribe.

3.5.1 Regulatory Framework

The Forest Service has a government-to-government responsibility to all federally-recognized tribes, as outlined in the Guide to USDA Programs for American Indians and Alaska Natives (USDA 1997a). American Indian tribes are afforded consideration under the National Historic Preservation Act (Section 2) (NHPA), NEPA, the Native American Graves Protection and Repatriation Act, the American Indian Religious Freedom Act, and the Religious Freedom Restoration Act, among other Executive orders and policy. Federal guidelines direct federal agencies to consult with representatives and traditionalists from federally recognized American Indian Tribes who may have concerns regarding federal actions potentially affecting religious practices, and other traditional cultural uses. Consultation also may involve cultural resource sites and remains associated with American Indian heritage. Any tribe whose aboriginal territory falls within a analysis area is afforded the opportunity to voice concerns for issues governed by NHPA, Native American Graves Protection and Repatriation Act, American Indian Religious Freedom Act, and Religious Freedom Restoration Act.

The American Indian Religious Freedom Act protects the “inherent right of the freedom to believe, express, and exercise their traditional religions.” These concerns include but are not limited to: access to sites, use and possession of sacred objects, and the freedom to practice sacred ceremonies. The Religious Freedom Restoration Act establishes a higher standard for justifying government actions that may impact religious liberties.

Executive Order 13175 requires federal agencies to consult with American Indian tribal representatives and traditionalists on a government-to-government basis. Executive Order 13007 requires federal agencies to consult with tribes on Indian sacred sites. Tribes are also covered by Executive Order 12898 regarding environmental justice, discussed under section 3.26.1, *Environmental Justice.*

The 2015 KFP direction considered in the analysis of American Indian Rights is:

> **GOAL-AI-01.** Respect Indian tribal self-government and sovereignty, honor tribal Treaty and other rights through protection or enhancement of such, and meet the responsibilities that arise from the unique legal relationship between the Federal Government and Indian tribal governments. Manage the Forest to address and be sensitive to traditional American Indian religious beliefs and practices.
>
> **FW-DC-AI-01.** The KNF recognizes and maintains culturally significant species and the habitat necessary to support healthy, sustainable, and harvestable plant and animal populations to ensure that rights reserved by Tribes in the Hellgate Treaty of 1855 are protected or enhanced.

FW-DC-AI-02. The KNF recognizes, ensures, and accommodates Tribal member access to the Forest for the exercise of treaty rights and cultural uses consistent with laws, policies, and regulations.

FW-DC-AI-03. The KNF recognizes and protects traditional cultural areas as associated with the traditional beliefs of a Tribe about its cultural history.

FW-GDL-AI-01. Consult with Tribes when management activities may impact treaty rights and/or cultural sites and cultural use, according to the consultation protocol.

3.5.2 Treaty Rights

The analysis area is located within lands encompassed by the Hellgate Treaty of 1855. The Hellgate Treaty was signed between the United States and the Flathead, Upper Pend d'Oreilles, and the Kootenai Tribes, and the federal government has consultation responsibilities to ensure that the Tribes' reserved rights are protected. The treaty-reserved rights include the "right of taking fish at all usual and accustomed places, in common with citizens of the Territory, and of erecting temporary buildings for curing; together with the privilege of hunting, gathering roots and berries, and pasturing their horses and cattle upon open and unclaimed land." The KNF's Libby Ranger District fits the description of "usual and accustomed places," and lies within the aboriginal territory of the Kootenai and the Salish (Flathead). Ongoing consultation with the CSKT ensures that tribal treaty rights are protected.

3.5.3 Analysis Area and Methods

The analysis area surrounds all mine facilities and the transmission line alternatives. Consultation with the KTOI and the CSKT has taken place from 1989 until present. In addition, the Coeur d'Alene and Kalispel Tribes were notified and an offer made for discussion about the project. The KTOI responded to the request, and met for discussion. The Kalispel Tribe responded that due to the project being on the east side of the Cabinets, it was well outside of Kalispel aboriginal territory. They wanted to continue to receive correspondence about the project. The early consultation from 1989 to 1992 was conducted during the NEPA work associated with the original Montanore Project. While this Montanore Project EIS updates the NEPA analysis, the 1992 Montanore Project Final EIS initially outlined the analysis area and therefore early consultation is relevant. The Montanore Project consultation resumed and extends from January of 2005 until present. The analysis depends on the response received from the tribes on 1) rights under the Hellgate Treaty; 2) sacred places and access to those places for the exercise of religion; and 3) burials. They have declined to comment, and the information is unavailable. Based on past projects in the analysis area, the unavailable information is not relevant to evaluating reasonably foreseeable significant adverse impacts on the human environment. Tribal involvement in project monitoring is described in Appendix C. The KNF would contact the Confederated Salish & Kootenai Tribes and the Kootenai Tribe of Idaho (collectively the Tribes) to determine if they were interested in monitoring mine construction activities on National Forest System lands and transmission line construction on National Forest System, State or private lands. If either or both tribes expressed an interest, MMC would develop a Tribal Monitoring Plan in cooperation with the KNF, DEQ, and the Tribes. This plan would facilitate the presence of tribal monitors from the Tribes during construction. The plan would outline the tribal monitor's qualifications, responsibilities, and capabilities as well as establish funding, which would be MMC's responsibility.

3.5.4 Affected Environment

3.5.4.1 Historical Tribal Distributions

Historically, the Kootenai Tribe was made up of seven bands, with four in Canada and three in the U.S. The three historic U.S. bands are: the Tobacco Plains Band, located around present-day Eureka, Montana; the Jennings Band, located around the confluence of the Kootenai and Fisher Rivers, and the Bonners Ferry Band, located around present-day Bonners Ferry, Idaho. The aboriginal territory of the bands of the Kootenai is an irregularly shaped parcel. The territory is bounded by a southeast-northwest line extending along the Continental Divide to the west side of Kootenay Lake in Canada. The boundary continues north of present-day Golden, British Columbia southward to the Clark Fork River, then follows eastward to the confluence of the Flathead and North Fork of the Flathead Rivers. In 1855, after U.S. negotiations with the Flathead (Salish), Upper Pend d'Oreilles, and the Kootenai Tribes, the Jennings and Tobacco Plains bands were moved to the Flathead Reservation and became known as the CSKT. The Bonners Ferry Kootenai did not sign the Hellgate Treaty and it was not until 1974 that the Tribe was deeded 12.5 acres of land north of Bonners Ferry, Idaho.

3.5.4.2 Consultation with Interested Tribes

Consultation with tribes was initiated during scoping for NMC's Montanore Project. The CSKT indicated an interest in the project and on December 8, 1989, the cultural resource inventory report was sent to the CSKT for review (Historical Research Associates 1989a and 1989b). In 1990, the CSKT and KTOI responded by outlining general concerns. The KTOI referenced treaty rights associated with huckleberry gathering, big game hunting, and stream fishing (December 6, 1990). The CSKT also referenced treaty rights including water quality issues, fish habitat, and more specifically copper contaminant effects on sturgeon (December 11, 1990). Information addressing these issues was relayed by the Forest Service with continued correspondence through 1991. Tribal consultation resumed under MMC's Montanore Project, with letters to the Tribal Chairmen for the CSKT, KTOI, the Kalispel and Coeur d' Alene Tribes dated July 18, 2005. The Kalispel Tribe responded that the project was outside of their aboriginal territory and therefore did not request further consultation (September 17, 2005). The Coeur d'Alene Tribe did not respond with interest in the project. Numerous meetings with the CSKT and KTOI took place to answer tribal questions and requests for information sent by the Forest Service. Written correspondence from the CSKT requesting that no mining be permitted was received on July 5, 2006 and July 9, 2007. Detailed correspondence is located in either the project record for Mines Management's or NMC's Montanore Projects. Both project records are located in the KNF Supervisor's Office.

3.5.5 Environmental Consequences

The lead agencies identified three scoping issues for tribal consultation: 1) rights under the Hellgate Treaty; 2) sacred places and access to those places for the exercise of religion; and 3) burials. The thresholds indicated by the three issues could not be measured, as the tribes have declined to provide the baseline data necessary to conduct effects analysis.

3.5.5.1 Alternative 1 – No Mine and Alternative A – No Transmission Line

In this alternative, no actions are proposed, and any previously recorded or as yet undiscovered cultural sites with Tribal affiliation would remain undisturbed. The CSKT letter dated July 5, 2006 conveyed the tribal perspective on the Montanore Project, "Throughout the consultation process the Kootenai Elders have expressed a general desire to see no mining permitted on the KNF. The Elders remain concerned with the potential impacts (both direct and indirect) to water quality, fisheries, wildlife, plant life, and non-renewable cultural resources. The Kootenai people have traditional stories, place names, and cultural history throughout the area of impact. The Elders have also noted the influx of mine employees, equipment, and other mine related activity could have an impact on Tribal use of this area." This position was affirmed in another memo dated July 11, 2006.

3.5.5.2 Effects Common to All Mine and Transmission Line Action Alternatives

While the tribes were afforded the opportunity to provide comments on all alternatives, they declined, stating that their opposition to the mine negated the need to determine which alternatives were more preferable to them. The tribes also declined to comment on the proposed Sedlak Park Substation site.

After the Swamp wetland mitigation site on private land was protected by a conservation easement, or conveyed to the Forest Service, the upland areas would be managed to protect and provide for future traditional cultural uses. Developed recreational use would not be encouraged.

3.5.5.3 Cumulative Effects

The CSKT considered the effects of the Montanore Project and the Rock Creek Project as one. The CSKT submitted the following comment regarding the Montanore Project: "The expansion of the Montanore Mine has the potential to impact Tribal ancestral sites, including trails, fishing and gathering areas, as well as occupation sites. Both mines have the potential to degrade water quality, thus impacting aquatic habitats that provide Tribal members with traditional plants and medicines. The degradation of the surrounding watershed should have far-reaching impacts on culturally significant fish and wildlife, including the endangered bull trout and white sturgeon" (July 11, 2006). Because the CSKT have chosen not to identify specific effects, the agencies cannot address specific direct or indirect impacts on these undisclosed resources. Analysis of cumulative effects described in other resource sections indicates that increased access to the general project area could increase the use of resources by the general public as well as tribal members. Vegetation removal as a result of construction of the proposed project or other permitted activities within the Libby Creek watershed could impact areas with plant species associated with tribal use. These potential effects on resources identified by CSKT are outlined in the various resource sections in this document.

3.5.5.4 Regulatory/Forest Plan Consistency

The consultation process for all alternatives is consistent with all 2015 KFP direction, and all other laws, regulations, and Executive Orders described in the section 3.5.1, *Regulatory Framework*. The KNF consulted with tribes when management activities may impact treaty rights and/or cultural sites and cultural use, according to the consultation protocol.

3.5.5.5 Irreversible and Irretrievable Commitments

The CSKT have stated their position that there would be irreversible and irretrievable impacts on non-renewable cultural resources. The specific resources referred to have not been disclosed to date.

3.6 Aquatic Life and Fisheries

This section describes changes to aquatic life and fisheries that may occur from the construction, operations, and reclamation of the Montanore Project. Existing conditions described in section 3.6.3, *Affected Environment* were determined through surveys and review of existing data sources and used to develop effects analysis for the aquatic resources in each watershed. Effects on fish and other aquatic populations were assessed based on effects on habitat.

3.6.1 Regulatory Framework

3.6.1.1 Organic Administration Act and Forest Service Locatable Minerals Regulations

The Organic Administration Act authorizes the Forest Service to regulate the occupancy and use of National Forest System lands. The Forest Service's locatable minerals regulations are promulgated at 36 CFR 228, Subpart A. The regulations apply to operations conducted under the U.S. mining laws as they affect surface resources on National Forest System lands under the jurisdiction of the Secretary of Agriculture. One of these regulations (36 CFR 228.8) requires that mining activity be conducted, where feasible, to minimize adverse environmental impacts on National Forest surface resources. 36 CFR 228.8 also requires that mining operators comply with applicable state and federal water quality standards including the Clean Water Act; take all practicable measures to maintain and protect fisheries and wildlife habitat which may be affected by the operations; and construct and maintain all roads so as to assure adequate drainage and to minimize or, where practicable, eliminate damage to soil, water, and other resource values.

3.6.1.2 Endangered Species Act

The KNF is required by the ESA to ensure that any actions it approves will not jeopardize the continued existence of a T&E species or result in the destruction or adverse modification of critical habitat. agencies are also required to develop and carry out conservation programs for these species. The KNF prepared a BA for aquatic resources that evaluates the potential effect of the proposed project on T&E aquatic species, including measures the KNF believes are needed to minimize or compensate for effects. The KNF submitted the BA to the USFWS for review and consultation in 2011, and revised it in 2013 (USDA Forest Service 2013a) to provide additional information about the project and to make it consistent with current regulatory requirements. The USFWS (2014c) then issued a Biological Opinion on the project in 2014. Section 1.6.1.2, *U.S. Fish and Wildlife Service* provides more information on the Biological Opinion.

Bull trout (*Salvelinus confluentus*) is currently listed as threatened under the ESA and occurs within the analysis area. The USFWS has designated bull trout critical habitat in the analysis area. Bull trout is discussed in section 3.6.3.9, *Threatened and Endangered Fish Species*.

White sturgeon (*Acipenser transmontanus*) is currently listed as endangered and occurs in the Kootenai River. The white sturgeon is restricted to 168 miles of the Kootenai River between Cora Linn Dam in Canada and Kootenai Falls in Montana. All proposed activities are upstream of Kootenai Falls. The proposed Libby Loadout in a disturbed area of the Kootenai Business Park east of Libby is the closest project facility to the Kootenai Falls. The proposed activities would not affect white sturgeon or its habitat, and effects on this species are not discussed further.

3.6.1.3 Wilderness Act

The Wilderness Act allows mineral exploration and development under the General Mining Law to occur in wilderness to the same extent as before the Wilderness Act until December 31, 1983, when the Wilderness Act withdrew the CMW from mineral entry, subject to valid and existing rights. 36 CFR 228.15 provides direction for operations within the National Forest Wilderness. Holders of validly existing mining claims within the National Forest Wilderness are accorded the rights provided by the U.S. mining laws and must comply with the Forest Service Locatable Minerals Regulations (36 CFR 228, Subpart A). Mineral operations in the National Forest Wilderness are to be conducted to protect the surface resources in accordance with the general purpose of maintaining the wilderness unimpaired for future use and enjoyment as wilderness and to preserve the wilderness character consistent with the use of the land for mineral development and production.

3.6.1.4 Tribal Treaty Rights

The Hellgate Treaty of 1855 reserved for the Kootenai Nation, among other rights, "the right to fish at all usual and accustomed places…on open and unclaimed lands." The 2015 KFP recognizes these treaty rights, and allows the Flathead/Kootenai-Salish Indian tribes to fish within the KNF. Additionally, the American Indian Religious Freedom Act allows Native Americans access to sites within the KNF that are still in use. Section 3.5, *American Indian Consultation* discusses American Indian rights.

3.6.1.5 Major Facility Siting Act

The Major Facility Siting Act directs the DEQ to approve a facility if, in conjunction with other findings, DEQ finds and determines that the facility minimizes adverse environmental impacts, considering the state of available technology and the nature and economics of the various alternatives.

3.6.1.6 Montana Water Quality Act

The Water Quality Act is the primary statute for water quality protection in the State of Montana. The DEQ enforces the Act, and the Act also provides authority for the establishment of surface water standards protective of aquatic life, mixing zone rules, and nondegradation rules. This act is described in more detail in section 3.13.1.2.2 of the *Water Quality* section.

3.6.1.7 National Forest Management Act

The National Forest Management Act requires the development, maintenance, and, as appropriate, the revision of land and resource management plans (forest plans) for units of the National Forest System. These forest plans provide for the multiple use and sustained yield of renewable resources in accordance with the Multiple-Use Sustained-Yield Act of 1960. One of the goals of the 2015 KFP is to "maintain or improve the distribution of native aquatic and riparian-dependent species and contribute to the recovery of threatened and endangered aquatic species" (GOAL-AQS-01).

Sensitive species are designated by the Regional Forester (FSM 2670.5). FSM 2672.42 directs the Forest Service to conduct a biological evaluation (BE) to analyze impacts on sensitive species. The sensitive species analysis in this document meets the requirements for a BE as outlined in FSM 2672.42. FSM 2670.22 requires that the Forest Service develop and implement management practices to ensure that sensitive species do not become threatened or endangered because of Forest Service actions and maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats distributed throughout their geographic range on National Forest System lands. Any decision on the Montanore Project cannot result in loss of sensitive species viability or create significant trends toward federal listing (FSM 2670.32). Sensitive fish species identified within the analysis area are the interior redband trout (*Oncorhynchus mykiss gairdneri*) and the westslope cutthroat trout (*Oncorhynchus clarki lewisi*). The western pearlshell mussel (*Margaritifera falcata*) is also Forest Service sensitive species and a species of concern in Montana (MNHP 2014). Torrent sculpin (*Cottus rhotheus*) is a species of concern in Montana, but no longer listed by Region 1 USDA Forest Service.

The KNF provides habitat for more than 300 different species of fish and wildlife (USDA Forest Service 2003b), many of which occur on the Libby Ranger District and within the Montanore Project analysis area. The presence or absence of these fish and wildlife species in part depends on the amount, distribution, and quality of each species' preferred habitat. In addition to habitat changes, many of these are impacted by fishing, hunting or trapping. FWP regulates fish and game populations in the analysis area. The Forest Service and the FWP work together to ensure that an appropriate balance is maintained between habitat capability and population numbers. The Forest Service also works closely with the USFWS to assist in the recovery of species listed under the ESA. Proposed federal projects that have the potential to impact species protected by the ESA require consultation with the USFWS.

3.6.1.8 Kootenai Forest Plan

The 1995 Inland Native Fish Strategy (INFS) was incorporated in the 2015 KFP. The concept of "priority watersheds" as described in INFS was refined in the 2015 KFP as a network of "conservation" and "restoration" watersheds. Accordingly, the 2015 KFP includes the desired condition that "conservation watersheds provide habitats that can support population strongholds of federally listed and sensitive species. Conditions in restoration subwatersheds improve to support population strongholds" (FW-DC-AQH-03). The conservation watersheds in the analysis area are Upper Libby Creek that includes Libby Creek its tributaries Howard Creek, Ramsey Creek, Poorman Creek, Midas Creek, Little Cherry Creek, Bear Creek, Cable Creek; Big Cherry Creek; West Fisher Creek that includes its tributary Standard Creek; Rock Creek and its tributaries West Fork Rock Creek and East Fork Rock Creek; and Middle Bull River that includes the East Fork Bull River and its tributaries Placer Creek and Isabella Creek. The restoration watersheds are Lower Bull River that includes Copper Gulch (a possible fisheries mitigation site); Upper Fisher River that includes the upper Fisher River and its tributary Miller Creek; Swamp Creek-Cowell Creek that includes Swamp Creek (a stream mitigation site); and Middle Kootenai River that includes Flower Creek (a possible fisheries mitigation site).

INFS also established stream, wetland, and landslide-prone area protection zones called Riparian Habitat Conservation Areas (RHCAs). INFS standards and guidelines apply only to National Forest System lands. RHCAs are portions of watersheds where riparian-dependent resources receive primary emphasis. INFS sets standards and guidelines for managing activities that potentially affect conditions within the RHCAs, and for activities outside of RHCAs that potentially degrade RHCAs. RHCAs are defined for four categories of streams or water bodies, depending on flow conditions and presence of fish, with different RHCA widths for each category (Table 64). The widths shown in Table 64 are minimum default widths. For fish-bearing streams, default RHCA buffers extend from the edge of both sides of the active stream channel to the outer edges of the 100-year floodplain, to the outer edge of the riparian vegetation, to a distance equal to the height of two site-potential trees, or 300 feet slope distance (600 feet, including both sides of the stream channel), whichever is greatest. Widths of RHCA buffers are based on current scientific literature that documents them to be adequate to protect streams from non-channelized sediment inputs (sediment produced from overland flow) and provide for other riparian functions. These riparian functions include delivery of organic matter, large woody debris recruitment, and stream shading. All four categories are represented by streams and water bodies in the analysis area.

Table 63. RHCA Categories and Standard Widths.

Stream or Water Body Category	Standard Width
Fish-bearing streams	Minimum 300 feet each side of the stream
Perennial, non-fish bearing streams	Minimum 150 feet each side of stream
Ponds, lakes, and wetlands greater than 1 acre	Minimum 150 feet from maximum pool elevation
Intermittent and seasonally flowing streams, wetlands less than 1 acre, landslides and landslide-prone areas	Minimum 100 feet from edge

Source: USDA Forest Service 2015b.

In addition, INFS identifies riparian management objectives (RMOs) that guide management of key habitat variables for good fish habitat on National Forest System lands. The RMOs for stream channel conditions provide the criteria against which attainment or progress toward attainment of riparian goals is measured. RMOs, as established by INFS standards and guidelines for forested streams, include pool frequency, large woody debris (LWD) frequency, and width/depth ratio (Table 64). Actions that retard attainment of these RMOs, whether existing conditions are better or worse than objective values, are considered to be inconsistent with INFS and therefore not in compliance with the 2015 KFP.

Table 64. Riparian Management Objectives Standards by Channel Width.

Wetted Width (ft)	Pools per Mile	LWD per Mile	Width/Depth Ratio
10	96	>20 pieces	<10
20	56	>20 pieces	<10
25	47	>20 pieces	<10
50	26	>20 pieces	<10

LWD = Large Woody Debris (diameter > 12 inches, length > 35 feet).

Source: USDA Forest Service 2015b.

INFS included project- and site-specific standards and guidelines that apply to all RHCAs on National Forest System lands and to projects and activities outside RHCAs on National Forest System lands that have the potential to degrade RHCAs. Some of the standards and guidelines require that activities not retard or prevent the attainment of the RMOs. “For the purposes of analysis, to ‘retard’ would mean to slow the rate of recovery below the near natural rate of recovery if no additional human-caused disturbance was placed on the system. This obviously will require professional judgment and should be based on watershed analysis of local conditions” (USDA Forest Service 2015b). Section 3.6.4.11, *Regulatory/Forest Plan Consistency* discusses compliance with the following RHCA standards and guidelines:

- Roads management (RF-1 through RF-5)
- Minerals management (MM-1, MM-2, MM-3, and MM-6)
- Lands (LH-3 and LH-4)
- General riparian area management (RA-1 through RA-4)
- Watershed and habitat restoration (WR-1 and WR-4)
- Fisheries and wildlife restoration (FW-1 and FW-4)
- FW-STD-RIP-03 incorporates and clarifies the INFS.
- Two additional riparian standards in the 2015 KFP: FW-STD-RIP-01 and FW-STD-RIP-02 are designed to maintain or improve conditions where RHCAs are intact and functioning and promote a trend toward desired conditions where they are not intact and functioning

3.6.2 Analysis Area and Methods

3.6.2.1 Analysis Area

The analysis area for direct, indirect, and cumulative effects includes areas where aquatic resources may be affected either by mine construction, operations, and closure; by construction, maintenance, and decommissioning of the transmission line; or by mitigation activities (**Figure 53**). Mine alternatives may affect the named and unnamed streams in the East Fork Bull River, Rock Creek, Ramsey Creek, Poorman Creek, Little Cherry Creek, Bear Creek, Cable Creek, Big Cherry Creek, and Libby Creek watersheds and any other areas where roads would be closed. The transmission line corridor area is drained by the Fisher River and its tributaries: Hunter Creek, Sedlak Creek, Miller and North Fork Miller creeks, Standard Creek, and West Fisher Creek; and by Libby Creek and its tributaries: Howard Creek, Midas Creek, and Ramsey Creek, all perennial streams. Numerous unnamed ephemeral streams also drain the analysis area. Short segments of the Miller Creek (Alternative D-R) and West Fisher Creek (Alternative E-R) transmission line alternatives would be within the Standard Creek watershed, but the line and any associated access roads would be located more than 1 mile from the creek and not within any RHCA. No effects on Standard Creek are expected, and it is not discussed further.

The existing aquatic habitat and populations of additional streams are discussed that would not be affected by mine or transmission line alternatives but would be part of the bull trout mitigation plan. These streams include West Fork Rock Creek, Copper Gulch, and Flower Creek. Of these, West Fork Rock Creek is a tributary to Rock Creek, Flower Creek is a tributary to the Kootenai River, and Copper Gulch is a tributary to the Bull River. The mainstem of Rock Creek and the reach of Libby Creek upstream of Libby Falls were also identified as potential mitigation sites. Additionally, Swamp Creek, a tributary to Libby Creek, may be used as part of the wetland mitigation plan. A second stream named Swamp Creek that is a tributary to the Clark Fork River is also outside the area of predicted effects from mining, but sites on this stream are proposed for use as benchmark monitoring sites. Proposed activity in other watersheds would be minimal and would have no potential for adverse effects on fish species and other aquatic organisms; these watersheds are not discussed further in this section.

Lakes included in the analysis area are Rock Lake, St. Paul Lake, Howard Lake, Ramsey Lake, Upper Libby Lake, and Lower Libby Lake (Figure 53). Ramsey Lake (not shown on Figure 53) does not provide aquatic habitat and the Libby Lakes and Howard Lake are not expected to be affected by the proposed project; these lakes are not discussed further.

3.6.2.2 Baseline Data Collection

3.6.2.2.1 Data Sources

The FWP's Montana Fisheries Information System (MFISH) database (FWP 2012) and the 1992 Montanore Project Final EIS (USDA Forest Service *et al.* 1992) were the primary sources used to determine fish distribution in the analysis area. The 1992 Final EIS also provided data on benthic macroinvertebrate and periphyton populations, as did additional surveys that were conducted at a selected number of sites in 1990 through 1994 as part of an interim monitoring program (Western Technology and Engineering 1992, 1993, 1994; Western Technology and Engineering and Phycologic 1995). Fish distribution surveys, fish genetic analyses, and habitat surveys have also been performed from before the initial baseline study in 1988 up through 2012, mainly by the FWP. Results of many of these surveys were summarized by Kline Environmental Research (2004). Additional data were used from habitat and/or fish surveys conducted on the East Fork Bull River and Rock Creek between 1992 and 1994 (Washington Water Power Company 1996), and on the East Fork Bull River in 1999 (Chadwick Ecological Consultants, Inc. 2000). Annual data on fish distribution, abundance, spawning surveys, and aquatic habitat surveys have also been gathered by Avista Corporation. (Avista) in East Fork Bull River and Rock Creek drainages from 1999 to 2011 for their hydropower relicensing agreement (GEI 2005; Hintz and Lockard 2007; Moran 2007; Horn and Tholl 2008; Lockard *et al.* 2008; Storaasli and Moran 2008; Avista 2011; Storaasli and Moran 2012). Descriptions and data for the Rock Creek watershed from the Rock Creek Project Final EIS and supplemental aquatic resources surveys were used (USDA Forest Service and DEQ 2001; Salmon Environmental Services 2012).

Some of the most recent aquatic resources data used were from surveys conducted in 2005 to supplement the existing data and in 2006 through 2008 as part of MMC's monitoring plan to address the aquatic biology and habitat monitoring requirements included as part of their MPDES permit. These data focused on fish distribution, habitat quality, location and navigability of culverts and other barriers, composition of spawning gravel, stream temperature, and the comparison of fish habitat quality in Little Cherry Creek and in the proposed drainage diversion (Kline Environmental Research 2005a, 2005b, 2008, 2009; Kline Environmental Research and Watershed Consulting 2005a, 2005b; Kline Environmental Research *et al.* 2005; Watershed Consulting and Kline Environmental Research 2005). Invertebrate and periphyton population data and fish tissues were also collected as part of the 2006 through 2008 sampling (Kline Environmental Research 2008, 2009). Additional surveys of the fish populations, macroinvertebrate populations, periphyton populations, and/or aquatic habitat were conducted in 2012 on the East Fork Bull River, Rock Creek, East Fork Rock Creek, West Fork Rock Creek, Big Cherry Creek, Poorman Creek, Ramsey Creek, Flower Creek, Cooper Gulch, and Swamp Creek (the Libby Creek tributary) by the USFWS, the USDA Forest Service, or MMC to either provide further baseline data for the impact assessment or to investigate the mitigation potential of these streams (Kline and Savor 2012; Kline Environmental Research and NewFields 2012). Also included are data compiled for the 2009 Westslope Cutthroat Trout Status Update Summary (May 2009) and the 2012 Redband Trout Status Update Summary (May *et al.* 2012).

3.6.2.2.2 Habitat Data

During the 1988 baseline study, physical habitat was evaluated at 18 stream reaches located on Libby, Little Cherry, Ramsey, Poorman, Bear, and East Fork Rock creeks. The habitat surveys classified stream reaches using the USDA Forest Service General Aquatic Wildlife System Level III assessment, which incorporates the Rosgen (1985) channel-typing system. This system categorizes reaches based on various measurements of entrenchment, width-to-depth ratio, sinuosity, substrate, and stream slope. The Forest Service also used this method to characterize a number of reaches in these streams in 1997, 1998, 2002, 2004, and 2005 (Kline Environmental Research 2004; USDA Forest Service 2005a).

Stream habitat surveys also were conducted in the Libby Creek watershed in July and August 2005 during low flow conditions at most sites shown in Figure 52. Site LC4 was not surveyed because it had only isolated, shallow pools as habitat. Survey protocols followed USDA Forest Service Level III Region 1/Region 4 fish habitat inventory procedures (Overton *et al.* 1997), and are described by Watershed Consulting and Kline Environmental Research (2005). Habitat units at each site were identified, with various measures such as length, width, average and maximum depths, number of pools, pool type, substrate composition, percent stable and undercut banks, and amount of large, woody debris existing in the stream channel recorded for each unit. Some of these sites were also surveyed in 2006 through 2008, with few habitat parameters recorded (Kline Environmental Research 2008, 2009). GIS and aerial imagery data were used to determine slope, canopy cover, amount of large woody debris, and types of habitat present in Poorman Creek, Ramsey Creek, a tributary to Ramsey Creek, and Libby Creek in 2012 (Kline Environmental Research and NewFields 2012).

A more extensive habitat survey was conducted in May and June 2005 for Little Cherry Creek and Drainages 10 and 5, the channels that are proposed to receive the flows from the diverted Little Cherry Creek in Alternatives 2 and 4. Methods used to collect the data were generally based on Bain and Stevenson (1999), with aspects of the USDA Forest Service methods incorporated to address the biological and physical variables determined to be essential for bull trout (USFWS 1998a). This survey documented distance, elevation, macrohabitat type, pool dimensions, large woody debris, substrate, valley slope and width, and riparian characteristics continuously along the entire length of the creek. The five habitat characteristics that could be documented in Drainages 10 and 5 (channel gradient, valley side gradient, flood prone width, riparian type, and large, woody debris) also were surveyed to allow for comparisons between what currently exists in Little Cherry Creek and what could be predicted to develop in the two channels (Kline Environmental Research 2005a).

Surveys of drainages within the disturbance boundary of the Poorman Impoundment Site were conducted in 2011 (Kline Environmental Research 2012). This study included the assessment of four headwater drainages between Poorman Creek and Little Cherry Creek. The duration of flow and presence or absence of a surface water connection to Libby Creek was determined for each drainage, and water depths and widths were measured, along with other habitat parameters.

Separate surveys were conducted that documented culverts and potential fish barriers in Libby Creek upstream of NFS road #231 (Libby Creek Road), and the full length of Little Cherry Creek, Poorman Creek, and Ramsey Creek (Kline Environmental Research 2005b; Kline Environmental Research *et al.* 2005). Culverts were surveyed and analyzed for their potential to block upstream passage of fish. All other fish barriers were photographed, described, and measured for breadth, height, and plunge pool depth. Once a permanent barrier to all fish under all flow conditions was identified on each tributary, the survey effort was discontinued. Kline Environmental Research (2005b) describes the methods used to characterize the barriers.

Stream gravel samples were collected from 15 sites on Libby, Little Cherry, Poorman, Bear, and Ramsey creeks using a McNeil core sampler (Kline Environmental Research and Watershed Consulting 2005b). Samples were collected in July and August 2005 from all locations shown in August 2005, day and night snorkel surveys were conducted at most 2005 sample sites shown in Figure 52, except for sites Be2, LC4, and L9. The sites on Bear Creek and Libby Creek were not sampled at that time because McNeil core samples had recently been collected in 2004 and 2005 by the FWP or USDA Forest Service at or near those locations (Wegner, pers. comm. 2006a). The upstream Little Cherry Creek site was not sampled for gravel because only isolated, shallow pools for fish were present at the site, and no fish were observed at the site immediately downstream. When sufficient quantities of gravel were present, ten core samples were collected from each reach with the McNeil sampler. A more complete description of methods used to collect and process the gravel samples is given by Kline Environmental Research and Watershed Consulting (2005b).

The Fisher River was surveyed in 2003, West Fisher Creek was surveyed in 1996, and Miller Creek was surveyed in 1998 and 2005 by the KNF (USDA Forest Service 2005a). All reaches surveyed on the Fisher River were downstream of the analysis area. The surveys of Miller Creek and West Fisher Creek provided information on Rosgen channel type, gradient, width/depth ratio, and substrate composition.

Habitat surveys were conducted on Rock Creek and the East Fork Bull River between 1992 and 1994 (Washington Water Power Company 1996) as part of a survey of the lower Clark Fork River tributaries. Various habitat variables were recorded, including average widths, average depths, maximum pool depths, bank stability, substrate composition, amount of large woody debris, and percentage of surface fines. Temperature at the time of sampling was recorded and the spawning area substrate composition and spawning habitat availability were evaluated. The Lower Clark Fork Habitat Problem Assessment (GEI 2005) summarized habitat surveys in the East Fork Bull River from 1993 to 2003 and habitat work in Rock Creek. The Rock Creek Project Final EIS used these data and also summarized similar habitat data from additional sources (USDA Forest Service and DEQ 2001). Surface fines and spawning substrate were evaluated by Salmon Environmental Services, LLC (2012) in 2011 and 2012 for the Rock Creek project as well. In addition, extensive habitat and large, woody debris surveys of the Rock Creek mainstem, East Fork Rock Creek, West Fork Rock Creek, and the East Fork Bull River were conducted in 2012 by USDA Forest Service or MMC personnel (Kline and Savor 2012). Habitat measurements included wetted widths, maximum and average water depths, number of pools per mile, and large, woody debris counts, as well as other parameters. GIS and aerial survey data were used to determine the slope, amount of large woody debris, canopy cover, and habitat types within reaches of East Fork Rock Creek (both upstream and downstream of Rock Lake), the Rock Creek mainstem, the East Fork Bull River, and tributaries of the East Fork Bull River and St. Paul Lake (Kline Environmental Research and NewFields 2012).

3.6.2.2.3 Periphyton Population Data

Periphyton populations were sampled in analysis area streams during August 1988, October 1988, and April 1989. Interim monitoring continued during 1990 and 1991 at all locations in the analysis area, and during 1993 and 1994 at Libby Creek sites only. The objective of the continued monitoring was to assess possible impacts of exploration activities during 1991 and elevated concentrations of nitrate in Libby Creek. Additionally, the periphyton assemblages at sites on Libby Creek were sampled multiple times from 2006 through 2008 as part of the monitoring included with the MPDES permit, and sites on Ramsey Creek, Poorman Creek, Little Cherry Creek, and Bear Creek were added to this monitoring effort in 2007 and 2008. Periphyton samples were collected from four headwater drainages located within the disturbance area boundary of the Poorman Impoundment Site in 2011 (Kline Environmental Research 2012). Periphyton samples were also collected in 2012 from a site on East Fork Rock Creek and from two tributaries to St. Paul Lake within the East Fork Bull River watershed (Kline Environmental Research and NewFields 2012).

Collection of the samples involved scraping algae from a variety of substrates and combining those scrapings to compose one sample per site. Non-diatom algae were identified to genus, with relative abundances of each taxon estimated as rare, common, very common, abundant, or very abundant. Diatoms were identified to species, with percent relative abundances calculated when possible. The sampling conducted in 2006 through 2008 focused on determining the taxonomic composition of the periphyton assemblages in the Libby Creek watershed. Full descriptions of methods used for each sampling event are documented by Western Resource Development Corp. (1989a), Western Technology and Engineering (1992, 1993, 1994), Western Technology and Engineering and Phycologic (1995), Kline Environmental Research (2008, 2009, 2012), and Kline Environmental Research and NewFields (2012).

3.6.2.2.4 Aquatic Macroinvertebrate Population Data

Stream macroinvertebrates were collected from over 30 locations in analysis area streams between 1986 and 2012 (Western Resource Development Corp. 1989a; USDA Forest Service and DEQ 2001; Western Technology and Engineering 1991, 1992, 1993, 1994; Western Technology and Engineering and Phycologic 1995; Hoffman *et al.* 2002; Dunnigan *et al.* 2004; USDA Forest Service 2006b; Kline Environmental Research 2008, 2009; Kline Environmental Research and NewFields 2012). Some reaches were sampled over 20 times during that time period.

Sampling began in 1988 in Libby Creek, Bear Creek, Little Cherry Creek, Poorman Creek, Ramsey Creek, and East Fork Rock Creek. Interim sampling continued through 1994 at selected reaches in these streams to assess possible impacts of mining activities that occurred during 1991. Additional macroinvertebrate data were collected from a single reach in Libby Creek in 2000 and 2003 in order to evaluate the effects of a restoration project that was completed during that time period (Hoffman *et al.* 2002; Dunnigan *et al.* 2004). The KNF conducted sampling annually at three to six reaches on Libby Creek, Bear Creek, West Fisher Creek, and the Fisher River from 1998 through 2004 (USDA Forest Service 2006b). Additionally, multiple sites on Libby Creek were sampled as part of the monitoring required under the MPDES permit for the Libby Adit in 2006 through 2008, with one site each on Ramsey Creek, Poorman Creek, Little Cherry Creek, and Bear Creek also sampled as part of this effort in 2007 and 2008 (Kline Environmental Research 2008, 2009). The macroinvertebrate assemblages within four headwater drainages located within the disturbance area boundary of the Poorman Impoundment Site were sampled in 2011 as well (Kline Environmental Research 2012). Macroinvertebrate sampling in East Fork Rock Creek occurred in 1986 through 1988 as part of the Rock Creek Project permitting (USDA Forest Service and DEQ 2001). East Fork Rock Creek was sampled again in 2005 and 2012, with samples also collected from two tributaries to St. Paul Lake in the East Fork Bull River watershed in 2012 (Kline Environmental Research and NewFields 2012).

Sampling methods differed over this time period in number of samples taken per site, type of equipment used to collect and process samples, and level of identification used for certain macroinvertebrate families. The differences in methods used complicate the ability to interpret any changes in population parameters over time.

3.6.2.2.5 Fish Population Data

During August and September 1988, fish populations at 13 sites on Libby Creek, Ramsey Creek, Poorman Creek, Little Cherry Creek, and the East Fork Rock Creek were sampled using backpack electrofishing equipment. Additionally, Rock Lake was sampled using gill nets and hook and line, and Rock Creek Meadows, a large wetland on East Fork Rock Creek below Rock Lake, was sampled using an electrofishing boat and hook and line. Sites were generally between 330 to about 1,000 feet in length. Each fish collected was identified, weighed, and measured, and scales were taken from most fish to provide estimates of age and growth. Spawning was assessed from electrofishing results and from visual searches along Libby, Ramsey, and Poorman creeks conducted in October 1989.

Additional surveys have been conducted on analysis area streams and lakes by the FWP and others. The results of most of these surveys within the Libby Creek watershed are summarized by Kline Environmental Research (2004, 2007a), with additional survey results listed in the MFISH database (FWP 2012). As part of the mitigation efforts for the construction and operation of Libby Dam, fish population surveys also were conducted on Libby Creek from 2000 through 2009 (Dunnigan *et al*. 2004, 2005, 2011). Spawning surveys were conducted annually on Bear Creek and West Fisher Creek from 1995 through 2009 as part of the same project. During July and August 2005, day and night snorkel surveys were conducted at most 2005 sample sites shown in Figure 52. Site LC4 was not surveyed because only shallow, isolated pools were present at that location, and no fish were observed downstream at site LC3. Sites Be2, L9, L10, and L11 were not surveyed because fish surveys have been conducted near these reaches during 2003, 2004, or 2005 by government agencies (Kline Environmental Research and Watershed Consulting 2005a). Two of the Little Cherry Creek sites, sites LC1 and LC3, were too shallow for snorkeling, and were instead surveyed visually from the banks. For each macrohabitat type within each stream reach, counts of fish, species identifications, and lengths were documented to the extent practical without capturing fish. Kline Environmental Research and Watershed Consulting (2005a) provide a more complete description of methods used. In 2012, reaches of Big Cherry Creek, Poorman Creek, and Swamp Creek were surveyed via electrofishing by MMC to provide further baseline data or to investigate mitigation potential (Kline and Savor 2012). Three reaches of Flower Creek, a tributary to the Kootenai River, were also surveyed to assess its mitigation potential.

Fish population surveys also were conducted on the East Fork Bull River and Rock Creek between 1992 and 1994 (Washington Water Power Company 1996), and on the East Fork Bull River in 1999 (Chadwick Ecological Consultants, Inc. 2000) as part of projects surveying the lower Clark Fork River tributaries and the Bull River drainage. Results of fish surveys conducted in Rock Creek from 1985 through 1996 and the results from metals analyses of trout tissue collected from Rock Creek in 1985 are summarized in the Rock Creek Project Final EIS (USDA Forest Service and DEQ 2001). From 2000 through 2010, fish population monitoring surveys were completed annually during all or most years on the East Fork Bull River and East Fork Rock Creek by Avista (Horn and Tholl 2008, 2011; Avista 2011). One to two reaches of Rock Creek, East Fork Rock Creek, and West Fork Rock Creek were surveyed by FWP personnel in 2012 to evaluate the fish populations to either provide further baseline data or, in the case of West Fork

Rock Creek, to investigate the mitigation potential (Kline and Savor 2012). Copper Gulch, which is also within the Lower Clark Fork drainage, was also surveyed by MMC or FWP personnel for mitigation purposes as well.

The PACFISH/INFISH Biological Opinion Effectiveness Monitoring Program has been monitoring bull trout populations and evaluating status of stream habitat within portions of the interior Columbia River and Missouri River basins since 2001. Fish community and some genetic data collected in the analysis area in 2009 as part of the monitoring program were also used (Young and McKelvey 2009).

3.6.2.2.6 Metals in Fish Tissue

Metals analyses of redband trout tissues collected from the most downstream site on Libby Creek were conducted at Montana State University, Bozeman, and the Department of Health and Environmental Sciences, Helena, Montana (Western Resource Development Corp. 1989a). Analyses of cadmium, lead, and mercury concentrations in rainbow trout tissues (identified only as Oncorhynchus sp.) were also conducted for one or more sites on Libby Creek in 2006 through 2008, and at a site on Bear Creek in 2007 and 2008 (Kline Environmental Research 2008, 2009).

3.6.2.2.7 Riparian Habitat Conservation Areas and Other Riparian Areas

The KNF maintains a map of RHCAs, which is available in the agencies' project record. Most streams within the analysis area are considered fish-bearing streams under INFS. RHCAs also are found around wetlands (Table 64). Wetlands in the analysis area were "buffered" by the standard widths shown in Table 64 to generate a final RHCA and other riparian area map (Figure 53). Similar habitat is found on private land in the analysis area. Such habitat is described as "other riparian areas" in the impact assessment.

3.6.2.2.8 Baseline Data Adequacy

The preceding section summarizes the baseline information collected for aquatic resources and the affected environment, and the following sections describe the approaches used by the lead agencies in analyzing potential effects. The subsequent section on the affected environment describes the best available information regarding aquatic resources in the analysis area. The KNF and the DEQ determined that the baseline data and methods used are adequate to evaluate and disclose reasonably foreseeable significant adverse effects on aquatic resources in the analysis area, and to enable the decision makers to make a reasoned choice among alternatives. Section 3.10.2.4, *Additional Data Collection* and Appendix C describe the additional aquatic resources data that would be collected during all phases of the project, including the Evaluation Phase and for final design. The agencies did not identify any incomplete or unavailable aquatic resources information.

3.6.2.3 Impact Analysis

The impact analysis methods focused on assessing the effects on fish, fish habitat, and other aquatic populations from the predicted changes in sedimentation rates, water quantity, water quality (nutrients, metals, and temperature), fish passage, and fish losses. Additionally, the effects of these changes on sensitive species, including threatened species, Forest Service sensitive species, and Montana species of concern, were assessed.

3.6.2.3.1 Sediment

Mine construction, mine activities, and transmission line construction may result in increased sediment in streams. Possible sources of sediment related to the proposed project were identified for the Evaluation, Construction, Operations, Closure, and Post-Closure Phases of mine activities for existing conditions and all mine and transmission line alternatives, as described in section 3.13, *Water Quality*. The agencies analyzed the potential effects of the project on erosion and sedimentation both qualitatively and quantitatively, and results of these analyses were used to qualitatively assess the effects of sedimentation on stream habitat for each alternative. The possible changes to stream habitat that may occur from changes in sediment delivery rates to streams were then evaluated as to their possible effect on fish and other aquatic populations within the analysis area. The uncertainty and limitations associated with the water quality analysis and the Water Erosion Prediction Project (WEPP:Road Batch) analysis used to estimate sediment delivery from roads and the transmission line were discussed in the agencies' WEPP:Road Batch analysis (ERO Resources Corp. 2015b) and section 3.13.4, *Environmental Consequences*. While the model results are expected to be representative of what would occur as a result of the project, the uncertainty and limitations of the modeling could potentially affect the qualitative interpretation of the effects of any changes in sediment delivery to streams as a result of the project on the aquatic habitat.

3.6.2.3.2 Water Quantity

The water bodies in the analysis area include first-order headwater streams and larger streams, as well as glacial lakes whose water sources are snowmelt, rainfall, and groundwater (shallow and deep). Streamflows are described in section 3.11, *Surface Water Hydrology*.

Multiple activities related to the mine operations may induce changes in surface water flows and lake levels and thus result in impacts on aquatic resources. Section 3.10, *Groundwater Hydrology* describes how mine and adit inflows and the pumpback wells are predicted to result in groundwater drawdown that may reduce stream baseflows and lake levels within the analysis area. In addition, discharges to Libby Creek from the Water Treatment Plant are predicted to increase flows downstream of the Libby Adit during all mine project phases, as described in section 3.11, *Surface Water Hydrology*. Streamflows would also potentially be impacted through infiltration from the LAD Areas (used in Alternative 2 only), interception of precipitation and runoff by the impoundment, stormwater runoff from other mine facilities, and the increases in runoff resulting from vegetation clearing. The transmission line alternatives would not affect streamflow in most cases; the exceptions to this are discussed in section 3.6.4.6.2, *Peak Streamflow*.

Three-dimensional (3D) hydrogeological models of the analysis area were used (Geomatrix 2011a) to estimate the range of effects predicted to occur to baseflows as a result of the project, as described in section 3.11.4, *Surface Water Hydrology*. Effects on streamflows focused on the evaluation of predicted impacts on low flows, peak flows, and average annual flows for eight selected sites over the various phases of the project, with one or more sites each located on East Fork Rock Creek, Rock Creek, East Fork Bull River, Ramsey Creek, Poorman Creek, Little Cherry Creek, and Libby Creek (Figure 52). Baseflow reductions were predicted to be negligible in other analysis area streams. In addition, predicted low flow changes and the associated changes in wetted perimeters for three additional sites were estimated for the Operations and Post-Closure Phases. These additional impact assessment sites included one site each on Libby Creek, East Fork Rock Creek, and East Fork Bull River (Figure 76).

Assessment of the resulting impacts on fisheries habitat and other aquatic resources from changes in streamflows was mainly based on the changes predicted to occur to low flows as represented by the percent changes to $7Q_{10}$ flows provided in section 3.11.4, *Surface Water Hydrology*. Changes to these flows represent the maximum effects that would occur to aquatic populations during the periods of the year when groundwater inflows comprise most or all of the flow in headwater reaches. Potential flow conditions during other times of the year were evaluated on a case-by-case basis, depending upon the available data and the magnitude of effects.

The effects on streamflow were quantified using the 3D model results for Alternative 3 only, but the effects under Alternatives 2 and 4 on east side streams would be similar to those that occur under Alternative 3. Without mitigation, effects on west side streams would be the same for all three alternatives. The time period and extent to which baseflow conditions persist in the stream reaches in the area varies from year to year based on the amount of precipitation, runoff, and other factors, but typically occurs during mid-August to October and then again from late December through March. The 3D model assumes that stream baseflows originate mainly from regional groundwater sources that would be affected by the dewatering that would occur as a result of the project; it may be difficult to separate the effects from natural stream flow variability (USDA Forest Service 2013a).

The uncertainty associated with the 3D model predictions is discussed in section 3.10.4.3.5, *Groundwater Model Uncertainty*. Uncertainty in the predicted changes to baseflow also results in uncertainty in the assessment of impacts on fisheries habitat and other aquatic resources. The 3D model results are the best currently available estimates of impacts and associated uncertainty that can be obtained using currently available data in the groundwater models. Both 3D groundwater flow models would be refined and rerun after data from the Evaluation Phase were incorporated into the models. Following additional data collection and modeling, the predicted impacts on surface water resources in the analysis area may change and the model uncertainty would decrease.

The three additional sites at which streamflow effects from mine inflows were modeled in 2012 were chosen to provide additional information for stream reaches where impacts on bull trout habitat may occur. The Libby Creek site (LB-2) is 1 mile upstream of Little Cherry Creek within a stream reach that would be affected by operation of the pumpback wells system (Figure 76). The East Fork Rock Creek site (RC-3) is located about 1 mile upstream of the confluence with West Fork Rock Creek, and the East Fork Bull River site (EFBR-2) is located at the confluence with Isabella Creek within the CMW. Both locations on the west side streams were chosen because data indicate bull trout are relatively abundant in these areas and use them for spawning. KNF hydrologists collected stream cross-section data in late summer and early fall 2012 at these three sites. The data were used to develop a relationship between wetted cross section area and discharge during the low flow period in these stream reaches (ERO Resources Corp. 2012b). Changes in the wetted cross-sectional area of the streams at these sites were then estimated for the project alternatives during the Operations and Post-Closure Phases, and are further discussed in section 3.11, *Surface Water Hydrology*.

The quantitative analysis of flow-related habitat effects from the project alternatives focuses on impacts on aquatic habitat for bull trout, the federally threatened species that occurs in the analysis area. Effects to other sensitive species (westslope cutthroat trout, interior redband trout, and western pearlshells), species of concern (torrent sculpin), and macroinvertebrate communities are qualitatively assessed.

The quantitative analysis of effects on bull trout habitat is based on the methods used and described in the BA prepared for the Montanore Project (USDA Forest Service 2013a). These methods use the estimated changes in baseflow from the 3D models for those stream reaches in which bull trout occur, and evaluate the effect these reductions in low flows would have with regard to the potential to affect adult migratory bull trout passage. Impacts on bull trout passage in the analysis area streams was based on USGS bull trout passage data from studies in central Idaho (Maret *et al*. 2005, 2006; Sutton and Morris 2004, 2005) and channel widths, depths, and habitat types present in the stream reaches of interest in the analysis area. Impacts on habitat availability for adult, juvenile, and spawning bull trout were also evaluated using relationships developed from these USGS studies, which assessed habitat availability for the various bull trout life stages using Physical Habitat Simulation System (PHABSIM) model data.

The USGS studies determined that a minimum stream depth of 0.6 feet was necessary for migratory adult bull trout passage (Maret *et al*. 2005, 2006; Sutton and Morris 2004, 2005), and this depth must be present over at least 25 percent of the total stream width and must be continuous for at least 10 percent of this width at a representative transect. In the BA, the KNF indicated that this should be considered a conservative criterion as passage at depths less than 0.6 feet has been recorded. Further details of how the passage criterion was used and applied to analysis area streams to determine passage is provided in the BA (USDA Forest Service 2013a).

The use of PHABSIM to evaluate habitat availability for fish is based on the preferences of a species and life stage for water depth, velocity, substrate, and cover, which can vary at different flows. PHABSIM and other related methods have been widely used to predict impacts (Reiser *et al*. 1989), but there are some concerns about its use (Orth and Maughan 1982, 1986; Mathur *et al*. 1985, 1986; Scott and Shirvall 1987; Armour and Taylor 1991; Bovee *et al*. 1994). These types of methods have been used to quantitatively link changes in habitat availability to effects on fish populations in several studies (Nehring and Anderson 1993; Baran *et al*. 1995; Jowett 1992), and they provide a way to estimate the magnitude of effects that might occur to aquatic resources based on differences in flow between existing conditions and the alternatives.

For the assessment of any habitat availability changes that would potentially occur for bull trout as a result of changes in low flows resulting from the project, the KNF (2013a) developed relationships between these parameters based on the USGS studies that indicated that for every 1 percent decrease in low flows, a corresponding 0.4 percent, 0.5 percent, and 1 percent decrease could be predicted to occur in adult, juvenile, and spawning bull trout habitat, respectively. While these relationships were not established using data specifically from analysis area streams, they were determined to be the best available method for the evaluation of aquatic habitat impacts on bull trout populations based on the information currently available.

The relationship between habitat availability and bull trout abundance is complex and reach specific (Al-Chokhachy *et al*. 2010), and factors such as substrate composition, species interactions, food availability, groundwater inputs, channel morphology, and stream temperatures can also significantly affect bull trout survival and reproduction (Montana Bull Trout Restoration Team 2000), but are not directly accounted for using these relationships. Based on this and a lack of studies supporting a direct linear relationship between bull trout abundance and habitat availability as estimated using PHABSIM or other related methods, the relationships derived in the BA were used to estimate the amount of habitat that would be predicted to be available under existing conditions compared to Alternative 3 rather than estimating direct loss of bull trout. The reductions in wetted cross-sectional area predicted to occur as a result of the project based on the data collected in 2012 from LB-2, RC-3, and EFBR-2 (Figure 76, Table 110) were also assessed in the BA (USDA Forest Service 2013a) to determine if they indicated the same general trends in changes to habitat availability and passage as these relationships developed using the USGS data.

The impact assessment assumed that lower or higher habitat availability in Alternative 3 compared to existing conditions would result in adverse or beneficial impacts, respectively, to bull trout populations, and that a greater magnitude of change in habitat availability would result in correspondingly greater impact on the populations. Additionally, while changes to habitat availability were not quantified for redband trout, westslope cutthroat trout, and other fish species within the analysis area, lower flows were assumed to result in lower habitat availability for these species as well. The success of the various mitigations proposed for any impacts were not determined based on these estimations of changes to habitat availability due to the uncertainty and complexity of estimating the effects on aquatic populations as a result of the project. Instead, mitigation success would be determined directly by use of monitoring data that would continue to be collected throughout the mine phases (USDA Forest Service 2013a). Collection of these data would allow for an adaptive approach to mitigation strategies that takes into account the actual progress made toward the bull trout mitigation objectives in the Lower Clark Fork and Kootenai Core areas.

Impacts on macroinvertebrate populations from changes in water quantity resulting from the project were also evaluated qualitatively based on the modeled changes to low flows and the general assumption that lower flows would result in less wetted surface area available to support these assemblages. The response of macroinvertebrate populations to decreases in flow may be less predictable than that of fish populations. Dewson *et al*. (2007) and Poff and Zimmerman (2010) reviewed literature reports of responses of macroinvertebrate diversity and abundance to alterations in flow magnitude, and found that while these parameters generally declined, there were some cases in which abundance or diversity increased even with large (greater than 70 percent) changes in flow. Poff and Zimmerman (2010) were not able to determine a quantitative relationship between the magnitude of the flow changes and any observed changes in the macroinvertebrate populations, nor could they identify an ecological threshold, due to the lack of data available for situations in which flows changed by less than 50 percent.

3.6.2.3.3 Water Quality

Projected changes in water quality during low flow conditions in the Evaluation, Construction, Operations, Closure, and Post-Closure Phases were compared to existing mean water quality concentrations for sites in Ramsey Creek, Poorman Creek, and Libby Creek in section 3.13,4, *Environmental Consequences* in the *Water Quality* section. Methods used in the mass balance calculations for prediction of water quality changes are discussed in section 3.13.2.2.2, *Impact Analysis*. Information from these sections was used to qualitatively predict the effect of any such changes on the aquatic assemblages and habitat. The uncertainty and limitations associated with the water quality analysis were discussed in section 3.13.4.5, *Uncertainties Associated with Water Quality Analysis*. While the analysis results are expected to be representative of what would occur as a result of the project, the uncertainty in the predicted changes to water quality also results in uncertainty in the qualitative interpretation of the effects of any changes in stream water quality on aquatic resources as a result of the project. As discussed in Section 3.13.4.2.3, *Environmental Consequences* in the *Water Quality* section, if mine void water flowed to the East Fork Bull River or East Fork Rock Creek after mine closure, it is not likely that changes in water quality in the river would be detectable. Mitigation would be designed to minimize post-mining changes in the East Fork Bull River and East Fork Rock Creek streamflow and water quality.

Surface water quality in the analysis area may be affected by reductions in groundwater contribution to streams, which could result in lower dissolved solids concentrations in these streams and lakes. If such a water quality change occurred, it would be detectable only during low flow periods when bedrock groundwater is the major source of supply to surface water. Even at low flows, the changes in water quality may be difficult to measure.

Nutrients

In 1992, the BHES issued an Order authorizing degradation and establishing allowable changes in surface water and groundwater quality adjacent to the Montanore Project for discharges from the project (BHES 1992). The Order established a limit for total inorganic nitrogen (TIN) as 1.0 mg/L (Table 76). The Order remains in effect for the operational life of the mine and as long as necessary thereafter. In issuing the Order, the BHES determined that a limit of 1 mg/L TIN would be protective of all beneficial uses (BHES 1992). In 1992, the DHES (now DEQ) determined that land treatment would provide adequate secondary treatment of nitrate (80 percent removal). The Order requires the DEQ to review design criteria and final engineering plans to determine that at least 80 percent removal of nitrogen would be achieved and the TIN concentration in Libby, Ramsey, or Poorman creeks would not exceed 1 mg/L. The Order also adopted the modifications developed in Alternative 3, Option C, of the Final EIS (1992), addressing surface water and groundwater monitoring, fish tissue analysis, and instream biological monitoring. In all alternatives, the agencies assumed TIN concentrations could increase up to 1 mg/L.

In 2014, the Board of Environmental Review adopted numeric standards for total phosphorus and total nitrogen for wadeable streams in Montana Ecoregions (DEQ 2014a). Wadeable streams are perennial or intermittent streams in which most of the wetted channel is safely wadeable by a person during baseflow conditions; this includes all streams in the analysis area. The analysis area is in the Northern Rockies Ecoregion; all wadeable streams have a seasonal total phosphorus standard of 0.025 mg/L and a seasonal total nitrogen standard of 0.275 mg/L between July 1 to September 30. During October 1 to June 30, the narrative standard for nutrients applies, which is that surface waters must be free of substances that will create conditions that produce undesirable aquatic life (ARM 17.30.637). In the draft renewal MPDES permit, the DEQ preliminarily granted a variance for total nitrogen of 15 mg/L, and determined that a variance for total phosphorus was not necessary because the facility did not show reasonable potential to violate the total phosphorus standard. Because nitrate would be the dominant nitrogen form, the analysis assumed that the BHES Order limit of 1 mg/L for TIN would be the applicable limit for nondegradation purposes.

The greatest ecological effect of increased nutrient concentrations would be an increase in primary production, potentially resulting in nuisance algal blooms either in the channel or downstream of the discharge. This analysis examined changes in nitrogen concentrations in the Libby Creek watershed, although nitrogen is only one of the factors that could influence production in the stream. Phosphorus is often a limiting factor to production and data indicate generally low phosphorus concentrations exist in analysis area streams. Predicted phosphorus concentrations in Libby Creek below the Water Treatment Plant effluent discharge point are provided for Alternative 3 in Table 129 in section 3.13.4.3.2, *Water Quality*. Phosphorus concentrations are predicted to increase above ambient concentrations, but would remain below the total phosphorus standard of 0.025 mg/L. Other factors, such as carbon availability, shading, stream velocity, and substrate composition can also limit algal production.

Ammonia is the only nutrient with known toxicity to aquatic life and, therefore, has a Montana aquatic life standards (ALS). Chronic criteria for ammonia are modified by ambient pH and temperature, and take into consideration the presence of sensitive early life stage fish. The presence of early life stage fish requires a more restrictive standard. Higher temperature and/or pH also result in a more restrictive standard. For the effects evaluation, projected changes in ammonia concentrations were compared to the chronic early life stage present criterion at the ambient pH and a stream temperature of 14˚C. Only minor differences in nutrient concentrations is expected during the all phases of the project; predicted impacts are discussed collectively.

Metals

Metal concentrations are generally low within analysis area streams, with a high percentage of values below detection limits. Existing baseline concentrations and estimated changes in concentrations due to the project are provided in Section 3.13.4 for metals, including antimony, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, silver, and zinc. The uncertainties associated with projected instream concentrations resulting from discharges are discussed in section 3.13.4.5, *Uncertainties Associated with the Water Quality Assessment*, and these uncertainties would also impact the evaluation of potential impacts on aquatic life. Water quality monitoring would be required for a full suite of metals (see Appendix C).

The impact assessment for aquatic life focuses on the effects from any metals that would be predicted to increase to concentrations greater than chronic or acute aquatic life standards (ALS) or BHES Order limits in surface water as a result of the project alternatives (Table 120, p. 700). BHES Order limits were established for chromium, copper, iron, manganese, and zinc concentrations. Existing and predicted metal concentrations are presented as total recoverable metals, and were compared to total recoverable metal standards when available. Because the effects of changes in metal concentrations would be similar during each phase, predicted impacts are discussed collectively.

Montana ALS for cadmium, copper, chromium (III), lead, nickel, silver, and zinc are stream hardness-modified concentrations (DEQ 2012a). Because the toxicity-hardness relationship is uncertain at hardness concentrations of less than 25 mg/L, a hardness concentration of 25 mg/L as $CaCO_3$ is used to calculate metals standards when ambient hardness is less than this value. Ambient hardness is less than 10 mg/L in many of the water quality monitoring locations, creating uncertainty for the analysis of effects of metals on fish.

The BHES Order limit of 0.05 mg/L for manganese in surface water was consistent with the Montana surface water quality standard in effect in 1992. Montana's surface water standard for manganese was designed to protect the beneficial use of surface water as a drinking water source. Manganese in drinking water can have adverse staining and taste characteristics. Montana does not have a surface water quality standard or an ALS for manganese (Table 120). The State of Colorado adopted a hardness-modified chronic manganese standard of 1.04 mg/L at a hardness of 25 mg/L for aquatic life (Colorado Department of Public Health and Environment 2013). Although this aquatic life criterion has not been adopted in Montana and is not being applied to the Montanore Project, it was used to evaluate potential effects of projected manganese concentrations, as it is likely to be a more appropriate indicator of potential adverse effect on aquatic life than the BHES Order limit of 0.05 mg/L.

Temperature

As discussed in section 3.13, *Water Quality*, Montana has surface water ALSs for temperature that restrict substantial increases or decreases in stream temperature, dependent on the naturally occurring range of temperatures within the stream (Table 120, p. 700). For bull trout, water temperatures ranging from 36° to 59°F (2° to 15°C) are needed, with adequate thermal refugia available for temperatures at the upper end of this range. Other fish and invertebrate species within the analysis area also have specific temperature range needs that could be affected by any changes resulting from the project.

Direct solar radiation is the primary contributor to daily fluctuations in stream temperature, but stream temperature is influenced by other factors as well: air temperature, topography, weather, shade, streambed substrate (bedrock versus gravel or sandy bottoms), stream morphology, the amount of subsurface streamflow, and groundwater inflows (USDA Pacific Northwest Research Station 2005). Potential effects to stream temperature due to the project are discussed in section 3.13.4 of the *Water Quality* section. Given all of the factors that may affect stream temperature (both natural and due to the project), as well as the constantly changing stream temperature regime, it is difficult to predict how mine project effects may alter stream temperature, to what extent stream temperatures may be changed, or whether effects due to the mine would be separable from natural effects. Changes in stream temperature as a result of the mine project are evaluated qualitatively with respect to their effects on aquatic populations and habitat.

3.6.2.3.4 Metals in Fish

Metal concentrations in fish tissues were determined from redband trout samples collected from Libby Creek downstream of the Little Cherry Creek confluence in 1988, as well as from one or more sites on Libby Creek in 2006 through 2008 and one site each on Bear Creek in 2007 and 2008 (Western Resource Development Corp. 1989a; Kline Environmental Research 2008, 2009). Metals measured in 1988 included cobalt, copper, lead, mercury, and zinc in fish ranging from 3 inches to greater than 7 inches. Cadmium, lead, and mercury concentrations were measured in the trout collected from 2006 through 2008. Results from metals analyses of trout tissue collected from Rock Creek in 1985 are summarized in the Rock Creek Project Final EIS (USDA Forest Service and DEQ 2001). All reported concentrations were assumed to be reported as wet weight unless otherwise stated. Potential changes in tissue concentrations for each alternative were not calculated due to the lack of information needed to determine site-specific bioaccumulation and bioconcentration factors. Effects due to an increase in metal tissue concentrations were evaluated through projected changes for instream metal concentrations.

3.6.2.3.5 Fish Passage and Fish Loss

Mine activities have the potential for altering stream habitat by the creation of barriers to fish passage. If fish passage is restricted, habitat may be fragmented, migratory corridors may be eliminated, and fish subpopulations can become isolated from the remainder of the population. If a fish population becomes isolated, neighboring populations may be unable to recolonize and act as a source of gene flow for the isolated population, leaving it more vulnerable to extirpation. In several Montana watersheds, lack of connectivity has been identified as a major threat to bull trout restoration and persistence (Parametrix 2005).

The methods used to determine if barriers to fish passage from decreases in low flows is expected to occur as a result of the project alternatives was discussed in section 3.6.2.3.2, *Water Quantity*, and was based on the analysis presented in the BA (USDA Forest Service 2013a). This analysis used criteria from multiple USGS studies (Maret *et al*. 2005, 2006; Sutton and Morris 2004, 2005) that assessed the channel widths and stream depths necessary to allow for passage of adult migratory bull trout. The likelihood that physical or flow barriers would develop in the analysis area from other project effects and the potential impacts of the development of those barriers on aquatic resources were assessed using best professional judgment. Additionally, mine actions and mitigation plans were evaluated with respect to their potential to cause loss of fish within the analysis area.

3.6.2.3.6 Threatened, Endangered, or Sensitive Species and Species of Concern

As part of the impact analysis, activities during all mine phases were evaluated to determine their potential to alter stream habitat in such a way as to adversely affect sensitive species. Threatened, endangered, or sensitive species include the bull trout, a federally listed threatened species, and interior redband trout, westslope cutthroat trout, and western pearlshell mussels, all of which are Forest Service sensitive species. Additionally, torrent sculpin are a species of concern in Montana. Trout have specific habitat requirements for spawning, egg incubation, and rearing of juvenile fish, and possible effects on habitat must be assessed for all life stages. Best professional judgment was used to determine the potential for any adverse effects of mine activities to occur. An assessment of effects to bull trout from the project was the focus of the BA (USDA Forest Service 2013a), and included assessment of impacts from changes to water quantity, water quality, temperature, riparian areas, non-native fish abundance and presence, and fish passage.

3.6.3 Affected Environment

3.6.3.1 Aquatic Habitat

3.6.3.1.1 Stream Habitat Characteristics

Fish habitat parameters for 15 stream reaches within the analysis area sampled in 2005 are summarized in Table 65, with more detailed data summaries provided by Watershed Consulting and Kline Environmental Research (2005). Additional data from the KNF and other sources on the Libby Creek, Rock Creek, West Fisher Creek, and Miller Creek watersheds are presented in Table 66 through Table 70. The habitat evaluations conducted in Libby Creek, Bear Creek, Little Cherry Creek, Poorman Creek, Ramsey Creek, and East Fork Rock Creek during 1988 and 1989 classified each stream reach using the Rosgen (1985, 1996) system. Figure 54 shows the Rosgen categories assigned to each reach. If the same reach was surveyed for two or more years, then the category assigned to that reach during the most recent survey is given.

Wegner (pers. comm. 2012) also categorized reaches within analysis area streams based on data collected during the Rosgen surveys as one of five stream types: source reaches, stable transport reaches, unstable transport reaches, stable depositional/transport reaches, or unstable depositional reaches (Figure 54). Source reaches are characterized as being steep and deeply entrenched, and typically transport a high amount of debris. Rapids and waterfalls are often present in such reaches, and there is no to low fisheries use. Stable transport reaches are less steep and entrenched than source reaches, and typically have higher fisheries use. Riffles and step-pool complexes are common in these reaches, and banks are typically stable. Unstable transport reaches can serve as a source of sediment, and generally are entrenched with unstable banks. Fish habitat in these reaches is of a lower quality than in the more stable reaches. Stable depositional/transport reaches have a low gradient and level of entrenchment, with stable banks, meandering riffles and pools, and high fisheries use. Unstable depositional reaches typically have braided channels, high bedload, high bank erosion and deposition, and low fisheries use. Such a reach also typically supplies large amounts of sediment.

Three habitat indices also were calculated as part of the 1988-1989 habitat evaluations (Western Resource Development Corp. 1989a). The riparian habitat condition index is calculated based on nine vegetation and substrate measures, with the overall value ranging from 0 to 36. All values above 30 indicate excellent riparian habitat in the analysis area, with values between 22 and 30 indicating good riparian habitat. Based on this index, riparian habitat was good or excellent throughout most stream reaches (Table 67).

The habitat vulnerability index rates sites for potential susceptibility to aquatic habitat degradation based on measures of valley bottom width, stream gradient, upper bank slope, lower bank slope, bank stability, and indications of sediment production. Scores higher than 60, between 45 and 60, and less than 45 indicate high, moderate, and low vulnerability to degradation, respectively. Most streams in the analysis area had a moderate vulnerability (Table 67).

The habitat condition index measures potential fishery habitat. It ranges from 0 to 100, with higher scores indicating higher quality of habitat. Overall, the analysis area scored high on measures such as bank cover and stability, while measures of pool quality and quantity were typically lower, resulting in an overall reduction in stream reach scores (Table 67).

As an additional part of the baseline habitat surveys conducted in 1988 and 1989 (Western Resource Development Corp. 1989a), the percentage of potential spawning and rearing areas for fish was estimated for each reach of East Fork Rock Creek and the streams within the Libby Creek watershed.

The composition of spawning gravel was sampled with a McNeil core sampler from 15 stream reaches in Libby Creek, Little Cherry Creek, Ramsey Creek, Poorman Creek, and Bear Creek in 2005 (Table 68) (Kline Environmental Research and Watershed Consulting 2005b; Wegner, pers. comm. 2006a). Additionally, a single site on East Fork Rock Creek, two sites on West Fork Rock Creek, and three sites on the East Fork Bull River were surveyed between 1992 and 1994 using similar sampling methods (Washington Water Power Company 1996). Samples were collected from sites that appeared most suitable for spawning. In the laboratory, samples were dried and sieved. Imhoff cones were used in the field to estimate fine sediment not accounted for in the McNeil core samples. This aspect of the stream habitat is important as the proportion of fine sediment in spawning gravel can be a limiting factor to the reproductive success of bull trout and other salmonids that deposit eggs in the stream gravel.

Table 65. 2005 Region 1/Region 4 Summary Data for 15 Stream Reaches in the Libby Creek Watershed.

Site	Study Length (ft.)	Gradient (Percent)	Width/ Depth Ratio	Percent Riffle	Percent Run/ Glide	Percent Pool	Pools/ mile	LWD/ mile	Percent Stable Banks	Percent Undercut Banks
Libby Creek										
L1	997	1.8	50.9	48.3	28.1	28.6	10.3	31.9	100.0	0.0
L2	928	1.5	104.7	52.0	23.2	24.8	4.4	22.8	100.0	0.2
L3	1000	3.5	39.4	64.2	20.2	15.6	12.2	153.0	100.0	2.8
L9	1000	1.5	48.1	56.8	24.3	18.9	10.2	126.8	100.0	0.0
L10	1000	4.0	39.4	70.6	9.8	16.4	12.2	73.9	100.0	0.2
L11	1000	15.0	27.7	69.9	9.5	12.0	10.2	26.4	100.0	0.0
Ramsey Creek										
Ra2	997	3.0	55.6	67.7	9.0	23.3	20.4	116.3	99.3	2.1
Ra3	1000	9.0	52.5	42.1	3.2	17.9	18.3	131.9	100.0	0.0
Ra4	1000	2.5	52.9	49.8	39.8	10.4	6.1	205.8	100.0	0.0
Poorman Creek										
Po1	1000	3.0	33.3	56.9	27.5	15.6	10.2	163.6	100.0	0.9
Po2	1000	6.0	42.5	66.3	4.2	27.9	24.5	105.6	100.0	1.3
Little Cherry Creek										
LC1	902	1.5	32.1	49.2	27.4	23.5	24.9	177.2	100.0	0.1
LC2	971	2.0	28.2	46.1	26.6	27.3	35.7	184.9	99.6	6.3
LC3	984	6.5	31.6	65.7	15.9	18.3	33.1	337.6	100.0	1.3
Bear Creek										
Be2	1066	2.0	32.9	77.7	6.1	16.2	11.5	153.5	99.7	0.1

LWD = large woody debris.

Source: Watershed Consulting and Kline Environmental Research 2005.

Table 66. Stream Geomorphology Data for Libby Creek and Tributaries.

Site and Year Sampled	Rosgen Type	BFW (ft.)	Pools/ft.	LWD/ft.	Width/ Depth Ratio
7 Libby 2005	D4	277	1/1,110	1/347	120.2
8 Libby 2005	F3	55	1/1,222	1/203	47.8
9 Libby 2005	B3c	39	1/797	1/80	34.7
10 Libby 1997	B3c	50	1/180	1/25	22.7
10 Libby 2004	B3c	37	1/279	1/70	35.1
11 Libby 1997	B3c	45	1/225	1/450	32.9
11.5 Libby 2004	B2a	33	1/223	1/335	76.6
12 Libby 1997	C4	37	1/249	1/23	19.4
12 Libby 2004	C3	28	1/5	1/50	57.0
13 Libby 1997	C3	28	1/141	1/37	19.7
13 Libby 2004	F3	29	1/192	1/36	43.4
14 Libby 1997	B3c	36	1/144	1/23	24.5
15 Libby 1997	F3b	23	1/165	1/247	16.6
15 Libby 2004	B3	24	1/127	1/85	28.2
16 Libby 1997	B3c	35	1/357	1/48	26.1
16 Libby 2004	F4b	24	1/173	1/11	38.3
17 Libby 1997	C3b	32	1/192	1/36	43.4
17 Libby 2004	B3c	22	1/117	1/6	110.4
1 Ramsey 1998	B3	23	1/7	1/16	17.5
1 Ramsey 2005	B3	24	1/153	1/77	18.2
2 Ramsey 1997	B2c	15	1/31	1/22	18.1
2 Ramsey 2005	B3c	24	1/247	1/11	17.2
1 Poorman 1997	B2a	16	1/40	1/108	18.1
1 Poorman 2005	A1a	14	1/13	1/4	25.5
2 Poorman 1997	F3b	24	1/13	1/13	15.3
2 Poorman 2005	B3	14	1/97	1/15	21.6
1 Little Cherry 1997	F4b	11	1/37	1/16	19.8
1 Little Cherry 2005	B4	10	1/39	1/14	15.9
2 Little Cherry 2005	A2	8	1/39	1/54	12.9
1 Bear 1997	B3c	25	1/127	1/63	24.9
1 Bear 2004	B3c	20	1/100	1/19	22.4
2 Bear 1997	F3b	33	1/111	1/21	31.4
2 Bear 2004	F3b	25	1/621	1/44	44.1
3 Bear 1997	F3	33	1/134	1/37	1.4
3 Bear 2004	F3	27	1/50	1/35	15.5
4 Bear 2002	G4c	17	1/121	1/18	1.1
1 Cable 1997	B4	21	1/60	1/45	29.9
1 Cable 2005	B3a	23	1/83	1/22	26.6
1 Howard 1997	B4	15	1/135	1/15	21.0
2 Howard 1997	B3a	11	1/32	1/37	32.4
1 Midas 1998	B4	13	1/50	1/10	14.2
2 Midas 1998	F4b	12	1/34	1/19	18.8
3 Midas 1998	F3b	8	1/31	1/16	17.0
4 Midas 1998	B4	8	1/21	1/15	12.2

Shaded values indicate RMOs or goals not met.

LWD = large woody debris; BFW = bankfull width.

Source: Libby Ranger District files (USDA Forest Service 2005a).

Table 67. Mean Habitat Values for Analysis Streams in 1988-1989.

Site	Mean Riparian Habitat Condition Index	Mean Habitat Vulnerability Index	Mean Habitat Condition Index	Potential Spawning Area (%)	Potential Rearing Area (%)
Libby Creek					
L1	33/Excellent	55.45/Moderate	74.1	44.6	7.7
L2	33/Excellent	55.61/Moderate	75.5	25.0	16.8
L4	18/Fair	48.79/Moderate	55.4	34.2	21.7
L5	29/Good	43.94/Moderate	66.8	26.2	18.2
L8	25/Good	44.70/Moderate	70.1	36.6	39.2
L10	33/Excellent	52.73/Moderate	70.6	26.7	20.6
L11	32/Excellent	55.91/Moderate	80.0	33.8	28.6
Ramsey Creek					
Ra2a	31/Excellent	58.94/Moderate	72.0	29.1	13.3
Ra3	32/Excellent	58.03/Moderate	65.4	18.6	21.9
Ra4	31/Excellent	60.45/High	50.9	4.4	99.0
Poorman Creek					
Po0	32/Excellent	45.76/Moderate	60.4	35.2	8.0
Little Cherry Creek					
LC1	33/Excellent	52.88/Moderate	65.9	25.2	17.8
Bear Creek					
Be1	29/Good	44.55/Moderate	73.2	29.1	25.1
Be2	31/Excellent	57.73/Moderate	78.6	37.6	31.6
Be3	30/Excellent	61.97/High	77.7	22.7	28.4
East Fork Rock Creek					
Ro1	33/Excellent	59.24/Moderate	75.4	5.7	34.2
Ro3	29/Good	63.03/High	60.6	3.6	91.1
Ro4	30/Excellent	53.18/Moderate	61.1	2.3	34.4

Source: Western Resource Development Corp. 1989a.

Generally, core samples showed that the upstream sites had a higher percentage of fine sediment and a smaller median substrate size in comparison to the downstream sites (Table 68). The most downstream reach on Libby Creek had the lowest percent fine sediment (14.6 percent), while the site sampled on East Fork Rock Creek had the highest percent fine sediment (43.0 percent) (Kline Environmental Research and Watershed Consulting 2005b). The average amount of stream substrate covered by fine sediment in low gradient riffles was also measured eight times from 2006 through 2008 at sites on Libby Creek, Bear Creek, Ramsey Creek, and Poorman Creek (Kline Environmental Research 2008, 2009). Surface fines composed less than 15 percent of the substrate in these areas within all sites except the site on Little Cherry Creek in August and October 2008 and the site on Libby Creek immediately upstream of the falls near LB-300 in October 2008.

Libby Creek

The Libby Creek stream reaches surveyed in 2005 were generally dominated by riffle habitat, with stable banks and good cover for fish (Table 65). All reaches were moderate in gradient ($\leq$ 4 percent), except the most upstream reach. The dominant substrate types at all reaches were gravel and cobble (Watershed Consulting and Kline Environmental Research 2005). GIS and aerial imagery data were used to survey the habitat in the upstream 5.6 miles of Libby Creek in 2012 (Kline Environmental Research and NewFields 2012). The average slope in this reach was determined to be 7 percent, with moderate canopy cover and amounts of large woody debris. Pools, glides, riffles, and cascades were present throughout this reach.

All five of the stream types identified within the analysis area were present within Libby Creek (Figure 54). A short reach within the headwaters was categorized as a source reach, which then transitioned into a stable transport reach upstream of the CMW boundary (Wegner, pers. comm., 2012). Stable transport reaches were also identified further downstream in Libby Creek from below the Midas Creek confluence to downstream of the Bear Creek confluence. A lower gradient reach between these reaches was characterized as stable but more depositional. An unstable depositional reach was also identified from the Ramsey Creek confluence extending downstream of the Midas Creek confluence (Figure 54).

In 2014, the DEQ and the EPA issued TMDLs and a water quality improvement plan for the Kootenai River-Fisher River project area, which includes Libby Creek (DEQ and EPA 2014). A TMDL is the maximum amount of a pollutant a waterbody can receive and still meet water quality standards. The DEQ and the EPA established water quality restoration goals for sediment in the plan on the basis of fine sediment levels in trout spawning areas and aquatic insect habitat, stream morphology and available instream habitat as it relates to the effects of sediment, and the stability of streambanks. Meeting the TMDL, of which Montanore's wasteload allocation of 24 tons per year is a part, will satisfy the water quality restoration goals. The DEQ believes that once the water quality restoration goals are met, all beneficial uses currently affected by sediment will be restored (DEQ and EPA 2014).

The DEQ and the EPA quantified watershed sediment load from four sources: streambank erosion, hillslope erosion (upland sediment sources), unpaved roads, and permitted point sources. The DEQ and the EPA estimated that streambank erosion was the largest contributing load of the four sediment sources. During development of the TMDLs and water quality improvement plan for the Kootenai River-Fisher River Project Area, the DEQ and EPA assessed sediment and habitat conditions at 15 stream reach sites. The two monitoring sites on Libby Creek, downstream of the analysis area, had the highest sediment load per mile from streambank erosion of the 15 monitored sites. For all of Libby Creek, including the section impaired for sedimentation/siltation downstream of the analysis area, the DEQ and the EPA estimated a sediment load of nearly 4,900 tons/year due to streambank erosion. Of the six streams required to be assessed for sediment loads in the Kootenai-Fisher TMDL project area, the mainstem of Libby Creek had the highest rate of streambank erosion per mile of stream (116 tons/mile of stream) of the six streams assessed by the DEQ and the EPA (2014).

The estimated existing sediment load described in DEQ and EPA (2014) was for the entire Libby Creek watershed. Using data and approaches described in DEQ and EPA (2014), the agencies' estimate of existing sediment load in the upper Libby Creek watershed without the Montanore Project is 1,621 tons/year. The agencies' estimate of future sediment load in the upper Libby

Creek watershed without the Montanore Project after the TMDL is achieved is 1,102 tons/year (Section 3.13.3.1.4, Table 123, p. 722).

RMOs and goals for the amount of large, woody debris and bank stability (Table 64) were generally achieved at the Libby Creek sites within the analysis area, but width/depth ratios were consistently not met (Table 66). Pool frequency was lower than these objectives at some sites also.

The riparian habitat condition index, rated as fair throughout the reach of Libby Creek downstream of the Poorman Creek confluence (Site L4), reflects the physical effects of abandoned placer mining operations. All other reaches were rated excellent or good. The mean habitat vulnerability index was rated moderate for all sites (Western Research Development Corp. 1989a).

The most likely locations for spawning in Libby Creek included the reaches downstream from its confluence with Bear Creek (Site L1), near its confluence with Poorman Creek (Site L4), downstream from Ramsey Creek (Site L5), and downstream from Howard Creek (Site L8). Potential spawning habitat ranged from 25 to 45 percent of the total length of each surveyed reach in Libby Creek, and potential rearing areas ranged from 8 to 39 percent (Table 67). Percent fine sediment ranged from 15 percent to 29 percent in 2005 (Table 68). Sampling conducted in 2006 through 2008 indicated that the percentage of surface fines in low gradient riffle habitat within most surveyed reaches of Libby Creek was less than 10 percent (Kline Environmental Research 2009). The reach of Libby Creek immediately upstream of Libby Falls near LB-300 had a higher percentage of fines than the other reaches during some sampling events in 2007 and 2008, with the percent of fines ranging from 1 percent to 17 percent.

In 2001 through 2006, sections of Libby Creek were restored by the FWP as part of the Libby Creek Demonstration, Upper Cleveland, and Lower Cleveland projects. These projects were implemented because accelerated bank erosion along some meander bends had resulted in a widened, shallow, and unstable stream channel that produced low quality habitat for native trout (Dunnigan *et al.* 2004, 2011). The Libby Creek Demonstration Project focused on 1,700 feet of the stream located above the confluence of Elliot Creek with Libby Creek. Two eroding banks in this area were contributing substantial amounts of sediment to Libby Creek. The project restored this reach of Libby Creek, reduced bank erosion, and increased the quantity and quality of rearing habitat for native salmonids (Dunnigan *et al.* 2005, 2011).

The other restoration projects, designated the Upper and Lower Cleveland restoration projects, focused on restoring stream function to about 6,100 feet of Libby Creek between the confluences of Howard Creek and Midas Creek (Dunnigan *et al*. 2011). The restoration effort was aimed at increasing sinuosity (and thereby stream length), habitat complexity, and the number of pools within the stream channel. The projects additionally added cobble structures, rootwad complexes, and rock vanes to increase gradient control, pool habitat, and bank protection. Various shrubs, willows, and cottonwoods were planted to establish a healthy riparian area (Dunnigan *et al.* 2004). Much of this habitat restoration work in upper Libby Creek was destroyed or damaged during a 2006 rain-on-snow event, but the habitat has continued to recover from this large flood event and has remained better than conditions before the restoration based on monitoring through 2009 (Dunnigan *et al*. 2011). Rain-on-snow events occur with sufficient frequency to make habitat improvements in Libby Creek difficult to maintain.

Table 68. Mean Particle Size Distribution of McNeil Core Samples.

Site	Mean Particle Size (mm)	Mean % fine sediment (<6.25 mm)
Libby Creek		
L1	37.6	14.6
L2	26.6	19.6
L3	24.2	25.0
L9†	19.0	29.0
L10	25.8	21.7
L11	23.9	19.7
Ramsey Creek		
Ra2	33.4	14.8
Ra3	23.6	22.2
Ra4	23.0	23.1
Poorman Creek		
Po1	28.0	17.2
Po2	22.8	21.0
Little Cherry Creek		
LC1	24.5	19.5
LC2	18.5	23.9
LC3	35.3	39.4
Bear Creek		
Be2†	25.0	23.0
Rock Creek		
Reach 2	Not Calculated	43.0
West Fork Rock Creek		
Reach 1	Not Calculated	28.0
Reach 2	Not Calculated	24.0
East Fork Bull River		
Reach 1	Not Calculated	25.0
Reach 2	Not Calculated	33.0
Reach 3	Not Calculated	15.0

†Sites were surveyed in 2005 by Libby Ranger District; data from other years also available.
mm = millimeter.
Sources: Kline Environmental Research and Watershed Consulting 2005b; Wegner, pers. comm. 2006a; Washington Water Power Company 1996.

Ramsey Creek

The stream reaches surveyed in 2005 in Ramsey Creek were dominated by riffle habitat and had stable banks. Gradient ranged from 2.5 to 9.0 percent (Table 65). The dominant substrate types at all reaches were cobble and gravel. The headwaters reach of Ramsey Creek and its tributary were assessed using GIS data and aerial imagery in 2012 (Kline Environmental Research and NewFields 2012). The upstream reach of the mainstem had an average slope of 0.3 percent and was dominated by glide habitat, while the tributary was determined to have an average slope of

43 percent and to be comprised mainly of cascade habitat. The tributary had no large woody debris.

The two downstream reaches on Ramsey Creek had a high amount of pool habitat. The farthest downstream Ramsey Creek reach had the highest amount of fish cover in Ramsey Creek, with larger pools that could offer winter fish habitat and a moderate amount of spawning gravel. The upstream Ramsey Creek reach had the lowest percentage of pool habitat out of all of the project stream reaches (Watershed Consulting and Kline Environmental Research 2005).

The upstream segment of Ramsey Creek near the CMW boundary was categorized as a source reach, with the rest of Ramsey Creek categorized as a stable transport reach (Figure 54) (Wegner, pers. comm. 2012). The RMOs describing the amount of large woody debris and bank stability were met in both Ramsey Creek reaches surveyed (Table 66). RMOs for pool frequency were not met during the 2005 surveys, and the goal for width/depth ratios were not met during any survey in Ramsey Creek, similar to other streams within the analysis area.

The riparian habitat condition index was rated as excellent for all reaches of Ramsey Creek. Based on the mean scores for each reach, the upper reach of Ramsey Creek was rated as having a potentially high vulnerability to degradation (Table 67). The other reaches were rated as having moderate potential vulnerability to degradation (Western Resource Development Corp. 1989a).

Potential spawning habitat ranged from 4 to 29 percent in the surveyed reaches of Ramsey Creek, and potential rearing areas ranged from 13 to 99 percent (Table 67). Percent fine sediment increased slightly in a downstream direction, varying from 15 percent to 23 percent in 2005 (Table 68). The average percentage of fine sediment in low gradient riffle habitat was surveyed within a single reach of Ramsey Creek in 2007 and 2008, and was estimated to be 1 percent or less (Kline Environmental Research 2009).

Poorman Creek

The stream reaches surveyed in 2005 in Poorman Creek were dominated by riffle habitat and had stable banks. Gradient was 3 percent in the upper reach and 6 percent in the lower reach (Table 65). The dominant substrate types at all reaches were cobble and gravel. GIS and aerial imagery data were used to assess the headwaters reach of this stream in 2012; average slope was estimated to be 13 percent, and cascades were the most common habitat type (Kline Environmental Research and NewFields 2012). This reach was also determined to have high solar exposure and no woody debris.

The downstream reach on Poorman Creek was braided, with much of the side channel water going subsurface before re-entering the main channel. The upstream Poorman Creek reach had high quality pocket pool habitat formed by cobble and small boulders that serve as good interstitial habitat for juvenile bull trout. The upstream segment of Poorman Creek was categorized as a source reach, while the downstream segment was categorized as an unstable transport reach (Figure 54) (Wegner, pers. comm. 2012). All RMOs and goals were met except for the objectives for width/depth ratios (Table 66).

The riparian habitat condition index for Poorman Creek was rated as excellent. The habitat vulnerability index was rated as moderate. Potential spawning area was found in the reach of Poorman Creek above its confluence with Libby Creek. Potential spawning habitat was 35 percent in the surveyed reach of Poorman Creek, and potential rearing area was 8 percent (Table

67). Percent fine sediment ranged from 17 percent to 21 percent in the two reaches surveyed in 2005 (Table 68). The average percentage of fine sediment in low gradient riffle habitat within the single reach of Poorman Creek surveyed in 2007 and 2008 was estimated to be 1 percent or less (Kline Environmental Research 2009).

Little Cherry Creek

The stream reaches surveyed in the Little Cherry Creek were dominated by riffle habitat and had stable banks. Gradient was moderate to fairly steep (Table 65). The dominant substrate types at all reaches were cobble and gravel.

The upstream Little Cherry Creek site provided limited winter habitat availability and poor pool habitat. Although a few larger pools did exist in the middle reach of Little Cherry Creek, overall this reach also provided poor pool habitat and little fish cover. The most downstream Little Cherry Creek reach had high habitat diversity, but low water volumes. All reaches of Little Cherry Creek were categorized as stable transport reaches (Figure 54) (Wegner, pers. comm. 2012). RMOs and goals were met for pool frequency, amount of large woody debris, and bank stability during each of the three habitat surveys, but were not met for width/depth ratios (Table 66).

The riparian habitat condition index for Little Cherry Creek was rated as excellent. The habitat vulnerability index was rated as moderate (Table 67). Potential spawning habitat was 25 percent in the surveyed reach of Little Cherry Creek, and potential rearing area was 18 percent (Table 67). Percent fine sediment increased downstream, ranging from 20 percent to 39 percent in 2005 (Table 68). The percentage of fine sediment in low gradient riffle habitat was near 2 percent in 2007 and the first sampling event in 2008. The percentage of sediment was much higher in August 2008 and then further increased up to 95 percent in October 2008, potentially as a result of logging activity nearby (Kline Environmental Research 2009).

Bear Creek

Bear Creek was dominated by riffle habitat and had stable banks, with the gradient at the site surveyed in 2005 being 2.0 percent (Table 65). The dominant substrate types were cobble and gravel. The headwaters reach of Bear Creek within the CMW was categorized as a source reach (Figure 54) (Wegner, pers. comm. 2012). Downstream of the CMW boundary, the stream transitioned into a stable transport reach, with a less stable reach present downstream of the Cable Creek confluence. The RMOs and goals for the amount of large woody debris present and for bank stability were met at each site surveyed, but the width/depth ratios did not meet these goals consistently (Table 66). Width-depth ratios at Cable Creek were also greater than the RMOs, and bank stability was low during the 2005 survey.

The mean riparian habitat condition index for Bear Creek was good in the upper reach and excellent in the two lower reaches. Based on the mean scores for each reach, the upper reach of Bear Creek was rated as having a potentially high vulnerability to degradation (Table 67). Other reaches of Bear Creek were rated as having moderate potential vulnerability to degradation (Western Resource Development Corp. 1989a).

Probable spawning areas include reaches in Bear Creek both downstream and upstream of Bear Creek Road (NFS road #278). Potential spawning habitat ranged from 23 to 38 percent in the surveyed reaches of Bear Creek, and potential rearing areas ranged from 25 to 32 percent (Table 67). The single reach surveyed on Bear Creek in 2005 was noted as having good over-wintering and juvenile salmonid rearing habitat, although it appeared to provide limited spawning habitat. Percent fine sediment at this site was 18 and 23 percent in 2004 and 2005, respectively (Table 68) (Wegner, pers. comm. 2006a), and was 8 percent or lower in the monitoring conducted from 2007 to 2008 (Kline Environmental Research 2009). Percent fine sediment was also measured by in Bear Creek in most years from 2002 through 2010 as part of the mitigation program for Libby Dam; mean percent fine sediment ranged from 16 percent in 2008 to 39 percent in 2005 (Dunnigan *et al*. 2011).

Big Cherry Creek

No habitat data were available for Big Cherry Creek from MFISH (FWP 2012) or the other sources used. Using data and approaches described in DEQ and EPA (2014), the agencies estimate the current sediment load in the Big Cherry Creek watershed to be 768 tons/year and future sediment load after the sediment TMDL is achieved to be 519 tons/year (Table 123).

Howard Creek

Howard Creek was not evaluated for riparian condition index or the vulnerability index. Based on habitat data collected in 1997 (Table 66), LWD and bank stability met RMO's, as did the pool frequency at one site. Width/depth ratios and the pool frequency at the remaining site surveyed did not meet the RMOs.

Midas Creek

Midas Creek was not evaluated for riparian habitat condition index or the vulnerability index. Banks were stable and both LWD and pool frequency met RMOs. Width/depth ratios were not being met based on 1998 surveys **(**Table 66).

Swamp Creek (Libby Creek tributary)

No data were available from the MFISH database (FWP 2012) or the other sources used that described the aquatic habitat within Swamp Creek. This stream would be used as part of the agencies' wetland and other waters of the U.S. mitigation plan.

Headwater Drainages

Habitat within four headwater drainages between Poorman Creek and Little Cherry Creek were surveyed in 2011 (Kline Environmental Research 2012). One drainage had no surface connection to Libby Creek or any other neighboring drainage during the periods surveyed. The percentage of the channel within the Poorman Tailings Impoundment site that was flowing in May 2011 but dry in September 2011 varied from 1 percent to 67 percent within the four drainages. Channelized segments were interspersed with non-channelized or dry segments in each of the four drainages. An average gradient of 8 percent was documented in the four drainages, and the average bankfull depth was 10 inches. Canopy cover varied widely, ranging from near zero to 100 percent.

Fisher River and Miller Creek Watersheds

The stream reaches surveyed in the mainstem of the Fisher River were downstream of the analysis area, but generally had gradients that were generally less than 1.0 percent (USDA Forest Service 2005a). Miller Creek was sampled in 1998 and 2005, and comparisons between years are shown in Table 69. Overall, gradients were moderate to steep, and mean substrate size ranged from gravel to cobble sizes. RMOs and goals for most of these stream reaches were met for all parameters except for width/depth ratios, but occasionally RMOs and goals for pool frequency, large woody debris frequency, and bank stability were also not met (Table 69). Mean percent fine sediment was measured in West Fisher Creek as part of the Libby Dam mitigation project in 2006, 2008, 2009, and 2010. Mean values ranged from 10 percent in 2008 to 32 percent in 2006 (Dunnigan *et al*. 2011). No habitat data were available for Hunter Creek and Sedlak Creek.

Rock Creek Watershed

Fish habitat was surveyed in two reaches of Rock Creek, two reaches of East Fork Rock Creek, and three reaches of West Fork Rock Creek between 1992 and 1994 as part of a survey of the tributaries of the lower Clark Fork River (Washington Water Power Company 1996). The two East Fork Rock Creek reaches were similar in location to the sites surveyed during the previous baseline surveys conducted in this stream, while the West Fork Rock Creek reaches extended from the confluence with East Fork Rock Creek upstream to West Fork Falls. Rock Creek was described as consisting of mainly run, low gradient riffle, and glide habitat types, with substrate that was predominately rubble, cobble, gravel, and boulder. Other than the low gradient section termed Rock Creek Meadows, East Fork Rock Creek was composed primarily of riffle and cascade habitats, with a higher percentage of larger substrate such as boulder and cobbles present. West Fork Rock Creek was primarily composed of high gradient riffle and pool habitat with rubble and gravel substrate. Surface fines within the Rock Creek drainage ranged from less than 1 to 31 percent, with the highest percentage occurring in the most downstream reach surveyed in West Fork Rock Creek. Generally the downstream reaches on Rock Creek contained lower amounts of large woody debris than the upstream East Fork Rock Creek reaches.

Substantial portions of the Rock Creek mainstem have seasonally intermittent flows, as do the downstream reaches of West Fork Rock Creek. The riparian zone within these two mainstem reaches was also observed to be significantly altered by logging and wildfires. Percent vegetated bank cover was higher in East Fork Rock Creek and West Fork Rock Creek, compared to the mainstem (Washington Water Power Company 1996). The riparian habitat condition index for East Fork Rock Creek was rated as good in the middle reach and excellent in the upstream and downstream reaches (Table 67). The middle reach was rated as having a potentially high vulnerability to degradation. The other reaches were rated as having moderate potential vulnerability to degradation (Western Resource Development Corp. 1989a). The riparian habitat condition index and habitat vulnerability index were not evaluated on any reaches within the mainstem Rock Creek or West Fork Rock Creek.

Potential spawning habitat ranged from 2 to 6 percent in the surveyed reaches of East Fork Rock Creek, and potential rearing areas ranged from 34 to 91 percent (Table 67). While each reach was not evaluated, the potential spawning and rearing areas for the stream as a whole also were estimated for Rock Creek, East Fork Rock Creek, and West Fork Rock Creek in 1992 to 1994 (Washington Water Power Company 1996). The combined percentage of potential spawning habitat in Rock Creek and East Fork Rock Creek was 1.1 percent. The percentage of potential rearing habitat in this stream was 16.1 percent. Within West Fork Rock Creek, the percentage of spawning and rearing habitat was 2.9 and 32.1 percent, respectively. When compared to other tributaries in the lower Clark Fork River, the percentage of potential spawning area was relatively low, while the percentage of rearing habitat in the Rock Creek drainage was similar to other streams. Percent fine sediment in spawning areas was 43 percent at the one reach surveyed in Rock Creek, and ranged from 24 to 28 percent in West Fork Rock Creek (Table 68), (Washington Water Power Company 1996).

Table 69. Stream Geomorphology Data for West Fisher and Miller Creeks and Tributaries.

Site and Year	Rosgen Type	BFW (ft.)	Pools/ ft.	LWD/ft.	Width/ Depth Ratio
1 West Fisher Creek 1996	D4	98.0	1/673	1/1009	109.0
3 West Fisher Creek 1996	B3c	18.3	1/324	1/93	32.9
5 West Fisher Creek 1996	C4	19.1	1/96	1/77	25.0
8 West Fisher Creek 1996	B3a	15.2	1/53	1/45	17.8
1 Miller Creek 1998	B3c	12.1	1/115	1/109	15.8
1 Miller Creek 2005	B4	16.4	Dry	1/10	11.5
2 Miller Creek 1998	B4c	10.8	1/34	1/80	14.8
2 Miller Creek 2005	F4	10.9	1/54	1/18	29.0
3 Miller Creek 1998	F4	11.2	1/120	1/243	13.3
3 Miller Creek 2005	E4	13.2	1/270	1/45	10.2
4 Miller Creek 1998	B4c	13.0	1/54	1/39	16.6
4 Miller Creek 2005	B4c	11.3	1/139	1/132	13.0
5 Miller Creek 1998	B3c	9.2	1/193	1/14	16.2
5 Miller Creek 2005	F4b	9.0	1/47	1/38	13.6
6 Miller Creek Trib. 1998	Da4	4.3	Dry	nc	21.5
6 Miller Creek Trib. 2005	Da4	3.8	Dry	1/5	9.9
7 Miller Creek Trib. 1998	B4	6.9	1/46	1/6	9.1
7 Miller Creek Trib. 2005	F4	6.1	Dry	1/98	22.6
8 Miller Creek 1998	B4c	9.8	1/66	1/28	13.2
8 Miller Creek 2005	F4b	11.5	1/5	1/18	25.7
9 South Fork Miller 1998	B4	6.7	1/33	1/98	18.0
9 South Fork Miller 2005	E4b	7.0	1/36	1/72	4.9
10 South Fork Miller 1998	C4b	5.2	1/32	1/8	20.1
10 South Fork Miller 2005	E4b	6.0	1/43	1/6	5.8
11 Miller Creek 1998	F4b	9.7	1/70	1/15	21.0
11 Miller Creek 2005	B4	8.4	1/46	1/11	20.5
12 North Fork Miller 1998	F3b	10.0	1/40	1/9	31.1
12 North Fork Miller 2005	F4b+	8.8	Dry	1/10	32.8
13 Miller Creek 1998	F4b	6.8	1/64	1/128	28.3
13 Miller Creek 2005	F4	5.8	1/39	1/8	17.4
14 Miller Creek 1998	B4a	5.2	1/24	1/8	12.2
14 Miller Creek 2005	G4	5.7	1/28	1/5	15.8
15 Miller Creek 1998	G4	4.8	1/28	1/6	9.8
15 Miller Creek 2005	F4b	3.0	0/10	nc	16.6

Shaded values indicate RMOs or goals not met.
BFW = bank full width; LWD = large woody debris; nc = not calculated.
Source: Libby Ranger District files (USDA Forest Service 2005a).

The habitat within the mainstem, East Fork, and West Fork of Rock Creek was also evaluated in August 2012 by the KNF (Kline and Savor 2012; Salmon Environmental Services 2012). The entire length of the mainstem was surveyed, and 3.2 miles and 2.1 miles of East Fork Rock Creek and West Fork Rock Creek, respectively, were surveyed as well. The upstream boundary of the surveys on both East Fork Rock Creek and West Fork Rock Creek were at waterfalls that act as barriers to fish migrating upstream. Riffle habitat predominated within all three streams, and small cobble, large cobble, and gravel were the most common substrates observed in these reaches. Average stream widths were more similar in the mainstem of Rock Creek and East Fork Rock Creek, and were narrower in West Fork Rock Creek, while average depths were similar between all three reaches (Table 70). While bank stability was not specifically measured during this study, RMOs were met for the amount of large, woody debris present within the reach. Width/depth ratios were higher than the RMOs and number of pools per foot lower than the RMOs for those parameters (Table 64) for all three streams. Kline and Savor (2012) provided additional information on pool widths and depths. The number of large pools per mile, defined as pools greater than 9.8 feet in width and 3.3 feet in depth at low flow, was low. About 15 and 4 of these types of pools occurred per mile in the mainstem and East Fork Rock Creek. No pools were present meeting the pool criteria in West Fork Rock Creek.

Table 70. Stream Habitat Parameters for the Rock Creek and East Fork Bull River Drainages in August 2012.

Reach Length (ft.)	Rosgen Channel Type	Average Wetted Width (ft.)	Average Depth (ft.)	Average Percent Fines in Pool Crest	Pools/ft.	Large Woody Debris/ ft.†	Width/ Depth Ratio
Mainstem Rock Creek							
29,077	NM	20	1.2	27	1/282	1/46	22.8
East Fork Rock Creek							
16,376	NM	20	1.1	15	1/455	1/26	21.9
West Fork Rock Creek							
10,775	NM	11	0.9	41	1/177	1/7	13.6
East Fork Bull River							
2,667	B3c	21	1.2	NM	1/205	1/89	20.1
1,684	B3	23	1.0	NM	1/140	1/83	23.6
1,050	A3-A2	21	0.8	NM	1/105	1/55	29.2

NM = parameter not measured.
†Large woody debris counts included those with diameters greater than 6 inches and lengths either greater than the stream width for the Rock Creek watershed and greater than 15 feet in length for the East Fork Bull River watershed.
Shaded values indicate RMOs or goals not met.
Source: Kline and Savor 2012.

GIS and aerial imagery data were used to assess some habitat features in a reach of the Rock Creek mainstem and reaches of East Fork Rock Creek upstream and downstream of Rock Lake in 2012 (Kline Environmental Research and NewFields 2012). The mainstem reach that was surveyed was located immediately downstream of the confluence of the east and west forks of Rock Creek, in a reach that has perennial flow. It had an average slope of 2 percent, with dense canopy cover and abundant large woody debris. Pools and glides were the most common habitat types. Average slope for the reach upstream of the lake was estimated to be 21 percent, with cascades common. Large woody debris was reported to be almost absent in this reach, but most of the reach was shaded due to narrow stream widths and riparian shrubs. Downstream of the lake, slope decreased and averaged 8 percent, with pools, riffles, rapids, and glide habitat present. Low to moderate canopy cover was present in this reach, and it also had moderate amounts of large woody debris.

Percent fines in the pool crest areas were highest in West Fork Rock Creek in 2012, where fines comprised 41 percent of the substrate on average in these areas (Table 70) (Kline and Savor 2012). Core data were also collected during these surveys from a stream reach 4 miles upstream of the mouth on the mainstem of Rock Creek and from a site immediately upstream of the confluence with the mainstem on West Fork Rock Creek. The average percentage of fines less than 0.25 inches was 17 and 34 percent, respectively (Carlson, pers. comm. 2012).

Surface fines and spawning substrate were also evaluated in a separate survey in the Rock Creek drainage in 2011 and 2012 (Salmon Environmental Services 2012). This evaluation concluded that most of the smaller substrates present in the Rock Creek drainage were located in channel margins and depositional bars in areas that were frequently dry during the low flow period. Suitable spawning habitat during this period was limited. The percent of surface fines 0.25 inches or less in diameter varied from none present at one of the East Fork Rock Creek sites to 14 percent at a site on the mainstem. Their evaluation of these and previous data determined that the amount of fine surface sediment in the Rock Creek drainage was generally at levels that would function appropriately for bull trout spawning and incubation. Potential sediment sources were also assessed during 2011, and the primary source of new sediment delivery in this watershed was determined to be bank erosion.

The reach of the mainstem Rock Creek immediately downstream of the Orr Creek confluence was dry during the surveys in 2012 (Salmon Environmental Services 2012), as was the most downstream portion of West Fork Rock Creek and the reach of West Fork Rock Creek upstream of the upper Forest Road 150 crossing.

East Fork Bull River Watershed

As part of the fish habitat survey between 1992 and 1994 (Washington Water Power Company 1996), three reaches of the East Fork Bull River were surveyed. The habitat in this stream consists primarily of high gradient riffle and pool habitat types, with mainly cobble and rubble substrate in the high gradient sections and sand and silt in low gradient sections. East Fork Bull River had lower amounts of fine sediment than most of the other lower Clark Fork River tributaries, ranging from 7 to 11 percent surface fines. It had moderately high amounts of large woody debris (Washington Water and Power Company 1996). A project completed in 2001 restored about 1,200 feet of the channel in the lower East Fork Bull River with subsequent work done to reduce sediment and increase fish habitat (Avista 2007).

While each reach was not evaluated, the potential spawning and rearing areas for the stream as a whole also were estimated for the East Fork Bull River in 1992 through 1994 (Washington Water Power Company 1996). The percentage of potential spawning habitat in the East Fork Bull River was 0.6 percent (Table 67). The percentage of potential rearing habitat in this stream was 4.1 percent. When compared to other tributaries to the lower Clark Fork River, these percentages were relatively low. Percent fines in the three reaches surveyed in 1992 through 1994 ranged from 15 percent to 33 percent (Table 67) (Washington Water Power Company 1996).

Stream habitat restoration projects initiated by Avista occurred in 2001 and 2009 in the lower reaches of the East Fork Bull River (Horn and Tholl 2011). The 2001 project involved rechannelization, revegetation, and installment of large, woody debris in a 1,200-foot reach on the lower East Fork Bull River known as the Stein property reach. In spring 2008, flows returned to the historical south channel. A second restoration project was begun in 2008 in a reach of the East Fork Bull River several hundred feet upstream from the Stein property reach called the East Fork Slide Project. This project included rechannelization, sediment source reduction, and habitat enhancement (Horn and Tholl 2008).

The habitat in the East Fork Bull River was surveyed by MMC in August 2012 to provide addition baseline data for this stream (Kline and Savor 2012). The three reaches surveyed were located near the mouth of the stream, between the Snake Creek and Lost Girl Creek confluences, and upstream of the North Fork East Fork confluence. Average wetted stream widths were similar between the three reaches, while average depths decreased in an upstream direction (Table 70). The RMOs were met for the amount of large, woody debris present within the reach and bank stability, but width/depth ratios were higher than the RMOs (Table 64) for all three reaches, and the number of pools present was lower for all but the most upstream reach (Table 70).

Kline and Savor (2012) also reported the number of large pools per mile in the three reaches, defined as the number of pools with average widths greater than 9.8 feet in width and 3.3 feet in depth at low flow. From downstream to upstream, the three reaches had 12, 6, and 5 of these pools per mile, indicating that such large, deep pools are found more frequently in the East Fork Bull River than in the Rock Creek watershed. The dominant substrate classes observed in the East Fork Bull River are cobble or gravel. The Rosgen classifications indicated that the two downstream reaches were stable, moderately entrenched, and had moderate gradients, while the upstream reach surveyed was steeper and more entrenched.

GIS and aerial imagery data were used to assess some additional habitat parameters in the East Fork Bull River watershed in 2012 (Kline Environmental Research and NewFields 2012). Placer Creek, a tributary to the East Fork Bull River, and two tributaries into St. Paul Lake were evaluated, as well as a reach of East Fork Bull River itself. The tributaries had average slopes ranging from 17 to 35 percent, while the upstream East Fork Bull River reach had an average slope of 12 percent. All tributaries were dominated by cascade habitat, and both rapid and cascade habitat were common in the East Fork Bull River reach. The tributaries had little to no large woody debris, but high amounts were noted in the East Fork Bull River reach, which also had denser canopy cover than the tributaries.

Swamp Creek and Wanless Lake

A habitat survey of three reaches of Swamp Creek (the Lower Clark Fork tributary) was conducted in 1992 through 1994 by Washington Water Power Company (1996). Habitat consisted primarily of runs, cascade, and riffles. Gravel and cobble were abundant in Swamp Creek, and surface fines composed on average 13 percent of the substrate composition. Large woody debris was less abundant in Swamp Creek than in many of the streams surveyed concurrently within the Lower Clark Fork River drainage. Spawning and rearing habitat availability were low, and were estimated to be 0.3 percent and 3.4 percent of the total habitat.

Copper Gulch

Habitat surveys of two reaches of Copper Gulch were conducted in 2000 by Land & Water Consulting, Inc. (2001), as summarized in GEI (2005). This stream was described as high gradient, with substrate dominated by gravel and cobble. Riffle habitat comprised 92 percent or more of all habitat surveyed within both reaches. The downstream reach of Copper Gulch was channelized, with flood control berms constructed, and alteration of the riparian zone was evident. These habitat modifications contributed to the degradation of fish habitat and intermittent flows that occur within this reach of the stream. The quantity of large, woody debris was extremely low in the downstream reach. Further upstream, stream habitat was more complex and stable, with deeper pools present and higher amounts of large, woody debris. Suitable spawning habitat was limited in both reaches.

Flower Creek

No habitat data were available for Flower Creek from MFISH (FWP 2012) or the other sources used. Flower Creek may be included as part of the mitigation plan.

3.6.3.1.2 Barriers to Fish Passage

Over the years, as part of the road system on the KNF, culverts have been installed on streams, some of which have created migration barriers to fish. Barriers have been created on tributaries to the main stems of Libby and West Fisher creeks. The KNF replaced one such barrier in 2007 on Midas Creek where the Libby Creek Road (NFS road #231) crosses the stream. Existing barriers that inhibit fish use of Libby Creek or its tributaries include: a large natural waterfall on Libby Creek; a thermal barrier in the lower several miles of the mainstem of Libby Creek near the mouth with the Kootenai River that occurs seasonally in some years; loss of flow in various reaches (in Libby Creek near the US 2 bridge and the lower segment of the stream near the mouth with the Kootenai River); and double pipe culverts on NFS road #14458 on upper Midas Creek. No permanent known man-made barriers are on the mainstem of Libby Creek. The Vaughn and Greenwall ditch, which was constructed in 1900 to provide a water source for mining activities, possibly provided a passage around the falls in Libby Creek. This ditch is no longer functional and upstream movement is no longer available. Bull trout above the falls are currently isolated from the remainder of the population although downstream movement likely occurs.

In September 2005, a search for barriers to fish passage in the analysis area was conducted (Kline Environmental Research 2005b); a survey to determine the fish passage status of culverts existing in the watershed was conducted in July and August 2005 (Kline *et al.* 2005). The only barrier on Libby Creek documented in these reports was the 39-foot waterfall (Libby Falls) located about 6,200 feet upstream of the Howard Creek confluence near LB-300 (Figure 76). The portion of Libby Creek downstream of NFS road #231 and Libby Creek Falls was not searched for barriers due to FWP's restoration efforts within that reach. No culverts exist on Libby Creek within the analysis area.

Permanent barriers to fish passage were found on Ramsey Creek, Little Cherry Creek, and Poorman Creek that appear to cause portions of these tributaries to be inaccessible to fish from Libby Creek. Little Cherry Creek provides the least amount of habitat for fish from Libby Creek, as a subsurface reach exists during low flow conditions immediately at its confluence with Libby Creek. Even during higher flow conditions, about 950 feet or less of the stream is accessible to fish from Libby Creek due to a series of barriers, the most upstream of which was judged to be impassable to all fish (although small populations of redband trout have been found upstream of those barriers, as discussed below). Additionally, two culverts exist on Little Cherry Creek at the crossing of NFS roads #6212 and #278, upstream of the natural barriers. Poorman Creek has a subsurface reach near its confluence with Libby Creek, but during adequate flow conditions about

2.5 miles of lower Poorman Creek are accessible before a barrier impassable to all fish is encountered. Downstream of this barrier at the crossing of NFS road #278, a culvert that acts as a secondary barrier to juvenile trout at all flows and to adult trout at high flows also exists. Ramsey Creek is accessible to Libby Creek for about 2.7 miles before a barrier to most fish occurs, followed by a barrier to all fish about 1.5 miles upstream of that barrier. No culverts exist on Ramsey Creek (Kline Environmental Research 2005a; Kline Environmental Research *et al.* 2005).

A natural fish barrier is present on East Fork Rock Creek 3 miles upstream from the confluence with West Fork Rock Creek. This barrier is located downstream of Rock Creek Meadows and at the outlet of Rock Lake and does not prevent downstream fish passage. A waterfall is also present on West Fork Rock Creek 2 miles upstream of the confluence with East Fork Rock Creek that would be impassable to fish moving upstream. In addition, the culverts associated with MT 200 on the mainstem and NFS road #150 on West Fork Rock Creek may be barriers to fish movement during low flow (Salmon Environmental Services 2012). West Fork Rock Creek has intermittent flow present within the reach upstream of the waterfall and also the reach near the confluence.

GEI (2005) estimated that about 28 percent of Rock Creek is intermittent (GEI 2005), which likely acts as a barrier to migrating bull trout seasonally. The summary of the flow regime in the Rock Creek watershed provided by Salmon Environmental Services (2012) stated that the mainstem flows intermittently during low flow for all but short reaches. Flow is maintained in these short reaches by groundwater and input from Engle Creek and Orr Creek.

A natural barrier is present over 1 mile upstream of the CMW boundary on the East Fork Bull River (USDA Forest Service and DEQ 2001; Washington Water Power Company 1996; Kline and Savor 2012). The barrier was not assessed to determine if they are barriers to all fish or if they are navigable to some fish under some flow conditions, although fish have been documented to be present upstream of this barrier (FWP 2012). This barrier is located downstream of the Isabella Creek confluence.

The mainstem of West Fisher Creek has no known permanent natural or man-made barriers. A partial barrier exists at the confluence of West Fisher Creek and the Fisher River. This barrier occurs because of the high amount of bedload that is transported down West Fisher Creek. In low water years, the stream has multiple shallow channels through which large migratory fish cannot pass. Miller Creek in the lower reaches near the confluence with the Fisher River is dry most of the year. Streamflow goes subsurface for nearly 0.5 mile in the drainage for most of the year. The stream connects with the Fisher River only during spring high flows, or during rain or snow events.

3.6.3.2 Water Quality Characteristics

Overall surface water quality in streams and lakes within the analysis area is excellent. Total suspended solids, total dissolved solids, major ions, and nutrient concentrations are generally low in analysis area streams, and are frequently at or below detection limits. The low concentrations of nutrients and minerals within the analysis area limit the productivity potential for aquatic life. Lakes located in or near the CMW are quite dilute.

Because of very low alkalinities, analysis area streams are poorly buffered. Consequently, surface waters tend to be slightly acidic, with most pH values slightly below 7.0. This acidity has two likely natural sources – organic acids originating from surrounding coniferous forests and dissolved carbon dioxide (CO_2) in surface water and groundwater draining into the area streams. Median water hardness in all sampled streams within the Libby Creek drainage was less than 30 mg/L as calcium carbonate ($CaCO_3$), with several sampling locations with median hardness values under 10 mg/L $CaCO_3$ (Appendix K). Water quality for the streams and lakes in the analysis area are discussed in section 3.13, *Water Quality.*

3.6.3.3 Aquatic Plants and Periphyton

The results of the 1988 and 1989 monitoring show that sparse growths of green algae (Chlorophyta), blue-green algae (Cyanophyta), and diatoms (Bacillariophyta) occur throughout the Libby Creek watershed within the analysis area. In general, the algal taxa found were typical of unpolluted, soft water streams in Montana. The low population densities are common in high-elevation streams and reflect the low nutrient content in the Libby Creek drainage waters. Of the green and blue-green algae taxa found within the analysis area, *Zygnema* and *Oscillatoria* were the most abundant and widespread genera (Western Resource Development Corp. 1989a).

Diatoms were present in all periphyton samples, but were collected at relatively low abundances at most reaches (Western Resource Development Corp. 1989a). Taxa richness also was low in these samples, ranging from 5 taxa to 27 taxa collected over the three sampling events in 1988 and 1989. The most abundant diatom taxon at most stations on most sampling dates was *Achnanthes minutissima* (Western Resource Development Corp. 1989a), which is often the first species to establish itself at a site disturbed by physical abrasion, and is common in mountain streams (Teply and Bahls 2005). When present in the samples, *A. minutissima* composed from 3 to 99 percent of the diatom community in these stream reaches. Relative abundances up to 25 percent of the diatom population indicate a normal level of disturbance, while relative abundances from 25 to 50 percent indicate minor disturbance (Teply and Bahls 2005). Relative abundances greater than 50 percent indicate moderate to high levels of disturbance.

Periphyton sampling continued from 1991 through 1994. Analysis of the samples collected in 1991 and 1992 from Little Cherry Creek showed a relatively high diversity of algae taxa, possibly as a result of nutrient enrichment. Poorman and Ramsey creeks had lower algal diversity, signifying low nutrient concentrations (Western Technology and Engineering, Inc. 1992, 1993). Periphyton samples were only collected from Libby Creek sites from 1993 to 1994. Based on diatom association indices (Western Technology Engineering, Inc. 1994, 1995), biological integrity upstream and at the nearest station downstream of the mining activities was good to excellent, and aquatic life was not impaired. The periphyton community did show some effects attributed to the elevated nitrogen concentrations in October 1991 at the site immediately downstream of the Libby Adit. Periphyton communities at this site were strongly dominated by *Ulothrix*, a green algae species that responds favorably to elevated nutrient concentrations. This site also had the highest diatom species richness and diversity values for that year. Biological integrity ratings were not adversely affected in later years (Western Technology Engineering, Inc. 1994, 1995) as the periphyton community was not as strongly dominated by one green algae species in later sampling.

Periphyton sampling was again conducted at three to five sites on Libby Creek during eight sampling events from 2006 to 2008, and at one site each on Bear Creek, Little Cherry Creek, Poorman Creek, and Ramsey Creek during five sampling events from 2007 to 2008 (Kline Environmental Research 2008, 2009). Sampling continued on two reaches of Libby Creek through 2011 (Kline Environmental Research and NewFields 2012). Presence-absence data were generated from the analysis of these samples. Diatoms were present at every site and sampling event, with diatom richness ranging from 16 to 54 taxa. Green and blue-green algae were common, while red algae (Rhodophyta) and yellow-green algae (Xanthophyta) were collected infrequently from sites on Libby Creek, Bear Creek, and Little Cherry Creek. Common taxa included the cyanobacteria genus *Phormidium* and the green algae genera *Zygnema* and *Ulothrix*.

The periphyton assemblages were sampled in May and September 2011 from 12 sites located on headwater drainages within the disturbance area boundary of the Poorman Impoundment Site (Kline Environmental Research 2012). The number of diatom taxa present at these sites ranged from 16 to 53 taxa, while the number of other algal taxa ranged from one to seven taxa. Algal cover was sparse in most of these reaches.

Periphyton samples were collected from nine sites in the Rock Creek drainage in 1985, with species composition described as typical of clean, soft waters in the Rock Creek Project Final EIS (USDA Forest Service and DEQ 2001). Diatoms and green, blue-green, and red algae were present. Periphyton accumulation was also monitored in Rock Creek, East Fork Rock Creek, West Fork Rock Creek, and the East Fork Bull River in 1993 (Washington Water Power Company 1996; USDA Forest Service and DEQ 2001). When compared to other tributaries in the lower Clark Fork River, net productivity and chlorophyll content was relatively high in Rock Creek and East Fork Rock Creek, while the chlorophyll content of the samples was relatively low in West Fork Rock Creek and the East Fork Bull River. In August 2012, algal samples were collected from sites on two tributaries to St. Paul Lake in the East Fork Bull River watershed and from a reach of East Fork Rock Creek upstream of Rock Lake (Kline Environmental Research and NewFields 2012). The number of diatom taxa ranged from 19 to 25 at these sites, with from 2 to 8 other algal taxa present. Golden algae (Chrysophyta), green algae, and blue-green algae were present at these sites, in addition to diatoms.

Aquatic plants and mosses also were documented during the 1988 periphyton surveys. Aquatic macrophytes occurred only incidentally within the analysis area, and included sparse numbers of water buttercup (*Ranunculus*) in spring seeps in the Libby Creek floodplain and in Rock Creek Meadows, as well as sedges (*Carex*) in Rock Creek meadows. Byrophytes (mosses) were the predominant vegetation found along many stream reaches. They were particularly abundant in the upstream portions of each stream, but were present wherever stable substrates and dense forest canopies occur. They occurred only sporadically in Libby Creek’s middle reaches, if at all (Western Resource Development Corp. 1989a).

Bryophytes were also collected from the four headwater drainages between Poorman Creek and Little Cherry Creek in 2011, and from two tributaries to St. Paul Lake and one reach of the East Fork Rock Creek upstream of Rock Lake in August 2012 (Kline Environmental Research 2011; Kline Environmental Research and NewFields 2012). The multiple sites sampled within the headwater drainages had up to four bryophyte taxa present at each site, but no bryophytes were collected at one site. *Brachythecium velutinum* was the most common bryophyte collected. Each sample from the tributaries of the East Fork Bull River above St. Paul Lake and East Fork Rock Creek consisted of one bryophyte taxa, including *Amblystegium serpens* var. *juratzkanum* and an unidentified liverwort taxon from the tributaries above St. Paul Lake, and *Scouleria aquatica* from the East Fork Rock Creek site.

3.6.3.4 Aquatic Macroinvertebrates

Stream macroinvertebrates were collected from over 30 locations in analysis area streams between 1986 and 2012 (Western Resource Development Corp. 1989a; USDA Forest Service and DEQ 2001; Western Technology and Engineering 1991, 1992, 1993, and 1994; Western Technology and Engineering and Phycologic 1995; Hoffman *et al.* 2002; Dunnigan *et al.* 2004; USDA Forest Service 2006b, Geomatrix 2006d, Kline Environmental Research 2008, 2009, 2012; Kline Environmental Research and NewFields 2012). Data are summarized in Appendix F.

During the initial baseline study (Western Resource Development Corp. 1989a), mean macroinvertebrate densities and total taxa richness were highly variable (Appendix F). Taxa richness refers to the number of species collected at each site for each sampling event. True flies (dipterans) were the most diverse group taxonomically, and had the highest relative abundance at some sites. Other insect groups with high diversity and relative abundances at all sites were mayflies (Ephemeroptera) and stoneflies (Plecoptera). Metal-intolerant macroinvertebrates, such as heptageniid mayflies, were consistently present at sites in each stream. Most of the macroinvertebrates collected are considered intolerant of fine sediments, metals, and organic pollution (Western Resource Development Corp. 1989a).

Calculated indices characterizing macroinvertebrate communities during the initial baseline period indicated diverse macroinvertebrate communities and high water quality exist in analysis area streams. Differences in community characteristics among the stations were generally slight, and were probably due to differences in stream order, microhabitat conditions, and variable sampling efficiencies.

Macroinvertebrate sampling continued from 1990 through 1994 at selected sites. Both higher and lower values for most of the calculated metrics were observed during this period as compared to the baseline monitoring period data. No consistent spatial, temporal, or seasonal trends were apparent (Appendix F).

Macroinvertebrate data have also been collected from several reaches within analysis area streams. These studies included sampling reaches of the Rock Creek drainage in some years from 1985 through 2005, and sampling reaches of Libby Creek, Bear Creek, Little Cherry Creek, Poorman Creek, Ramsey Creek, West Fisher Creek, and the Fisher River from 1998 through 2004 (USDA Forest Service and DEQ 2001; Hoffman *et al*. 2002; Dunnigan *et al.* 2004; USDA Forest Service 2006b; Geomatrix 2006d). The data are presented in Appendix F.

More recent data for the analysis area are presented in Table 71. Taxa richness has generally been high in recent sampling, with the exception of East Fork Rock Creek in 2005 and 2012, Fisher River in 2002 and 2003, the most downstream Libby Creek site in 2002, the two upstream Libby Creek sites in spring 2007, and the two tributary sites above St. Paul Lake in 2012. Ephemeroptera, Plecoptera, and Trichoptera (EPT) taxa can be used as an indicator of water quality, as they are considered sensitive to a wide range of pollutants (Plafkin *et al.* 1989; Wiederholm 1989; Klemm *et al.* 1990; Lenat and Penrose 1996; Wallace *et al.* 1996; Barbour *et al.* 1999; Lydy *et al.* 2000). The EPT index is a ratio of the number of EPT taxa collected compared to the number of total taxa collected. Values for these metrics typically increase with better water quality. The sensitive EPT taxa composed a substantial proportion of the macroinvertebrate community in all reaches sampled, making up 50 percent or more of the total number of taxa in all of the recent sampling events except for the 2005 events on East Fork Rock

Creek and one of the sampling events at the downstream Libby Creek site and Bear Creek in 2006 and 2008, respectively (Table 71).

Of the metrics calculated, percent EPT abundance is one of the most informative because it is less sensitive to differences in sampling and identification methods than most of the other metrics calculated. This metric reflects proportional abundances rather than actual numbers of invertebrates collected. A high abundance of EPT organisms indicates good water quality, as these taxa are generally intolerant of pollutants, low oxygen, high sediment loads, and high temperatures. Percent EPTs were generally high at most sites during most sampling events, and few trends between sites, years or seasons were identified (Appendix F).

Evenness ranges from 0 to 1, and is a measure of how well each species is represented within the invertebrate community. The Shannon-Weaver diversity index is recommended by the EPA as a measure of the effects of stress on invertebrate communities (Klemm *et al.* 1990). Shannon-Weaver index values greater than 2.50 are generally indicative of a healthy invertebrate community (Wilhm 1970). Most Shannon-Weaver diversity and evenness values indicated that healthy, well-balanced macroinvertebrate communities exist in the analysis area streams. The lowest diversity values were recorded in East Fork Rock Creek in 2005, with values ranging from 0.69 to 1.53.

Average Montana Multimetric Index scores were calculated for the samples collected in 2006 through 2008 by Kline Environmental Research (2008, 2009). Values for this index ranged from 57 to 81. Index scores greater than 63 indicate that the stream is not impaired. Only the downstream Libby Creek site near the Crazyman creek confluence scored below this threshold during two of the seven sampling events.

These general findings indicate that the macroinvertebrate communities within the analysis area are variable temporally, spatially, and seasonally, and are likely influenced by factors other than water quality. The flow regime may be a major factor affecting macroinvertebrate abundances, with repeated high flow events resetting densities at low levels. The natural flow regime is dictated by drainage basin characteristics and precipitation events.

Macroinvertebrate assemblages were also sampled at twelve sites within four headwater drainages located in the disturbance area boundary of the proposed Poorman tailings facility planned for use with Alternative 3 in May and September 2011 (Kline Environmental Research 2012). These drainages do not have perennial flow throughout their length, and the composition of their macroinvertebrate communities is expected to reflect the flow conditions present. Lower metric values generally occurred at those sites that had water present during the May sampling event, but were dry in September. The number of taxa present at these sites ranged from one taxa to 27 taxa, with no EPT taxa present at two to three sites during each sampling event. EPT taxa comprised up to 65 percent of the abundance at the other sites. Macroinvertebrate density varied widely within and between the drainages.

Table 71. Characteristics of Macroinvertebrate Populations during 2000-2008.

Stream	Sampling Date	Taxa Richness	EPT Taxa Richness	EPT Index	Shannon-Weaver Diversity Index	Evenness	Data Source
Libby Creek Headwaters Reach	Aug-06	33	18	55	3.78	NC	Kline Environmental Research 2008, 2009
	Oct-06	22	11	50	3.05	NC	
	Apr-07	13	10	77	3.38	NC	
	Aug-07	24	14	58	3.38	NC	
	Oct-07	25	16	64	2.90	NC	
	Apr-08	32	19	59	3.66	NC	
	Aug-08	26	NC	NC	NC	NC	
	Oct-08	34	NC	NC	NC	NC	
Libby Creek Reach Immediately Upstream of Falls	Sep-00	24	16	67	2.26	0.5633	USDA Forest Service 2006b
	Aug-01	39	28	72	2.55	0.4860	
	Aug-03	41	28	68	2.47	0.5340	
	Jul-04	30	24	80	2.47	0.5910	
	Aug-06	23	16	70	3.34	NC	Kline Environmental Research 2008, 2009
	Oct-06	31	17	55	3.36	NC	
	Apr-07	12	9	75	2.79	NC	
	Aug-07	32	18	56	4.09	NC	
	Oct-07	32	20	63	3.27	NC	
	Apr-08	30	17	57	3.68	NC	
	Aug-08	24	NC	NC	NC	NC	
	Oct-08	26	NC	NC	NC	NC	
Libby Creek Reach Near Midas Creek Confluence	Sep-00	33	25	76	NC	NC	Dunnigan *et al.* 2004; Hoffman *et al.* 2002
	Aug-03	35	28	80	NC	NC	
	Aug-07	23	16	70	2.96	NC	Kline Environmental Research 2008, 2009
	Oct-07	23	16	70	2.69	NC	
	Apr-08	28	14	50	3.35	NC	
	Aug-08	32	NC	NC	NC	NC	
	Oct-08	37	NC	NC	NC	NC	

Stream	Sampling Date	Taxa Richness	EPT Taxa Richness	EPT Index	Shannon-Weaver Diversity Index	Evenness	Data Source
Libby Creek Reach Near Bear Creek confluence	Jul-04	21	18	86	2.63	0.7720	USDA Forest Service 2006b
	Aug-07	25	13	52	3.02	NC	Kline Environmental Research 2008, 2009
	Oct-07	26	15	58	2.60	NC	
	Apr-08	35	18	51	4.05	NC	
	Aug-08	27	NC	NC	NC	NC	
	Oct-08	33	NC	NC	NC	NC	
Libby Creek Reach Near Crazyman Creek Confluence	Oct-00	29	22	76	2.25	0.5537	USDA Forest Service 2006b
	Aug-01	43	28	65	2.59	0.5370	
	Aug-02	13	11	85	2.25	0.8820	
	Aug-03	34	24	71	3.09	0.7850	
	Jul-04	42	27	64	1.75	0.2790	
	Aug-06	25	11	44	3.35	NC	Kline Environmental Research 2008, 2009
	Oct-06	29	17	59	3.20	NC	
	Apr-07	20	12	60	3.07	NC	
	Aug-07	37	19	51	3.16	NC	
	Oct-07	25	14	56	3.23	NC	
	Apr-08	32	16	50	3.40	NC	
	Aug-08	32	NC	NC	NC	NC	
	Oct-08	30	NC	NC	NC	NC	
Ramsey Creek	Aug-07	22	16	73	3.70	NC	Kline Environmental Research 2008, 2009
	Oct-07	35	21	60	3.69	NC	
	Apr-08	32	16	50	3.94	NC	
	Aug-08	34	NC	NC	NC	NC	
	Oct-08	34	NC	NC	NC	NC	
Poorman Creek	Aug-07	32	19	59	3.85	NC	Kline Environmental Research 2008, 2009
	Oct-07	32	21	66	3.80	NC	
	Apr-08	43	23	53	4.22	NC	
	Aug-08	29	NC	NC	NC	NC	
	Oct-08	34	NC	NC	NC	NC	

Stream	Sampling Date	Taxa Richness	EPT Taxa Richness	EPT Index	Shannon-Weaver Diversity Index	Evenness	Data Source
Little Cherry Creek	Aug-07	26	13	50	3.86	NC	Kline Environmental Research 2008, 2009
	Oct-07	38	19	50	4.11	NC	
	Apr-08	33	18	55	3.96	NC	
	Aug-08	36	NC	NC	NC	NC	
	Oct-08	43	NC	NC	NC	NC	
Bear Creek	Aug-00	32	24	75	2.75	0.6500	USDA Forest Service 2006b
	Aug-01	33	23	70	2.66	0.5710	
	Aug-03	39	29	74	3.01	0.7150	
	Jul-04	28	22	79	2.54	0.6440	
	Aug-07	22	17	77	3.15	NC	Kline Environmental Research 2008, 2009
	Oct-07	29	17	59	3.75	NC	
	Apr-08	43	20	47	4.11	NC	
	Aug-08	34	NC	NC	NC	NC	
	Oct-08	38	NC	NC	NC	NC	
Fisher River at US 2	Aug-01	34	19	56	2.62	0.5910	USDA Forest Service 2006b
	Jul-02	10	7	70	2.02	NC	
	Aug-03	16	9	56	2.10	0.5920	
	Jul-04	37	25	68	1.92	0.4530	
West Fisher Creek	Oct-00	28	17	61	2.26	0.5547	USDA Forest Service 2006b
	Aug-01	39	26	67	2.83	0.5960	
	Jul-02	29	19	66	2.64	0.6210	
	Aug-03	39	23	59	2.79	0.6540	
	Jul-04	27	20	74	2.51	0.5970	
East Fork Rock Creek	Sep-05	9	4	44	1.53	0.4819	Geomatrix 2006d
	Sep-05	7	2	29	1.08	0.3831	
	Sep-05	11	4	36	0.69	0.1986	
	Aug-12	8	7	88	2.75	0.1360	Kline Environmental Research and NewFields 2012
St. Paul Lake Tributaries	Aug-12	1	0	0	NC	NC	Kline Environmental Research and NewFields 2012
	Aug-12	2	1	50	NC	NC	

EPT = Ephemeroptera, Plecoptera, and Trichoptera; NC = not counted

3.6.3.5 Fisheries

3.6.3.5.1 Libby Creek Drainage Fish Populations

Electrofishing studies were conducted at 12 sites located on Libby Creek, Poorman Creek, Ramsey Creek, Little Cherry Creek, and East Fork Rock Creek in August and September 1988 (Figure 52 and Table 72). Native salmonid fish species collected within the Libby Creek drainage in 1988 were redband trout and bull trout (Table 72). While no effort was made to collect sculpins (*Cottus* sp.), they were noted as common at some sites. Both torrent sculpin and slimy sculpin inhabit the Libby Creek drainage. Torrent sculpin is a Montana species of concern. Redband trout was the dominant trout species in all analysis area streams in the Libby Creek watershed, ranging from 65 percent of the trout collected in Ramsey Creek to 100 percent of the trout collected in Little Cherry Creek. Bull trout were collected from all analysis area streams except for Little Cherry Creek. Trout densities in all streams within the Libby Creek drainage were low (Table 72), with all streams except for Little Cherry Creek having no more than 8 trout per 100 square meters (1076 square feet).

No trout were collected at the most upstream sites on Libby Creek (L11) or Ramsey Creek (Ra4). Site Ra4 was located above a barrier to all fish. Site L11 also may be located upstream of a barrier to fish passage, but barrier surveys did not extend that far upstream (Kline Environmental Research 2005b). Site L11 is the only site within the CMW in the Libby Creek drainage. Trout scales were analyzed for age and growth during the 1988 baseline survey. Most trout within the analysis area were young (age I, II, and III), as is typical for low productivity mountain headwater streams. Older (age IV) redband trout were found only in Ramsey Creek, while older bull trout (age IV or V) were found at sites on Ramsey and Libby creeks. Growth rates for all age classes were low, likely due to limitations caused by the low nutrient concentrations.

Using external characteristics to differentiate between pure interior redband trout and redband/rainbow, redband/cutthroat trout, and rainbow/cutthroat trout hybrids in the field is not reliable. Because no genetic analyses were performed at the time of the 1988 study, some uncertainty exists as to whether the redband trout collected during this study were pure redband trout or hybrids. Based on the results of genetic analyses conducted after the initial baseline study and described below, hybridization of redband trout with stocked rainbow trout and westslope cutthroat trout does occur in the analysis area streams.

To provide additional baseline data on fish populations in the analysis area, day and night snorkeling surveys were also conducted at ten sites located on Little Cherry Creek, Libby Creek, Poorman Creek, and Ramsey Creek in July and August 2005 (Table 73) (Kline Environmental Research and Watershed Consulting 2005a). Overall, the distribution of fish within the analysis area in 2005 was similar to those reported in the 1988 baseline surveys. Based on the difficulty in accurately differentiating between redband trout, rainbow trout, and their hybrids, these fish were recorded only as *Oncorhynchus* sp. during these surveys. While the brook trout and bull trout surveyed had external characteristics consistent with one or the other species, hybrids between these two species also occur within the analysis area and evidence of hybridization is not always readily apparent. Additionally, both torrent and slimy sculpin are found in analysis area streams. Sculpin were not identified at the species level. Consistent with the 1988 results, the dominant fish species at all sites where fish were observed in 2005 was *Oncorhynchus* sp.

Abundance and number of fish species were greatest in Libby Creek during the 2005 surveys (Table 73). Brook trout, a non-native species, were first collected in Libby Creek within the analysis area in 2004 (Kline Environmental Research 2004). During the 2005 survey, brook trout outnumbered bull trout by a nearly 8 to 1 ratio at the Libby Creek sites. Longnose dace and large-scale suckers were only seen at the most downstream Libby Creek site during the nighttime snorkeling surveys. Sculpin were most abundant at this site, and also were seen in higher numbers during the night surveys (Kline Environmental Research and Watershed Consulting 2005a).

The only fish observed in Little Cherry Creek in the 2005 study were *Oncorhynchus* sp. (Table 73), consistent with the 1988 survey. *Oncorhynchus* sp. was also the only trout species observed in Poorman Creek in the 2005 study, although bull trout were documented in the 1988 surveys. No fish were seen upstream of the first permanent fish barrier in Poorman Creek (Kline Environmental Research and Watershed Consulting 2005a; Kline Environmental Research 2005b). Both bull trout and *Oncorhynchus* sp. were observed in Ramsey Creek. Bull trout were not seen at the upper Ramsey Creek site as was reported in the 1988 baseline survey. No fish were observed in Ramsey Creek upstream of the first permanent barrier to all fish (Kline Environmental Research and Watershed Consulting 2005a; Kline Environmental Research 2005b). Data from the surveys conducted in 1988 and 2005 were combined with data from the MFISH database (FWP 2012) and other sources to provide a more detailed summary of the fish populations within the analysis area streams. A list of the fish species that occur in each stream, as well as any available data on densities or abundances of these species, are included in these summaries. Additionally, if results of any genetic analyses were available, these data are also discussed.

Libby Creek Fish Populations and Genetics

Based on the results of the previously discussed surveys and the MFISH database (FWP 2012), the following fish species occur in the segment of Libby Creek within the analysis area: rainbow trout, interior redband trout, westslope cutthroat trout, bull trout, brook trout (*Salvelinus fontinalis*), slimy sculpin (*Cottus cognatus*), mountain whitefish (*Prosopium williamsoni*), longnose dace (*Rhinichthys cataractae*), largescale suckers (*Catostomus macrocheilus*), and various salmonid hybrids noted above. Results of the specific surveys documented in either the MFISH database (FWP 2012), Kline Environmental Research (2004), or Dunnigan *et al.* (2004, 2005) only record rainbow trout (presumably referring to redband trout, rainbow trout, and their hybrids), brook trout, bull trout, mountain whitefish, longnose dace, and sculpin as having been collected from the segment of Libby Creek within the analysis area downstream of Libby Falls, and only bull trout as having been collected from the segment of Libby Creek upstream of the falls. Occasionally, amphibians were also collected during the fish population surveys; species included the Rocky Mountain tailed frog (*Ascaphus montanus*) and the Columbia spotted frog (*Rana luteiventris*).

Table 72. Redband, Bull, and Westslope Cutthroat Trout Population Characteristics in 1988.

Site/ Stream	Redband Trout			Bull Trout			Westslope Cutthroat Trout		
	Density (fish/100 m^2)	Average Length (cm)	Average Weight (grams)	Density (fish/100 m^2)	Average Length (cm)	Average Weight (grams)	Density (fish/100 m^2)	Average Length (cm)	Average Weight (grams)
Libby Creek									
L2	3	12.4	22.7	<1	12.2	9.1	0	—	—
L8b	0	—	—	2	18.0	59.0	0	—	—
L10	0	—	—	2	19.3	68.0	0	—	—
L11	0	—	—	0	—	—	0	—	—
Little Cherry Creek									
LC1	18	9.1	9.1	0	—	—	0	—	—
LC2	16	9.7	13.6	0	—	—	0	—	—
Poorman Creek									
Po0	8	11.9	22.7	<1	16.8	49.9	0	—	—
Po1a	8	11.7	22.7	0	—	—	0	—	—
Ramsey Creek									
Ra2a	3	12.4	27.2	2	13.7	40.8	0	—	—
Ra3	2	15.7	45.4	1	20.1	77.1	0	—	—
Ra4	0	—	—	0	—	—	0	—	—
East Fork Rock Creek									
East Fork Rock Creek	0	—	—	4	16.0	40.8	10	14.2	36.3
Rock Creek Meadows	0	—	—	0	—	—	ND[†]	22.4	122.5
Rock Lake	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND = Not determined; see section 3.6.3.5.5, *Analysis Area Lakes*, (p. 381) for discussion of available Rock Lake data. Methods used in Rock Creek Meadows did not allow for density determinations.

[†]Westslope cutthroat trout collected at Rock Creek Meadows site are thought to be hybridized with Yellowstone cutthroat trout and rainbow trout.

Source: Western Resource Development Corp. 1989a.

Table 73. Total Fish Counts per 1,000-foot (305 meters) Stream Reach During Day and Night Snorkeling Surveys in 2005.

Site	Time	Fish Species						Young of Year Fish
		Oncorhynchus sp.	Brook Trout	Bull Trout	Sculpin	Longnose Dace	Largescale Sucker	
Libby Creek								
L1	Day	53	12	0	0	0	0	49
	Night	102	8	1	10	35	5	4
L2	Day	53	0	1	1	0	0	14
	Night	96	0	0	1	0	0	13
L3	Day	114	7	0	1	0	0	18
	Night	94	4	2	0	0	0	1
Little Cherry Creek								
LC1	Day	11	0	0	0	0	0	15
	Night	11	0	0	0	0	0	17
LC2	Day	5	0	0	0	0	0	1
	Night	35	0	0	0	0	0	0
LC3	Day	0	0	0	0	0	0	0
	Night	0	0	0	0	0	0	0
Poorman Creek								
Po1	Day	62	0	0	1	0	0	11
	Night	72	0	0	2	0	0	1
Po2	Day	0	0	0	0	0	0	0
	Night	0	0	0	0	0	0	0
Ramsey Creek								
Ra2	Day	28	0	1	0	0	0	1
	Night	24	0	2	0	0	0	0
Ra3	Day	27	0	0	0	0	0	0
	Night	35	0	0	0	0	0	0
Ra4	Day	0	0	0	0	0	0	0
	Night	0	0	0	0	0	0	0

Source: Kline Environmental Research and Watershed Consulting 2005a.

Surveys conducted from 1988 through 2011 show variable trout densities between years and survey sites, ranging from no trout collected during surveys of some reaches to up to 12 to 133 trout/100 meters (328 feet) within a reach (Kline Environmental Research 2004, 2008; Dunnigan *et al.* 2005, 2007, 2011; FWP 2012). Redband trout and/or their hybrids were the dominant trout species at almost all sites downstream of the falls during years sampled. Bull trout were generally collected in low numbers in most reaches downstream of the falls, but were present in surveys conducted near the Libby Placer Mining Company property between the Howard Creek and Midas Creek confluences from 2005 through 2009 (Dunnigan *et al*. 2011; FWP 2012). These data are consistent with the results of the 1988 baseline surveys. Only bull trout were collected during surveys conducted by the FWP from the reach of Libby Creek near Libby Falls from 2005 through 2010. Density estimates were included in some of these surveys, while the number of fish collected was included in others. Bull trout densities reached up to 5.2 bull trout per 100 square meters of stream. Brook trout were first collected in Libby Creek within the analysis area in 2004, but were collected more frequently from Libby Creek sites downstream of the analysis area in earlier years (Kline Environmental Research 2004; Dunnigan *et al.* 2005). One or more brook trout were collected from Libby Creek in multiple surveys conducted within the reach near the Libby Placer Mining Company property from 2005 through 2009 (Dunnigan *et al*. 2011; FWP 2012).

Genetic analyses were performed on rainbow trout tissues collected from sites in Libby Creek within the analysis area in 1991, 1992, 2000, and 2006. The analyses conducted in 1991 and 2000 from Libby Creek between the confluence of Howard Creek and Ramsey Creek (FWP 2012) showed that all fish collected were rainbow trout. Clarification as to the sub-species of rainbow trout was not found for the 1991 analysis in the MFISH database. A memo from Robb Leary (2003) of the University of Montana to Mike Hensler of the FWP stated that the 2000 analyses were characteristic of a pure redband trout population. These results suggest that the 1991 analysis results likely also referred to redband trout. Non-native rainbow trout have been stocked in Howard Lake, potentially allowing these trout to access Libby Creek through Howard Creek.

Trout also were collected for genetic analysis in 1992 from a more downstream segment of Libby Creek between the confluences of Ramsey and Poorman creeks. These trout were shown to be redband trout/rainbow trout hybrids (52.3 percent redband, 45.7 percent rainbow). The trout collected for the 2006 genetic analyses were from a reach of Libby Creek upstream of the Little Cherry Creek confluence. Results indicated that these trout were rainbow trout/westslope cutthroat trout hybrids (98.9 percent rainbow, 1.1 percent westslope cutthroat trout), instead of the redband trout/rainbow trout hybrids that were collected farther upstream in 1992. The subspecies of rainbow trout was not specified in the 2006 analyses (FWP 2012).

Ramsey Creek Fish Populations and Genetics

In addition to the survey conducted in 2005, fish distribution surveys on three reaches of Ramsey Creek were conducted between 1976 and 1988, with bull trout and redband trout collected at total densities ranging from 4 to 26 trout/100 meters (Kline Environmental Research 2004; FWP 2012). Genetic analysis performed on six trout collected from Ramsey Creek in 1991 (FWP 2012) indicated that the rainbow trout population was hybridized with westslope cutthroat trout (98.7 percent rainbow trout, 1.3 percent westslope cutthroat trout). Based on the historical distribution of redband trout throughout this area and the results of subsequent genetic analyses, these hybrids are likely redband trout hybridized with westslope cutthroat trout rather than rainbow trout hybrids. An additional 25 fish were analyzed in 2000. Analysis revealed that 24 of those trout were pure redband trout, and one trout was a redband/westslope cutthroat hybrid. Based on the results of this analysis, the memo from Robb Leary to Mike Hensler (2003) stated that the population could be considered to be redband trout from a management perspective.

Poorman Creek Fish Populations and Genetics

Poorman Creek has been sampled five times between 1982 and 2012, with total trout densities at sites ranging from 5 trout/100 meters to 36 trout/100 meters (Kline Environmental Research 2004; FWP 2012, Kline and Savor 2012). Rainbow trout (no sub-species listed), redband trout, and slimy sculpin are listed as occurring commonly in the creek, with bull trout occurring rarely (FWP 2012). The most recent sampling event was conducted by MMC personnel in August 2012 at two sites located immediately upstream and downstream of the culvert for Forest Service Road

278, which is a mile upstream of the mouth of Poorman Creek (Kline and Savor 2012). Twenty-seven and fourteen rainbow trout (no sub-species listed) were collected from upstream and downstream of the culvert, respectively, with one rainbow trout/cutthroat trout hybrid collected at each site. These numbers indicate that 23 and 21 trout/100 meters of stream were present at that time, respectively, based on the reach lengths surveyed. No bull trout have been collected in surveys of Poorman Creek since a single one was collected 1994 near the confluence with Libby Creek (FWP 2012). Bull trout were also collected at low abundances in 1982 and 1988.

Genetic analyses were conducted on tissues from five trout in 1991 and 25 trout in 2000, and indicated that the trout population in Poorman Creek consists of pure rainbow trout, but does not specify the subspecies of rainbow trout (FWP 2012). The memo from Robb Leary (2003) to Mike Hensler states that the allele frequencies detected during the genetic analyses are actually characteristic of redband trout, not rainbows. The memo also states that while the population should conservatively be considered non-hybridized, the possibility of the population being slightly hybridized with westslope cutthroat trout cannot be ruled out without further data.

Little Cherry Creek Fish Populations and Genetics

The MFISH database (2008a) lists interior redband trout, bull trout, westslope cutthroat trout/rainbow trout hybrids, and redband/rainbow trout hybrids as occurring in Little Cherry Creek. Field data for all surveys summarized in the MFISH database and by Kline Environmental Research (2004) document only the collection of redband or rainbow trout, with no specific data pertaining to the collection of bull trout or any other species. Only one additional survey is documented in MFISH other than the results of the initial baseline study. This survey was conducted from a section of Little Cherry Creek about 1 mile upstream from its confluence with Libby Creek and documents 24 redband trout collected from an unknown length of the stream.

Genetic analyses were performed on trout collected in 1991, 1992, and 2005 from Little Cherry Creek. The earlier results of the genetic analysis conducted on the 25 trout collected in 1991 and the five trout collected in 1992 determined that these trout were redband/westslope cutthroat trout hybrids (1991 analysis) and redband/rainbow trout hybrids (1992 analysis) (Kline Environmental Research 2004; FWP 2012). A recent genetic analysis conducted on 30 trout collected in 2005 from Little Cherry Creek determined that the trout population was composed of non-hybridized pure redband trout (Leary 2006). The 2005 results prompted the re-examination of the 1991 and 1992 results. Re-analysis of the 1991 results determined that what was initially taken to be a small amount of hybridization with westslope cutthroat trout was more likely to be redband trout genetic variation that was indistinguishable from that usually characteristic of westslope cutthroat trout due to the small sample size. The 1992 results also were determined to have erroneously reported that the trout population was hybridized with rainbow trout due to the limited genetic sampling that had occurred throughout the drainage. More recent genetic sampling in the area resulted in those analyses being re-interpreted so as to confirm the presence of a non-hybridized redband trout population in Little Cherry Creek (Leary 2006).

Bear Creek and Cable Creek Fish Populations and Genetics

Bear Creek is north of the Little Cherry Creek Tailings Impoundment Site, and was not surveyed in 1988 but has been surveyed frequently since then. Based on the MFISH database, brook trout, bull trout, redband trout, rainbow trout, and westslope cutthroat trout have been observed in Bear Creek. During most sampling events in Bear Creek that occurred from 1982 through 1995, rainbow (presumably redband and redband hybrid) trout have been the dominant species, ranging from 46 to 100 percent of the trout observed. Bull trout have been observed during almost every sampling event, both in the upstream and downstream portions of the creek, and have ranged from 3 to 100 percent of all fish collected. A single brook trout and a single westslope cutthroat trout (or a hybrid) were observed in a 1994 and 1995 sampling event, respectively.

FWP surveys conducted annually in Bear Creek from 1999 through 2008 estimated bull trout densities in a reach of Bear Creek 4 miles upstream from the mouth to range from 0.4 bull trout/100 square meters in 2008 to 14 bull trout/100 square meters in 2001 (FWP 2012). Bull trout densities in these surveys have been lower since 2004 compared to the earlier years. In other surveys, only the number collected was provided, with up to 125 bull trout observed within a reach in sampling events from 2005 through 2011 (FWP 2012). Genetic testing of fish from three reaches of Bear Creek in 2009 associated with the PACFISH/INFISH Biological Opinion Effectiveness Monitoring Program tested 60 fish, 19 of which were bull trout and 41 were unknown *Oncorhynchus* (Young and McKelvey 2009).

The MFISH database lists Columbia Basin redband trout and both migratory and resident bull trout as occurring in Cable Creek, a tributary of Bear Creek (FWP 2012). Results from a single survey conducted near the mouth of Cable Creek in 1982 are provided in the database. One bull trout and 19 Columbia Basin redband trout were collected in this snorkeling survey.

Genetic testing has been conducted twice on trout tissues collected from Bear Creek. The results of the analysis of four trout in 1991 indicated that the trout population consisted of rainbow/cutthroat hybrids (98.7 percent rainbow, 1.3 percent cutthroat), but did not indicate whether “rainbow” referred to rainbow or redband trout genes. Based on the analyses conducted in 2000, the trout population in Bear Creek is composed of pure redband trout and redband/westslope cutthroat hybrids, as 29 of the trout analyzed were redbands, with the remaining fish being a redband/cutthroat hybrid. Genetic analysis in 2009 confirmed the presence of hybrid trout in Bear Creek, with the 27 fish collected for analysis determined to westslope/redband/rainbow trout hybrids (FWP 2012).

Big Cherry Creek Fish Populations and Genetics

The MFISH database lists brook trout and westslope cutthroat trout as occurring commonly in Big Cherry Creek, with bull trout, Columbia Basin redband trout, mountain whitefish, and slimy sculpin occurring rarely based largely on professional judgment (FWP 2012). Fish population surveys of this stream were conducted in 1982, 1986, 1994, 2009, and 2012 in one or more reaches (FWP 2012; Kline and Savor 2012). In the surveys from 1982 through 1994, redband trout were generally the dominant species and sometimes the only species collected, with over 300 of these fish collected in a survey conducted in 1982. Density or abundance estimates were not provided for all surveys, but 121 redband trout/100 meters were estimated to be present in 1987. Brook trout were also collected in low numbers in 1982, 1987, and 1994, with a single westslope cutthroat trout collected in 1994 as well. In the two surveys conducted in 2009 at more upstream locations than the earlier surveys, westslope cutthroat trout were the dominant species, with sculpin also present in both surveys and four bull trout present in one of the sites surveyed (FWP 2012).

Three reaches of Big Cherry Creek were surveyed in August 2012 to provide additional data for the baseline assessment (Kline and Savor 2012). The three reaches surveyed were all 10 to 13 miles upstream of the confluence with Libby Creek, with sites surveyed downstream of the Forest Service Road 4785 bridge, upstream of Forest Service 876 bridge, and downstream of the Forest

Service Road 876 bridge. Rainbow trout/cutthroat trout hybrids were collected from all three reaches, at abundances estimated to be 6 to 7 trout/100 meters. Additionally, four bull trout were collected at the most upstream location, and a single brook trout was collected from the site located just upstream of the Forest Road 876 bridge. The bull trout ranged in size from 95 mm to 564 mm, with an average of 213 mm, suggesting that multiple age classes were present. The largest bull trout at this site was collected for genetic analysis, which determined that it was likely assigned to either the West Fisher River or Callahan Creek, both of which are tributaries downstream of Libby Dam.

Genetic analysis has also been conducted on over 150 trout collected from multiple locations in Big Cherry Creek in 1994, 2000, and 2006 (FWP 2012). These analyses confirmed that hybridization between Columbia Basin redband trout and westslope cutthroat trout occurs in this stream. The analysis of trout collected from two locations in 1994 indicated that those collected about 10 miles upstream of the confluence with Libby Creek were pure Columbia Basin redband trout, while those collected 4 miles downstream of that site were hybrid trout described as being 97.3 percent Columbia Basin redband trout and 2.7 percent westslope cutthroat trout. Hybrid trout were also collected from two locations in 2000 and from a single location in 2006.

Genetic testing of fish from two reaches of Big Cherry Creek associated with the PACFISH/INFISH Biological Opinion Effectiveness Monitoring Program was completed in 2009. Seventy fish were tested; 4 were bull trout, 60 were westslope cutthroat trout and 6 were sculpin (Young and McKelvey 2009).

Midas Creek Fish Populations and Genetics

Based on the MFISH database, bull trout, redband trout, westslope cutthroat trout, and cutthroat/rainbow trout hybrids have been observed or are believed to occur in Midas Creek. Midas Creek was surveyed in 1987 near the confluence with Libby Creek and the catch was comprised of all "rainbow trout" and one bull trout (Marotz *et al*. 1988). Genetic analyses conducted in 1991, 1997, and 2006 indicated that westslope cutthroat trout are hybridized with redband trout in this stream.

Swamp Creek Fish Populations and Genetics

The MFISH database does not include any specific surveys of Swamp Creek (the Libby Creek tributary), but lists westslope cutthroat trout as occurring there based on professional judgment (FWP 2012). Surveys of four reaches of this stream were conducted in July and August 2012 by the FWP and MMC (Kline and Savor 2012). The four reaches were interspersed within the 3.5 mile stretch upstream of the confluence of Swamp Creek and Libby Creek. Brook trout were the most abundant fish within each reach, and were the only species collected in the two downstream reaches. From 10 to 42 brook trout were collected from each site. At the two upstream reaches, rainbow trout/cutthroat trout hybrids were also collected, with four of these trout observed at each site. One of these reaches also had two additional trout collected that were visually identified as pure cutthroat trout rather than hybrids. Genetic analysis of tissues from 18 fish collected in 1999 indicated that the hybrid trout present were 86 percent westslope cutthroat trout and 14 percent rainbow trout (FWP 2012).

3.6.3.5.2 Fisher River Drainage Fish Populations and Genetics

All of the alternative transmission line alignments would follow or cross streams within the Fisher River watershed. Brook trout, bull trout, rainbow trout, mountain whitefish, largescale suckers, longnose dace, longnose suckers (*Catostomus catostomus*), redside shiners

(*Richardsonius balteatus*), northern pikeminnow (*Ptychocheilus oregonensis)*, and sculpin are listed as residing in this reach of the Fisher River (FWP 2012). Genetic surveys conducted on 90 rainbow trout collected from three locations in the upstream portion of the Fisher River in 2005 indicate these are pure interior redband trout, although the presence of westslope/rainbow trout hybrids in reaches further downstream was verified through genetic analyses in earlier years.

Additionally, one or more of the transmission line alternatives follow and/or cross West Fisher Creek, Miller Creek, Hunter Creek, and Sedlak Creek, all of which are within the Fisher River watershed. The MFISH database (FWP 2012) lists brook trout, bull trout, redband trout, westslope cutthroat trout, mountain whitefish, rainbow trout, sculpin, and longnose dace as occurring in West Fisher Creek, and Rocky Mountain tailed frogs were also collected in some fish population surveys. Brook/bull trout hybrids were also reported as being collected from reach near the mouth of this stream in 2009 and 2010. Surveys of one or more reaches of this stream were conducted in 1987, 1993, and 2002 through 2010. Most surveys conducted near the confluence of West Fisher Creek and the Fisher River indicated that rainbow trout were the dominant species, although bull trout were collected in similar or greater numbers in 2005 and 2006. Bull trout densities were estimated from surveys conducted about 3.7 miles upstream of the confluence, and varied from 0.1 to 1.6 bull trout/100 square meters. Tissues from 25 trout collected in 2000 from West Fisher Creek from a reach 6 miles upstream of the mouth underwent genetic analysis and were determined to be westslope/rainbow trout hybrids. Analysis of 30 fish from further upstream in 2006 indicated all were pure westslope cutthroat trout. Analysis of 49 bull trout and brook trout collected in 2007 included 36 pure bull trout, 12 pure brook trout, and a single brook trout/bull trout hybrid.

Miller Creek, a tributary to the Fisher River, is reported to contain brook trout, redband trout, westslope cutthroat trout, redband/cutthroat trout hybrids, slimy sculpin, and torrent sculpin. Brook trout have been the most abundant species in surveys conducted since 2002. Genetic analyses conducted in 1997 and 2000 indicated that the westslope cutthroat trout were 100 percent pure in a reach 3 miles upstream of the confluence with the Fisher River, but were hybridized with rainbow trout further downstream (FWP 2012). Rocky Mountain tailed frogs were collected from Miller Creek during fish population surveys as well.

Genetic testing of fish from two reaches of Miller Creek associated with the PACFISH/ INFISH Biological Opinion Effectiveness Monitoring Program was completed in 2009. All 10 fish tested were brook trout in the reach above North Fork Miller Creek. Downstream of the North Fork Miller Creek, 51 fish were tested; 41 were westslope cutthroat trout and 10 were brook trout (Young and McKelvey 2009). PACFISH/ INFISH monitoring also tested fish from West Fisher Creek. No fish were found at the headwaters sampling site. At a site about 0.75 mile upstream of the Standard Creek confluence, bull trout, 30 westslope cutthroat trout, and 10 sculpin were identified. Species diversity was high at the site above Lake Creek. Of the 33 fish tested, 7 brook trout, 2 bull trout, 1 westslope cutthroat trout, 2 longnose dace, 11 sculpin, and 10 unknown *Oncorhynchus* were identified.

No surveys were listed for Sedlak Creek or Hunter Creek within the MFISH database (FWP 2012), but westslope cutthroat trout were noted as occurring in Sedlak Creek based on professional judgment.

3.6.3.5.3 Lower Clark Fork River Drainage Fish Populations

Rock Creek Watershed Fish Populations and Genetics

During the initial baseline surveys in 1988, westslope cutthroat trout were the dominant trout species in East Fork Rock Creek, comprising 71 percent of all trout collected and having a density of 10 trout/100 square meters (Table 72). Many of the westslope cutthroat trout collected from the Rock Creek Meadows site near the outlet of Rock Lake were thought to be hybridized with Yellowstone cutthroat trout and rainbow trout. Bull trout also were collected during these surveys at densities of 4 trout/100 square meters. The trout scales analyzed for age and growth during the 1988 baseline survey indicated that most trout within the analysis area were young (age I, II, and III), as is typical for low productivity mountain headwater streams, as older fish reside in larger downstream areas. Older bull trout and westslope cutthroat trout (age IV and/or V) also were found in East Fork Rock Creek and Rock Creek Meadows, respectively. As in the Libby Creek drainage streams, growth rates for all age classes were low, likely due to limitations caused by the low nutrient concentrations and harsh environmental conditions.

In addition to the bull trout and westslope cutthroat trout observed in East Fork Rock Creek during the initial baseline survey, brook trout, brown trout (*Salmo trutta*), Yellowstone cutthroat trout, rainbow trout, westslope/Yellowstone/rainbow trout hybrids, and slimy sculpin also occur in the Rock Creek drainage (FWP 2012). Rocky Mountain tailed frogs were also collected from the Rock Creek watershed during some fish population surveys. Fish populations from one or more sites in East Fork Rock Creek, West Fork Rock Creek, and Rock Creek were surveyed in 1985, 1986, 1988, 1993, 1994, 1996, and 2001 through2012 (Washington Water Power Company 1996; USDA Forest Service and DEQ 2001; FWP 2012; Horn and Tholl 2011; Kline and Savor 2012). While only presence-absence data or counts were recorded for many of these earlier surveys, total trout densities recorded from surveys in East Fork Rock Creek as summarized by the USDA Forest Service and Montana Department of Environmental Quality (2001) ranged from 13 to 36 trout/100 square meters, with westslope cutthroat trout comprising from 69 to 93 percent of the total trout collected during the 1985 to 2000 period. Bull trout were the only other trout species collected in these surveys, and they were collected at densities up to 11 trout/100 square meters during this time period.

Since 2000, sites on East Fork Rock Creek have been surveyed annually during almost all years from 2001 through 2012 by Avista, FWP, or Forest Service personnel (Horn and Tholl 2011, FWP 2012; Kline and Savor 2012). Only westslope cutthroat trout and bull trout were present within these reaches, with the exception of a few westslope cutthroat/rainbow trout hybrids collected in 2007 and 2010 within the upstream reaches of East Fork Rock Creek near Rock Lake. Bull trout densities were stable or had gradual increasing trends observed at these sites, with densities ranging from 2 to 28 trout/100 meters over that time period (Horn and Tholl 2008; FWP 2012; Kline and Savor 2012). Radio tagging and genetic studies indicate that both migratory and resident bull trout occur in the Rock Creek drainage (Avista 2011; Salmon Environmental Services 2012). Westslope cutthroat trout densities were more variable from 2001 through 2012, with population estimates ranging from 12 to 106 trout/100 meters. The westslope cutthroat trout population appears to be composed of mostly resident fish, although one radio-tagged trout was tracked from the Cabinet Gorge Reservoir in 2002 (Avista 2011).

In the mainstem of Rock Creek, total trout densities were generally lower than in the East Fork Rock Creek, but reached up to 32 trout/100 square meters, with westslope cutthroat trout also dominating the fish populations in most surveys (as summarized in USDA Forest Service and

DEQ 2001). Brook trout were the dominant species in downstream reaches during two surveys in 1993 and 1996. Based on these surveys and the surveys documented in the MFISH database (FWP 2012), brook trout appear to mainly inhabit the downstream reaches of Rock Creek. The seasonally dewatered reach may have prevented this species from colonizing the upstream reaches (Horn and Tholl 2011). Bull trout were collected in some surveys in the mainstem Rock Creek, but generally were collected less frequently and in lower densities than in East Fork Rock Creek (USDA Forest Service and DEQ 2001). The most recent survey of Rock Creek was conducted in September 2012 by the FWP at a reach downstream of the Engle Creek confluence (Kline and Savor 2012). Brook trout and cutthroat trout were collected in similar numbers, with 47 trout collected within the 100-meter reach.

As summarized in USDA Forest Service and DEQ (2001), bull trout were the most abundant species collected from reaches of West Fork Rock Creek in surveys that occurred in 1985, 1986, and 1993, but only westslope cutthroat were collected in surveys conducted at several sites in 1996. When present, bull trout densities ranged up to 13 trout/100 square meters, and westslope cutthroat trout densities reached up to 22 trout/100 square meters. Fish densities were generally higher in the upstream reaches of West Fork Rock Creek than in the downstream reach that has intermittent flows. Bull trout were not collected in the two additional surveys listed in the MFISH database and conducted in July 2007 and August 2009 (FWP 2012), but six bull trout, as well as 42 westslope cutthroat trout, were collected in a more recent survey conducted in August 2012 by the KNF within a reach near the mouth of West Fork Rock Creek (Kline and Savor 2012; Salmon Environmental Services 2012). The 2007 survey was conducted by Avista personnel and was located within two reaches in the downstream 0.7 miles of the stream, and reported that 78 and 1 westslope cutthroat trout were collected from these reaches, respectively. The 2009 survey reach was just upstream of the 2007 reaches, and resulted in the collection of 33 westslope cutthroat trout by Forest Service personnel.

The 1988 study discusses results of genetic analyses from fish thought to be westslope cutthroat trout collected in 1984 (Western Resource Development Corp. 1989a; FWP 2012) from near the mouth of Rock Creek and on East Fork Rock Creek near the Rock Creek Meadows site. Based on the results of these analyses, the westslope cutthroat population at the mouth of Rock Creek was considered pure, but subject to genetic invasion, while the Rock Creek Meadows population was considered to be hybridized (92.8 percent westslope cutthroat trout, 5.2 percent Yellowstone cutthroat trout, and 2 percent rainbow trout) (Western Resource Development Corp. 1989a). Past stocking activities in Rock Lake or Rock Creek Meadows are responsible for this hybridization. East Fork Rock Creek has barriers to upstream fish movement in Rock Creek Meadows and at the outlet of Rock Lake, but these barriers do not prevent downstream fish passage. Hybridized cutthroat trout have access into areas occupied by pure strains (USDA Forest Service and DEQ 2001; Washington Water Power Company 1996). In addition, during the 2010 survey conducted by Avista (Horn and Tholl 2011), a single westslope cutthroat trout/rainbow trout hybrid was collected from a reach of East Fork Rock Creek several kilometers upstream of the West Fork Rock Creek confluence. The identity of this fish was genetically confirmed. This was the first occurrence of a non-native salmonid in this reach of East Fork Rock Creek, although westslope cutthroat trout hybrids have been collected from the mainstem Rock Creek in previous years (FWP 2012).

Genetic testing of fish from three reaches of East Fork Rock Creek associated with the PACFISH/INFISH Biological Opinion Effectiveness Monitoring Program was completed in 2009. All 30 fish tested were westslope cutthroat trout in the headwater reach about 4 miles upstream of West

Fork Rock Creek. At the mid-reach site, 36 fish were tested; 6 were bull trout and 30 were westslope cutthroat trout. At a site just above the confluence of West Fork Rock Creek, 38 fish were tested; 8 were bull trout and 30 were westslope cutthroat trout. (Young and McKelvey 2009). PACFISH/ INFISH monitoring also tested fish from West Fork Rock Creek. No fish were found at the headwaters sampling site. At a site 1 mile upstream of East Fork Rock Creek, 30 westslope cutthroat trout were identified. At a site just above the confluence of East Fork Rock Creek, 16 fish were tested; 10 were bull trout and 6 were westslope cutthroat trout.

While fish that were thought to be brook/bull trout hybrids have been observed in the Rock Creek watershed, genetic analyses have indicated no evidence of hybridization of this trout population. These analyses further indicate that the bull trout population in the Rock Creek watershed is genetically distinct from neighboring populations based on a summary of the data by Avista personnel (Salmon Environmental Services 2012).

As part of Avista's monitoring of bull trout in the Rock Creek drainage, 10 radio tagged bull trout were detected between 2003 and 2007 moving into Rock Creek, including one fish that was detected in the drainage two years in a row. Observations of these radio tagged fish along with capture of migratory sized adult bull trout in weir traps installed in Rock Creek indicate low, but stable, bull trout numbers over the years. From 2004 to 2011, a total of 12 migratory bull trout were captured below the Cabinet Gorge Dam that were genetically assigned to Rock Creek; these fish were thus transported and released back into Rock Creek (Avista 2011). Of these twelve, two fish were recaptures of juveniles that had been previously collected in fish traps located in Rock Creek. Additional information about Avista's monitoring is reported in Lockard *et al.* 2003; Lockard and Hintz 2005; Lockard *et al.* 2005; Hintz and Lockard 2006, 2007; Lockard *et al.* 2008; Bernall and Lockard 2008; Moran *et al*. 2009; Avista 2011.

East Fork Bull River Fish Populations and Genetics

The East Fork Bull River was not surveyed as part of the 1988 study, but one or more sites were surveyed between 1992 and 1994 and from 1999 to 2011 (Washington Water Power Company 1996; Chadwick Ecological Consultants, Inc. 2000; Horn and Tholl 2008, 2011; FWP 2012). Results from these surveys indicate that brook trout, brown trout, bull trout, westslope cutthroat trout, mountain whitefish, rainbow trout, sculpin, and northern pike minnow are present in the East Fork Bull River. Rocky Mountain tailed frogs were also collected during some of the fish population surveys. The 1992 through 1994 surveys indicated that fish densities were high for cutthroat trout and brown trout, with average densities of 64 fish/100 meters and 21 fish/100 meters, respectively. Densities were lower for bull and brook trout, which had average densities of 8 fish/100 meters and 7 fish/100 meters, respectively (Washington Water Power Company 1996). Surveys included in the MFISH database (FWP 2012) suggest that fish populations are present in about 7 miles of the East Fork Bull River, up to near the confluence with Placer Creek. No surveys of Placer Creek were documented in the database, but bull trout could be present in this tributary as well.

Fish densities were estimated from snorkeling surveys within four reaches of the East Fork Bull River in 1999 (Chadwick Ecological Consultants, Inc. 2000). Westslope cutthroat trout and bull trout were found in all four reaches of the East Fork Bull River, while brown trout, brook trout, and mountain whitefish were observed in one or both of the two downstream reaches and sculpin were observed in all but the most upstream reach. Westslope cutthroat trout were the dominant species throughout the reaches surveyed, with densities up to 2 trout/100 square meters. Based on these estimates, the East Fork Bull River had about 2,600 westslope cutthroat trout present throughout its length. Bull trout were collected at considerably lower densities than westslope cutthroat trout in the East Fork Bull River in 1999, with all reaches having less than 1 trout/100 square meters. Generally, bull trout densities were highest in the upstream reaches of this stream. The East Fork Bull River was estimated to have about 200 bull trout present throughout its length. Surveys of reaches in other streams within the Bull River drainage in 1999 indicated that the majority of the bull trout in this watershed are found in the East Fork, with 85 percent of these trout collected from all sites within the Bull River watershed being collected from this stream.

Subsequent sampling in the East Fork Bull River since 2000 has continued to indicate that higher densities of bull trout exist in the upstream reaches. From 2000 through 2010, bull trout densities have ranged from 1.3 trout/100 meters at a downstream site in 2006 to as high as 43 bull trout/100 meters in more upstream reaches in 2005 (Horn and Tholl 2008, 2011; FWP 2012). Estimates of westslope cutthroat trout abundance from surveys conducted during this same time periods in the East Fork Bull River ranged up to 52 trout/100 meters (Horn and Tholl 2011; FWP 2012). The additional surveys recorded in the MFISH database (FWP 2012) only gave the number of fish collected, but these numbers indicated that trout density is relatively high in the East Fork Bull River, particularly near the confluence with the Bull River. Brown trout was the dominant fish species in many of the surveys, but westslope cutthroat, brook trout, and mountain whitefish were also frequently collected in high numbers. Sampling by Avista found similar results, with brown trout generally being the most abundant species in the lower reaches but bull trout, brook trout, mountain whitefish, and westslope cutthroat trout also being present (Horn and Tholl 2008, 2011). In upstream reaches near or within the CMW, westslope cutthroat trout or bull trout were the dominant fish species, with brown trout and brook trout present in lower numbers if at all. Northern pike minnows and sculpins were collected more rarely and generally in low numbers (Chadwick Ecological Consultants, Inc. 2000; FWP 2012). Genetic testing of fish from two reaches of East Fork Bull River associated with the PACFISH/INFISH Biological Opinion Effectiveness Monitoring Program was completed in 2009. The testing identified 10 bull trout and 30 westslope cutthroat trout in the reach below Isabella Creek. Between Isabella Creek and St. Paul Lake, all 30 fish tested were westslope cutthroat trout (Young and McKelvey 2009).

Avista initiated a non-native salmonid suppression program in 2007, with non-native fish removed from the lower 2 miles of the East Fork Bull River from 2007 through 2009 using electrofishing methods (Horn and Tholl 2011). While brown trout and other non-native fish were still present in the lower reaches following this effort, monitoring in 2009 and 2010 indicated a shift toward native species was occurring in this reach. Westslope cutthroat trout was the most abundant species in these two years. While brown trout remained more abundant than bull trout, numbers of bull trout collected were higher than in all previous years of this study since 2000. This shift could also have resulted in part from the reactivation of the historical channel that occurred within this reach in 2008 due to a natural avulsion that occurred upstream.

Length-frequency data and scale analysis conducted during the 1999 survey suggest that the migratory life form of bull trout exists in the East Fork Bull River drainage. Resident bull trout also likely exist in the drainage, as some younger trout within the size range expected for resident trout were observed. The absence of “resident” fish past age III raises uncertainties about the existence of a true resident population (Chadwick Ecological Consultants, Inc. 2000). Research has shown radio tagged bull trout transported from Lake Pend Orielle moving to the East Fork Bull River. The genetic information, sampling surveys, and telemetry indicated that this population is primarily a migratory population (Katzman and Hintz 2003, Moran and Storassli 2008).

Genetic analysis of bull trout tissues collected in 1993 from three locations on the East Fork Bull River indicated that the bull trout populations were pure. A single bull trout/brook trout hybrid was listed as captured from the weir trap in 2007 and 2010 (Moran and Storaasli 2008; FWP 2012). No documentation was provided that suggests that these fish were genetically analyzed. Bull trout/brook trout hybrids were collected in other locations within the Bull River watershed in 2005, 2006, and 2007 (Moran *et al*. 2009; Horn and Tholl 2011). Genetic analyses conducted on westslope cutthroat trout tissues in 1983, 1984, and 2004 also determined that these populations were pure (FWP 2012). Population surveys conducted in 2002, 2009, and 2011 reported the collection of small numbers of westslope cutthroat/rainbow trout hybrids from the East Fork Bull River, generally from the most downstream reach of the river (FWP 2012). These trout may have been visually identified and not necessarily confirmed via genetic analyses.

Swamp Creek Fish Populations and Genetics

Brook trout, brown trout, bull trout, westslope cutthroat trout, sculpin, largescale sucker, mountain whitefish, brook/bull trout hybrids, and westslope/rainbow trout hybrids have been collected in Swamp Creek (tributary to the Lower Clark Fork River) between 1992 to 2010 (Washington Water Power Company 1996, Chadwick Ecological Consultants 2002; GEI 2005, FWP 2012). Fish population surveys were conducted in Swamp Creek by Washington Water Power Company (1996) in 1992 through 1994. The most downstream reach of Swamp Creek was dry at this time, but brook trout, westslope cutthroat trout, and brown trout were collected upstream of this reach. Brook trout were the most abundant species collected, with densities up to 85 fish/100 meters. Westslope cutthroat trout were found in both reaches surveyed in Swamp Creek at densities that ranged from 10 fish/100 meters to 47 fish/100 meters. Brown trout were only collected in one of the two reaches surveyed that had water present, and were collected at densities of 13 fish/100 meters.

Chadwick Ecological Consultants (2002) surveyed multiple reaches of Swamp Creek and its tributaries in 2001, with bull trout, brown trout, brook trout, westslope cutthroat trout, largescale suckers, and sculpins collected. Westslope cutthroat trout were the most abundant species collected in most reaches, and bull trout were collected from the mainstem Swamp Creek in low numbers. Surveys of various reaches of Swamp Creek conducted by Avista in 2006, 2007, and 2010 indicated that brook trout were frequently the most abundant species present during this time period, although westslope cutthroat trout and bull trout were occasionally more numerous (FWP 2012). These surveys did not provide density data, but documented the number of each species collected. While bull trout were absent during the 1992 to 1994 surveys, they were present in one or more surveys conducted in 2006, 2007, and 2010. A single hybrid brook/bull trout was collected in 2007, although no data were provided to determine if it was identified as a hybrid based on visual observations or genetic analysis (FWP 2012).

The MFISH database (FWP 2012) indicated that a single westslope cutthroat/rainbow trout hybrid was collected from the mid-reaches of Swamp Creek in 2007. This fish was likely identified visually, as results of genetic analyses conducted in that year are not included. Earlier analyses were conducted between 1984 and 1994 (FWP 2012, Washington Water Power Company 1996). Most analyses indicated that the westslope cutthroat trout population was pure, but Washington Water Power Company (1996) states that trout collected in 1994 from a reach near the CMW boundary were hybridized westslope/Yellowstone cutthroat trout. Additionally, 30 trout collected for genetic analysis from Wanless Lake in the headwaters of Swamp Creek in 1987 were determined to be westslope/Yellowstone cutthroat trout hybrids (FWP 2012).

Bull trout were collected for genetic analyses from Swamp Creek and other streams in 1997 through 1999 (Neraas and Spruell 2001). Of the 17 bull trout collected, three of these were determined to be hybridized with brook trout. A survey was conducted in 2004 by Avista specifically for the purpose of conducted genetic analyses on any bull trout that were collected, but none were observed in that year (GEI 2005).

Copper Gulch Fish Populations and Genetics

The MFISH database (FWP 2012) lists resident bull trout and westslope cutthroat trout as occurring rarely in Copper Gulch based on professional judgment. The summary of fish populations provided in GEI (2005) indicates that mountain whitefish, hybrid westslope cutthroat trout, brook trout, and brown trout may also be present. Two reaches of Copper Gulch were surveyed in August 2012 by the FWP to investigate the mitigation potential of this stream (Kline and Savor 2012). One reach was located immediately upstream of the confluence with the Bull River, while the other reach was located almost 2 miles upstream of the confluence. Brook trout, brown trout, and rainbow trout/cutthroat trout hybrid were collected from the downstream site, with brook trout comprising 62 percent of the trout collected. At the upstream reach, 57 cutthroat trout were collected, with no other species present. These trout were visually identified as pure. Twenty-three trout were collected for genetic analysis in 1992 from a reach of Copper Gulch 1 mile upstream of the mouth, and were determined to be pure westslope cutthroat trout.

3.6.3.5.4 Flower Creek Fish Populations and Genetics

The MFISH database (FWP 2012) lists westslope cutthroat trout and brook trout as common or abundant in reaches of Flower Creek, with bull trout, rainbow trout, slimy sculpin, and torrent sculpin listed as occurring rarely. Data provided include results from surveys in 1960 and 2009, with an additional report attached that included results of a survey conducted in 1959 (Opheim 1960). In 1959 and 1960, westslope cutthroat trout were the most abundant species, and brook trout and bull trout were also present. Westslope cutthroat trout were estimated to have been collected at densities between 23 and 43 fish/100 meters in the 1960 survey, with bull trout and brook trout densities estimated at 4 and 10 fish/100 meters, respectively. Three reaches of Flower Creek were surveyed in 2009, with brook trout, sculpin, and westslope cutthroat trout collected. No density estimates were provided from these surveys, but a total of 167 westslope cutthroat trout were collected, and this was the only species present in the most upstream reach sampled. Eleven brook trout and 16 sculpin were also collected in addition to the westslope cutthroat trout in the other two reaches. Twenty fish were collected for genetic analysis in 1994; these trout were westslope cutthroat/rainbow trout hybrids (FWP 2012).

Additional surveys of three reaches of this stream were conducted by MMC in August 2012 (Kline and Savor 2012). These reaches were between 3 and 6 miles upstream of the confluence of Flower Creek and the Kootenai River, with a reach surveyed a mile upstream of the upper reservoir, immediately upstream of the lower reservoir, and immediately downstream of the lower reservoir. Rainbow trout/cutthroat trout hybrids were the most abundant species collected from all three sites, at abundances estimated to range from 6 to 20 trout/100 meters. Brook trout were also common at the two downstream sites, and four cutthroat trout visually identified to be pure were collected from downstream of the lower reservoir. In addition, a single bull trout/brook trout hybrid was collected from both the upstream site and the site downstream of the lower reservoir. These fish were collected for genetic analysis, and the hybridization was verified.

3.6.3.5.5 Analysis Area Lakes

Rock Lake, St. Paul Lake, Howard Lake, Ramsey Lake, Upper Libby Lake, and Lower Libby Lake are within the analysis area. While no fish population data were available for Ramsey Lake, St. Paul Lake, or the Libby Lakes, the MFISH database (FWP 2012) indicates that Yellowstone cutthroat/westslope cutthroat trout hybrids inhabit Rock Lake. Nineteen fish were collected in Rock Lake in 1988, with some thought to be pure westslope cutthroat trout and other hybrids (Western Resource Development Corp. 1989). Genetic analyses were conducted on trout from this lake in 1985 and 1993. Results of both analyses were similar, and indicated that the fish are hybridized in Rock Lake, containing between 79 percent and 82 percent westslope cutthroat trout genes, and between 18 percent and 21 percent Yellowstone cutthroat trout genes. In Howard Lake, non-native rainbow trout are considered abundant and are also stocked annually by FWP (FWP 2012).

3.6.3.6 Spawning Surveys

In October 1989, about 22 miles of Libby, Ramsey, and Poorman creeks were surveyed for bull trout redds (spawning nest made by trout) as part of the initial baseline study. Two spawning areas made by large, apparently migratory bull trout were found downstream of the project. Above the falls, ten small bull trout redds also were found, which were the product of resident fish. No bull trout spawning activity was observed in Ramsey Creek or Poorman Creek. Also, no spawning or spent bull trout or mountain whitefish were observed in the 11-mile portion of Libby Creek surveyed during the November 1988 mountain whitefish survey (Western Resource Development Corp. 1989a; Kline Environmental Research 2004).

Redd surveys also were conducted in October 1995 and 1996 in Libby, Ramsey, Poorman, and Little Cherry creeks. Four possible redds were noted, one on Libby Creek upstream of its confluence with Little Cherry Creek, and three on Ramsey Creek. The three redds identified on Ramsey Creek were noted as possibly being brook trout redds (Kline Environmental Research 2004), but are more likely to have been bull trout redds because surveys have not reported brook trout as occurring in Ramsey Creek. As part of the mitigation efforts for the construction and operation of Libby Dam, redd surveys were conducted on Bear Creek annually from 1995 through 2009. About 4 miles were surveyed on each occasion, with the number of bull trout redds observed ranging from three in 2005 to 36 in 1999 (Dunnigan *et al.* 2004, 2005, 2011). Three sites on Libby Creek were surveyed for bull trout redds in 2006, and these three sites, an additional Libby Creek site, and a single site each on Bear Creek, Little Cherry Creek, Poorman Creek, and Ramsey Creek were surveyed in 2007 and 2008 as part of the monitoring requirements for the Libby Creek adit permit (Kline Environmental Research 2008, 2009). No redds were observed during these surveys.

Redd surveys also have been conducted by the FWP and KNF within the Fisher River, East Fork Bull River, Rock Creek, and Swamp Creek (tributary to the Clark Fork River) watersheds. The Fisher River watershed was surveyed for redds in 1993, with one suspected bull trout redd observed in the Fisher River, and 12 redds observed within other tributaries in the drainage (Kootenai Tribe of Idaho and FWP 2004). Additionally, between 6 and 10 miles of West Fisher Creek have been surveyed for bull trout redds from 1995 through 2009; redd counts have ranged from none found in 1997 to 27 observed in 2005 (Dunnigan *et al*. 2011).

The East Fork Bull River has been surveyed for both brown and bull trout redds (Washington Water Power Company 1996; Moran 2007, Storaasli and Moran 2012). Brown trout redds were surveyed from 1980 through 1982, with an average of 33 redds observed each year. Surveys for bull trout redds were begun in 1992, with 12 redds observed. Both bull trout and brown trout redd surveys were conducted in 1993, 1994, and 1995. Three brown trout redds were observed in 1993, but no bull trout redds were found. Accurate redd counts were not possible in 1994 and 1995 due to high flows (Washington Water Power Company 1996). Bull and brown trout redd surveys also were conducted on the East Fork Bull River from 2001 to 2011 by Avista (Storaasli and Moran 2008, 2012). The number of bull trout redds in the East Fork Bull River ranged from four in 2008 to a high of 32 in 2002. Brown trout redd surveys during this same time period for East Fork Bull River ranged from five in 2006 to 46 in 2002 (Storaasli and Moran 2008, 2012). Brown trout redds were generally excavated as part of the Avista's non-native fish suppression program.

Washington Water Power Company (1996) and Avista (Storaasli and Moran 2012) also conducted redd surveys on Rock Creek and Swamp Creek between 1993 and 2011. As in the East Fork Bull River, the redd surveys in 1994 and 1995 did not result in accurate counts due to high flow conditions in Rock Creek and prevented redd counts from occurring in Swamp Creek. Only a single bull trout redd was found in Rock Creek during the 1993 survey (Washington Water Power Company 1996). In the Avista surveys conducted from 2004 through 2011 in East Fork Rock Creek, bull trout redds ranged from one redd observed in 2005, 2008, and 2010 to six in 2004 and 2009 (Storaasli and Moran 2008, 2012; Salmon Environmental Services 2012). Brown trout redd surveys were not conducted in Rock Creek or Swamp Creek at this time. The redd survey conducted in Swamp Creek in 1993 located three bull trout redds in October, and four older redds thought to be bull trout redds in December during a brown trout redd survey (Washington Water Power Company 1996). No bull trout redds were observed in Swamp Creek in 2001 through 2004, and in 2009. The highest number of redds observed during the Avista surveys was ten redds observed in 2011 (Storaasli and Moran 2012).

3.6.3.7 Metal Concentrations in Fish Tissues

Concentrations of copper, lead, mercury, zinc, and cobalt in redband trout tissues collected from Libby Creek in 1988 are shown in Table 74. Mercury concentrations were measured in muscle tissue, while all other metal concentrations (*e.g.,* copper, lead, and zinc) were measured in liver tissue (Western Resource Development Corp. 1989). The current water quality criteria level for methylmercury in fish tissues for the protection of human health is 0.3 mg/kg whole body wet weight (EPA 2001). The initial baseline study report (Western Resource Development Corp. 1989a) does not specifically state if the results listed in Table 74 were based on wet weight or dry weight, although it does mention that "it was difficult to weigh the frozen samples due to loss of moisture." Based on this, the best assumption is that the samples were intended to be weighed as wet weight. All mean concentrations of mercury in the sampled fish were below the level set by the EPA, although the maximum mercury concentration was slightly above this level. Regulatory criteria for metal concentrations in fish tissues have not been established for the remaining metals.

Table 74. Metal Concentrations in Redband Trout in Libby Creek.

Metal	Minimum Metal Concentration (mg/kg)	Maximum Metal Concentration (mg/kg)	Average Metal Concentration (mg/kg)
Cobalt	0.1	12.4	1.9
Copper	2.4	29.4	6.5
Lead	<0.1	<1.4	<0.5
Mercury	0.1	0.4	0.19
Zinc	22.3	62.8	30.1

mg/kg = milligram per kilogram.
Note: Mercury concentrations were measured in muscle tissue, while all other metal concentrations were measured in liver tissue. Results given were not specified as wet weight or dry weight measurements, but are presumed to be based on wet weight.
Source: Western Resource Development Corp. 1989a.

Additionally, ten trout identified as *Oncorhynchus* sp. were collected for tissue analysis from a reach of Libby Creek downstream of the Crazyman Creek confluence in 2006, and an additional ten trout each were collected from this site, a site on Libby Creek downstream of the Midas Creek confluence, and a site on Bear Creek in 2007 and 2008 (Kline Environmental Research 2008, 2009). Whole-body tissue concentrations of cadmium, lead, and mercury were analyzed in these fish. Concentrations for all three metals were below minimum detection levels at some sites and years, and mercury concentrations were below the detection level in slightly over half the samples. The highest mercury concentration recorded was 0.16 mg/kg dry weight within a fish collected at the downstream Libby Creek site in 2006. While the necessary data to convert the dry weight concentration into wet weight was not provided, these concentrations would be less than the human health criterion threshold based on a typical moisture content of 80 percent in tissues. Cadmium and lead concentrations were higher in the 2008 samples than in the two previous years, reaching 0.4 mg/kg dry weight and 14 mg/kg dry weight, respectively, at the Bear Creek site.

Metal concentrations also were analyzed in westslope cutthroat trout tissues collected from Rock Creek and East Fork Rock Creek in 1985, as reported in the Rock Creek Project Final EIS (USDA Forest Service and DEQ 2001). In East Fork Rock Creek, mean copper concentrations were 3.0 mg/kg, mean zinc concentrations were 75.0 mg/kg, and mean mercury concentrations were 0.1 mg/kg. In the mainstem Rock Creek, mean copper concentrations were 3.0 mg/kg, mean zinc concentrations were 82.0 mg/kg, and mean mercury concentrations were 0.1 mg/kg. Mercury concentrations were measured in muscle tissue similar to the tissue from fish collected in the Libby Creek drainage. Copper and zinc concentrations were measured in gill tissue. These concentrations are assumed also to be based on wet weights. Copper and mercury concentrations in samples from Rock Creek and East Fork Rock Creek fish were generally less than concentrations in samples from Libby Creek fish, while zinc concentrations were substantially higher.

3.6.3.8 Historical Impacts on Fisheries

Baseline aquatic data reflect the influences of historical mining activities on fishery and habitat conditions in Libby Creek. Before the 1860s, the upper valley was essentially intact, influenced primarily by wildfires and floods. While Native Americans used the upper valley for subsistence purposes (harvesting berries and wildlife), upper Libby Creek was not among those streams routinely used for fishing (USDA Forest Service *et al.* 1992).

In 1867, placer mining began in Libby Creek and its tributaries, including the analysis area (Kline Environmental Research 2004). By 1868, about 800 miners were working the bed of Libby Creek and its tributaries, diverting streams, and cutting timber for housing and placer works. Left behind were scattered patches of disturbed streambed, floodplains devoid of timber, and degraded aquatic habitat.

In 1887, the mining community of Old Libby was established in the area. From the mid-1890s to 1937, hydraulic mining extended impacts on fisheries in the upper valley of Libby Creek within the analysis area (Kline Environmental Research 2004). After excavating and washing old stream channels, floodplains, and streambanks for gold and silver, the “waste” was left in place or allowed to wash down river. Use of mercury in the processing of ore increased, and mercury is found currently in area streams.

The upper Libby Creek drainage burned in 1889 and 1910, the valley was virtually stripped of all standing timber, and little habitat or fish resources were left to be affected by mining. Photos from the period indicate that Libby Creek was a wide, shallow stream with a cobble/gravel substrate. Howard Lake still remained a fishery after the 1910 fire. The few stream fish that remained after the 1910 fire probably were restricted to the headwaters, where only placer mines had been. Howard Lake and Libby Creek had regular stocking beginning in the late 1920s. In 1914, steam-operated mining equipment was used in Libby Creek. Large draglines and steam shovels dug into the bed and floodplain. Heavy equipment and hydraulic mining continued into the 1940s, after which time only a few placer mines remained. Additionally, timber was harvested on private land in the upper Libby Creek drainage in the 1950s. The first non-native fish (western coastal rainbow trout from California and brook trout from the eastern United States) were imported by rail in 1914 and released in local streams (USDA Forest Service *et al.* 1992).

Eighty years of mining and periodic wildfire in upper Libby Creek and the lower end of its tributaries limited available fish habitat throughout the Libby Creek drainage. The fish habitat that remained was concentrated in the upper headwaters of tributaries, including Bear, Ramsey, and Poorman creeks. Re-growth of conifers has begun to stabilize the stream system in the upper valley (USDA Forest Service *et al.* 1992).

3.6.3.9 Threatened and Endangered Fish Species

Bull trout occur in analysis area streams and are currently listed as threatened by the USFWS. The USFWS also designated bull trout critical habitat in the analysis area (Figure 55). The BA for threatened, endangered, and proposed aquatic species and designated aquatic critical habitat evaluated the following parameters (USFWS 1998a), and rated each as functioning appropriately, functioning at risk, or functioning at unacceptable risk for the bull trout subpopulations within the analysis area.

3.6.3.9.1 Description of the Population Area

Historically, bull trout were likely distributed throughout the Libby Creek, East Fork Bull River, Rock Creek, and Fisher River watersheds. The current bull trout populations within the analysis area are composed of both a resident and a fluvial/adfluvial (stream/lake) migratory component (FWP 2012). Bull trout have been reported from both upstream and downstream of the Libby Creek Falls on Libby Creek, as well as within Bear Creek, Cable Creek, Midas Creek, Poorman

Creek, Ramsey Creek, East Fork Rock Creek, West Fork Rock Creek, Rock Creek, West Fisher Creek, Fisher River, and the East Fork Bull River (Figure 55) (Western Resource Development Corp. 1989a; Chadwick Ecological Consultants, Inc. 2000; Kline Environmental Research 2004; FWP 2012). Bull trout spawning has also been documented within the Libby Creek watershed, with redds located in Libby Creek (both upstream and downstream of the falls), Bear Creek, and possibly in Ramsey Creek. The redds located in Ramsey Creek were not determined definitively to be bull trout redds. Additionally, redd surveys have documented bull trout spawning in the Fisher River, East Fork Bull River, and Rock Creek watersheds (Washington Water Power Company 1996; USFWS 2002).

3.6.3.9.2 Subpopulation Size

As summarized in section 3.6.3.5.1, *Libby Creek Drainage Fish Populations*, redd surveys conducted from 1988 to 2009 within various streams in the Libby Creek watershed identified bull trout redds during one or more of the surveys in reaches in Libby Creek, Ramsey Creek, and Bear Creek. Bear Creek appears to be used most frequently for bull trout spawning, with up to 36 redds identified during surveys. Bull trout densities in the Libby Creek watershed upstream of the Bear Creek confluence ranged up to 14 fish/100 square meters based on data collected from 1989 through 2010 (Western Resource Development Corp. 1989; Kline Environmental Research 2004; Kline Environmental Research and Watershed Consulting 2005a; FWP 2012). Density data were not provided for all sampling events, but count data indicated that over 100 bull trout were collected from single reach of Libby Creek or Bear Creek in one or more years (FWP 2012). Bull trout count data indicate that Bear Creek supports the strongest population within the Libby Creek watershed. Within Libby Creek, densities were often highest upstream of Libby Falls, where an isolated resident population exists. Based on these numbers and spawning survey data, the bull trout subpopulation, although viable, is small in the Libby Creek watershed.

The BA (USDA Forest Service 2013a) categorized the Libby Creek, Big Cherry Creek, and Bear Creek bull trout subpopulation sizes as functioning at risk based on low numbers, particularly of migratory adult trout, degraded habitat in some areas, and the possibility of catastrophic flooding events occurring. Ramsey and Poorman Creek were listed as having subpopulations that were functioning at risk and functioning at unacceptable risk, respectively. Available data suggest discontinued use of Poorman Creek. Other tributaries had insufficient or no data available to determine the risk to the populations in those streams.

Most data for the Rock Creek and East Fork Bull River watersheds indicate relatively high densities of bull trout in these streams compared to streams within the Libby Creek drainage. In the East Fork Bull River, over 100 juvenile bull trout were captured annually in some years between 2000 and 2006 from the traps used by Avista as part of the downstream juvenile bull trout transport program (Moran *et al*. 2009). Numbers were lower from 2006 through 2008, with 29 juvenile trout or less collected from these traps in each of these three years. Additional Avista data from population surveys of two to three sites each year from 2000 to 2010 indicated that 20 to 65 bull trout were collected each year, at densities up to 43 trout/100 meters (Horn and Tholl 2011).

In Rock Creek, 17 to 136 juvenile bull trout were captured annually in the traps located in East Fork Rock Creek from 2001 through 2011, although in most years the number of juveniles captured was less than 60 (Moran *et al*. 2009; Avista 2011). Few to no adults were captured in most years. Electrofishing surveys that were conducted from 2001 through 2010 collected from 23 to 51 bull trout at densities reaching a maximum of 28 bull trout per 100 meters of stream

(Avista 2011; FWP 2012). Much of these data support the contention that Rock Creek is secondary to the Bull River in terms of recruitment of juvenile bull trout to the Cabinet Gorge Reservoir, although Rock Creek has steadily contributed trout and had higher numbers in some years (USFWS 2006; Avista 2011).

Bull trout redds have been observed in the East Fork Bull River and Rock Creek. Surveys conducted by Avista in the East Fork Bull River reported the presence of 4 to 32 redds annually between 2001 and 2011, while one to six redds were observed in East Fork Rock Creek from 2004 through 2011 (Storaasli and Moran 2008, 2012; Salmon Environmental Services 2012). These surveys indicate that East Fork Bull River, and to a lesser extent Rock Creek, are two primary spawning streams that support the Lower Clark Fork River bull trout population (Montana Bull Trout Scientific Group 1996). The Rock Creek bull trout subpopulation size was categorized as functioning at risk in the BA since the population is isolated by the intermittent flows (USDA Forest Service 2013a), while the East Fork Bull River subpopulation was categorized as functioning at risk/functioning appropriately.

Bull trout appear to be less numerous in the Fisher River watershed than in the East Fork Bull River or Rock Creek watersheds. Fish population surveys within West Fisher Creek indicated that bull trout were present at densities less than 1 trout/100 square meters (FWP 2012). Spawning surveys from 1995 through 2009 observed up to 27 redds suspected to be bull trout redds annually (Dunnigan *et al*. 2011). The Fisher River and West Fisher Creek bull trout subpopulation sizes were categorized as functioning at risk due to the low numbers that are thought to be present in this drainage (USDA Forest Service 2013a).

3.6.3.9.3 Growth and Survival

The age and growth analysis data for the Libby Creek watershed were collected during the 1988 initial baseline data survey and were summarized in section 3.6.3.5.1, *Libby Creek Drainage Fish Populations*. Based on this analysis data, most bull trout within the Libby Creek drainage are young, as is typical for low-productivity mountain-headwater streams. Older bull trout were only found in the upstream portions of Libby Creek and Ramsey Creek, and in East Fork Rock Creek. Growth rates for all age classes were low, potentially due to limitations caused by low nutrient concentrations. Data to determine survival rates for the Libby Creek drainage subpopulation are insufficient.

Bull trout growth in Rock Creek and the East Fork Bull River was relatively low when compared with other tributaries to the lower Clark Fork River (Washington Water Power Company 1996). Instantaneous survival rates for age III+ bull trout were 18 percent for the East Fork Bull River and 23 percent for Rock Creek. These survival rates were lower than the average for the other tributaries to the lower Clark Fork River (Washington Water Power Company 1996). No data on bull trout growth rates were available for the Fisher River watershed.

Growth and survival was categorized as functioning at risk for Libby Creek, Ramsey Creek, the Fisher River, West Fisher Creek, and the East Fork Bull River based on the BA (USDA Forest Service 2013a). Poorman Creek and the Rock Creek drainage were categorized as functioning at unacceptable risk for this parameter based on the lack of bull trout being collected in Poorman Creek in recent years and the low growth and survival rates within the Rock Creek watershed. Bear Creek was categorized as functioning appropriately based on the consistent presence of juvenile bull trout and redds.

3.6.3.9.4 Life History Diversity and Isolation

Bull trout are widely distributed throughout the lower Kootenai River watershed, with spawning and rearing by migratory adults occurring in tributaries that drain British Columbia, Idaho, and Montana. The Libby Creek population has both a resident and a fluvial/adfluvial, migratory life history form. The resident population is isolated from the rest of the bull trout within and downstream of the analysis area by Libby Falls, which is located about 1.2 miles upstream of the Howard Creek confluence. The migratory population spends their adult lives in Kootenay Lake or the Kootenai River, with upstream migration restricted by Libby Dam, which is impassable to bull trout moving upstream, but not downstream.

Spawning and rearing of bull trout have been documented in Libby Creek and the Fisher River watersheds, as well as other Kootenai River tributaries (Western Resources Development Corp. 1989a; USFWS 2002; FWP 2012). Observation of redds has established that bull trout do use portions of Libby Creek, Bear Creek, and possibly Ramsey Creek for spawning (Western Resource Development Corp. 1989a; Dunnigan *et al.* 2005, 2011). It is not clear if these redds were from resident or fluvial bull trout in most cases, but Bear Creek was documented to have redds present from both life history forms in 1999 (Dunnigan *et al*. 2011). The Libby Creek and Fisher River subpopulations are categorized as functioning at risk in most streams assessed in the BA, with the Poorman Creek subpopulation listed as functioning at unacceptable risk (USDA Forest Service 2013a). The low numbers of migratory trout, fish passage barriers, high stream temperatures and periodic dewatering of short reaches that occurs downstream of the analysis area are listed as risk factors for this parameter.

Bull trout in the East Fork Bull River and Rock Creek are included in the Lower Clark Fork River Core Area within the Clark Fork River Management Area, one of 23 Management Areas of the Columbia River Interim Recovery Unit (USFWS 2014c), and are isolated from the bull trout populations in the lower Kootenai River watershed. East Fork Bull River and Rock Creek are considered important spawning streams for this subpopulation (Montana Bull Trout Scientific Group 1996), and redd surveys by Avista support this contention. The bull trout population in Rock Creek is likely composed primarily of resident fish (USFWS 2003a). Migratory fish do use the stream as demonstrated by radio tagged bull trout tracked to this stream (Hintz and Lockard 2007; Moran *et al*. 2009). Two reaches of Rock Creek, including a reach located near the confluence with the Clark Fork River, are intermittently dewatered and act as seasonal barriers to fish passage (USFWS 2007a; FWP 2012). The BA designated this parameter as functioning at risk for the Rock Creek watershed based on these barriers and the low numbers of migratory fish thought to be present (USDA Forest Service 2013a).

Both the resident life history forms and fluvial/adfluvial migratory life history forms are present in the East Fork Bull River drainage (Chadwick Ecological Consultants, Inc. 2000; Katzman and Hintz 2003; FWP 2012; Moran and Storaasli 2008; Moran *et al*. 2009). Radio tagged bull trout transported from Lake Pend Orielle have been observed moving in to the East Fork Bull River. Genetic information, sampling surveys, and telemetry indicate this population is primarily a migratory population (Katzman and Hintz 2003). This subpopulation was categorized as functioning at risk in the BA because other connected subpopulations are not as strong (USDA Forest Service 2013a).

3.6.3.9.5 Persistence and Genetic Integrity

The bull trout populations that occur in the Libby Creek and Fisher River watersheds are part of the Kootenai River Core Area in the Kootenai River Basin Management Area, one of 23 Management Areas in the Columbia River Interim Recovery Unit (USFWS 2014c). A primary core area indicates that good connectivity exists within the area, with large lakes and migratory corridors present. Six local populations have been documented in the Kootenai River core area, with one of these populations estimated as having greater than 100 individuals, and three others, including the population in Libby Creek, estimated as having numbers approaching 100 individuals. If a core area has five local populations with 100 or more spawning adults and 1,000 or more adult fish, it is assumed to consist of enough individuals to protect genetic integrity and be less vulnerable to the effects of environmental instability (USFWS 2002).

Section 3.6.3.1.2, *Barriers to Fish Passage,* discusses barriers on analysis area streams to bull trout. Connectivity between Libby Creek and the Kootenai River varies from year to year, with the most downstream reach of Libby Creek becoming warm during the low flow period in some years, and presenting a thermal barrier to upstream migration into the analysis area. While the isolated, resident bull trout population that inhabits the upstream portion of Libby Creek has persisted for many years, it is more vulnerable to extirpation via catastrophic events such as droughts, landslides, floods, or fire than the trout in the watershed downstream of the falls. The Fisher River is connected to the Kootenai River and to Quartz Creek, the most prolific spawning tributary, but this watershed also experiences high temperatures that may limit migration during low flows (USDA Forest Service 2013a).

The bull trout populations within the Lower Clark Fork Recovery Unit, which includes Rock Creek and the East Fork Bull River, continue to persist, although sometimes in low numbers, in the watersheds where they likely occurred historically. Migratory trout life history forms have largely been replaced by resident trout life history forms in many of the tributaries, limiting genetic diversity and increasing the risk of local extinctions (Montana Bull Trout Scientific Group 1996; USFWS 2002). The presence of migratory bull trout has been established in both Rock Creek and the East Fork Bull River (Washington Water Power Company 1996; Chadwick Ecological Consultants, Inc. 2000; Moran *et al*. 2009; Avista 2011). Bull trout with migratory life histories are necessary for the long-term success of the species because generally they are more resilient and more resistant to environmental variation and stressors (Rieman and Mcintyre 1993; Montana Bull Trout Scientific Group 1996). The upstream and downstream transport program for bull trout conducted by Avista aids in ensuring the long-term success of this life history trait (Moran *et al*. 2009).

The presence of brook trout threatens the persistence and the genetic integrity of bull trout within the analysis area within both core areas. Brook trout have been documented downstream of the analysis area in the lower Libby Creek drainage for many years, and were first documented in upper Libby Creek drainage in 2004 and in the Fisher River drainage in 1986 (FWP 2012). During the 2005 surveys of the Libby Creek drainage, brook trout were almost eight times as numerous as bull trout at the Libby Creek sites surveyed (Figure 52). Additionally, a significant increasing trend in brook trout abundance was observed from 1998 through 2009 in a section of Libby Creek immediately downstream of the analysis area and the US 2 stream crossing in surveys conducted as part of the mitigation for the Libby Creek Dam project (Dunnigan *et al.* 2011). While no decreasing trend in bull trout densities was observed in this section and no trends in brook trout abundance were observed at sites further upstream, the increases indicate that the probability of impacts on bull trout populations from hybridization and displacement from competition with brook trout is high.

Genetic analysis in the upper Libby Creek drainage found no indication of hybridization (Arden *et al.* 2007). No genetic analyses have been performed on the bull trout within the Fisher River itself to determine if hybridization has occurred, but analysis indicated that hybridization between bull trout and brook trout was occurring in West Fisher Creek in 2007 (FWP 2012). Additionally, hybrid trout were reportedly collected from West Fisher Creek in 2009 and 2010 as well. Brook trout hybridization is suspected in O'Brien Creek, a Kootenai River tributary located farther north in the basin. Additionally, a 25 percent hybridization rate was detected from a sample of 24 bull trout from the Kootenai River (USFWS 2002). The subpopulation of bull trout that inhabit Libby Creek upstream of Libby Creek Falls is assumed to be protected from the threat of hybridization with brook trout because the barrier created by the falls prevents brook trout from accessing that portion of the stream. The bull trout populations in Libby Creek and the Fisher River are considered to be functioning at risk based on the analysis included in the BA (USDA Forest Service 2013a).

Within the Lower Clark Fork River Core Area, genetic analyses on bull trout from three reaches of the East Fork Bull River were conducted in 1993. Almost 60 trout were tested; none showed signs of hybridization (FWP 2012). While genetic verification was not documented, a single brook trout/bull trout hybrid was noted as having been collected from a trap near the mouth of the East Fork Bull River in both 2007 and 2010 (Moran and Storaasli 2008; FWP 2012). Brook trout are present in most streams in the lower Clark Fork River drainage that currently support bull trout, including Rock Creek and the East Fork Bull River. Hybridization has not been verified as occurring in the Rock Creek drainage (Avista 2011), and the seasonally dry reach at the mouth of Rock Creek may be playing a role in excluding brook trout. Brook trout are known to be extensively hybridized with bull trout in Mission Creek (USFWS 2002; FWP 2012), a tributary to the Flathead River that is within the same Recovery Unit as the East Fork Bull River and Rock Creek. Brown trout do not pose a hybridization risk, but do pose a risk to bull trout persistence through interspecific competition for spawning and rearing habitat. Brown trout are well established in the downstream reaches of the East Fork Bull River. The Rock Creek and East Fork Bull River bull trout populations were categorized as functioning at risk for persistence and genetic integrity in the BA (USDA Forest Service 2013a).

3.6.3.9.6 Designated Critical Habitat

In 1998, the USFWS listed the bull trout as a threatened species and in 2005 designated critical habitat in five streams in the analysis area: Libby Creek, Poorman Creek, Ramsey Creek, Rock Creek, and West Fisher Creek. In 2010, the USFWS designated additional segments of Libby Creek, Rock Creek, and West Fisher Creek, and also designated some segments of Bear Creek, East Fork Bull River, and Fisher River (Figure 55). The 2010 designation removed the short segments of critical habitat in Ramsey Creek and Poorman Creek designated in 2005. In the 2010 designation, segments in Libby Creek, West Fisher Creek, and Fisher River covered by the Plum Creek Native Fish Habitat Conservation Plan are considered essential excluded habitat. Bull trout are found in the Libby Creek, Rock Creek, East Fork Bull River, and Fisher River drainages in the mine area and along the transmission line alternative corridors (Figure 55).

Most segments of designated critical habitat on Libby Creek are on Montana's list of water quality-impaired streams. Aquatic life support and cold-water fishery uses are only partially supported for this reach. Historical effects of mining and periodic wildfire in upper Libby Creek have limited available fish habitat throughout the Libby Creek drainage. Habitat data on Libby Creek suggest that riparian vegetation and bank stability are improving in the area. Pool habitat and large woody debris, which are important components of bull trout habitat, are present throughout Libby Creek and Bear Creek (Table 65 and Table 66), but the frequency and quality of large, deep pools is low. Redd surveys have indicated that use of Bear Creek for spawning is high, indicating appropriate habitat is available in this stream.

Two segments of designated critical habitat, one 2.8 miles and the other 3.1 miles long, are found on West Fisher Creek in the analysis area (Figure 55). These two segments are along the Alternative E-R transmission line corridor. West Fisher Creek has pools and large woody debris throughout most of its length other than near the mouth of the stream where it becomes very wide. Bank stability is variable, but there is adequate habitat to support fish through the reaches of critical habitat (Table 69).

The segment designated as critical habitat in the East Fork Bull River extends 8.0 miles upstream from the confluence with the Bull River and provides spawning and rearing habitat. The river provides adequate large wood debris to provide bull trout with adequate cover in most reaches. About 30 percent of the available habitat in the reaches above Snake Creek and into the wilderness is dominated by pools. The remainder is high-gradient riffle.

The designated critical habitat in East Fork Rock Creek and Rock Creek is on Montana’s list of impaired streams. Probable causes for the Rock Creek impairment are anthropogenic substrate alterations, with the probable source of these impairments listed as silvicultural activities. The designated critical habitat in lower Rock Creek is adversely affected to some degree in most years due to the seasonal lack of connectivity preventing upstream movement of adult migratory bull trout. Rock Creek lacks surface flow during periods of low flow for the majority of its lower 3.4 miles. Annual subsurface streamflow conditions in summer and early fall severely affect the ability of bull trout to find suitable spawning areas. Consequently, it is likely that reproduction in most years is significantly limited (USFWS 2007a).

3.6.3.10 Forest Service Sensitive Species and State Species of Concern

Westslope cutthroat trout and interior redband trout are Forest Service sensitive species and inhabit streams within the analysis area. Western pearlshell mussels, another Forest Service sensitive species, and torrent sculpin, a Montana species of concern, may also occur within the analysis area.

3.6.3.10.1 Westslope Cutthroat Trout

The Forest Service, DEQ, FWP, and other parties entered into a Memorandum of Understanding and Conservation Agreement in 2007 that was developed to expedite implementation of conservation measures for westslope cutthroat trout throughout their respective historical ranges in Montana (American Wildlands *et al.* 2007). An associated range-wide Interior Redband Trout conservation strategy will serve as a companion document to this Agreement. The range-wide conservation strategy will contain site-specific details relating to conservation actions designed to accomplish the mission and goals in the agreement. Implementation of the agreement will be accomplished through more detailed regional or watershed conservation programs that are developed locally.

Description of the Population Area

Historically, westslope cutthroat trout were likely distributed throughout the analysis area within the Kootenai and Clark Fork River watersheds. Based on the results of genetic analyses, no pure westslope cutthroat trout populations have been found to inhabit the Libby Creek watershed within the analysis area. The hybrid trout populations in Ramsey Creek, Bear Creek, Little Cherry Creek, and segments of Libby Creek downstream of the mine area likely include rainbow/westslope cutthroat, redband trout/westslope cutthroat, and westslope/redband/coastal rainbow trout hybrids (Kline Environmental Research 2004; FWP 2012). The trout tissues tested showed only slight hybridization of the rainbow or redband trout with westslope cutthroat trout, containing 2 percent or less westslope cutthroat trout genes. Based on these results, this species would not be impacted by the proposed activities within the Libby Creek watershed because pure populations are not present

While the MFISH database documented the collection of a few westslope cutthroat trout/rainbow trout hybrids, presumably visually identified, during surveys in 2002, 2009, and 2011, results from all genetic analyses indicated that the westslope cutthroat trout population in the East Fork Bull River is pure (FWP 2012). Genetic analysis of trout from the Rock Creek and the Fisher River watersheds also indicated that pure westslope cutthroat trout were present, but hybrid cutthroat trout have also been collected from these drainages (Horn and Tholl 2011, FWP 2012). Based on these analyses and surveys, pure westslope cutthroat trout populations exist in these three watersheds and could potentially be affected from activities in the analysis area, but the populations may already be threatened by hybridization with rainbow trout.

Subpopulation Size

No westslope cutthroat trout were reported in fish population surveys of the Fisher River mainstem within the analysis area, and only two surveys and the results of genetic analyses recorded the collection of westslope cutthroat trout and their hybrids in West Fisher Creek (FWP 2012). These trout were collected frequently in Miller Creek, as were redband trout/westslope cutthroat trout hybrids, but density data were not provided for these surveys. Relative abundance data indicate that westslope cutthroat trout and their hybrids generally composed between 13 and 67 percent of the trout population in Miller Creek, although no westslope cutthroat trout were collected from the most upstream site surveyed in 2009 (FWP 2012). May (2009) reported densities of 50 to 150 fish/mile in Miller Creek.

Within the Rock Creek watershed, westslope cutthroat trout densities were variable in the surveys conducted annually in most years from 2001 through 2012 in East Fork Rock Creek, with population estimates ranging from 12 to 106 trout/100 meters (Horn and Tholl 2011; Avista 2011, FWP 2012; Kline and Savor 2012). Westslope cutthroat trout were collected at densities of 50 to 150 fish/mile in West Fork Rock Creek and at 0 to 50 fish/mile in Rock Creek, East Fork Rock Creek and Copper Gulch (May 2009). Other earlier surveys also often reported relatively high densities of westslope cutthroat trout within this watershed (Western Resource Development Corporation 1989a; Washington Water Power Company 1996; USDA Forest Service and DEQ 2001), and westslope cutthroat trout were the dominant species in this stream in most surveys. Hybrid westslope cutthroat trout were collected from the more upstream reaches of East Fork Rock Creek and in Rock Lake in 1984, and a single hybrid trout was collected from a reach of East Fork Rock Creek downstream of Rock Meadows in 2010 (Horn and Tholl 2011). The hybridization in analysis area streams may be more widespread than reported, because reliably distinguishing between pure and hybridized westslope cutthroat trout in the field is difficult. The genetic analysis conducted in 1984 indicates that the hybrid trout are composed of 93 percent westslope cutthroat trout genes (FWP 2012).

Westslope cutthroat trout are also relatively abundant in the East Fork Bull River (Washington Water Power Company 1996; Chadwick Ecological Consultants, Inc. 2000; Horn and Tholl 2008, 2011; May 2009; FWP 2012). They were frequently the dominant species in this upper reaches of this stream. Estimates of westslope cutthroat trout abundance in this stream ranged up to 52 trout/100 meters. Based on these data, westslope cutthroat trout populations in the Rock Creek and East Fork Bull River watersheds appear to be viable and thriving, although hybridization with rainbow trout is a concern in both watersheds.

Growth and Survival

Data collected in 1986 and 1987 in East Fork Rock Creek and Rock Lake showed few to no young-of-year fish (age I) (Western Resource Development Corp. 1989a). The trout collected from Rock Lake appeared to have an older age structure than those collected from East Fork Rock Creek, but likely this resulted from the different sampling methods employed to collect trout from the lake (Western Resource Development Corp. 1989a). Growth rates during these surveys were described as low in comparison to other tributaries within the lower Clark Fork River drainage. The instantaneous survival rate of 23 percent was similar to the average for these streams. The East Fork Bull River was surveyed during the same time frame, with the oldest trout collected in the age III+ class. Growth rates and the instantaneous survival rate (26 percent) were similar to the average for the other tributaries within the drainage (Washington Water Power Company 1996). Growth and survival rates in the Rock Creek and East Fork Bull River watersheds appear to be similar or slightly lower than other streams in the lower Clark Fork River drainage.

Life History Diversity and Isolation

Westslope cutthroat trout populations within the Fisher River, Rock Creek, and East Fork Bull River drainages likely consist of both resident and fluvial life history forms, although little data were available for the Fisher River drainage. The only documented barriers to fish passage in East Fork Rock Creek are in the upstream reaches near Rock Lake. No flow at the mouth of Rock Creek isolates fish in Rock Creek seasonally. A natural barrier is present on the East Fork Bull River upstream of the CMW boundary and downstream of the Isabella Creek confluence (Washington Water Power Company 1996; USDA Forest Service and DEQ 2001; Kline and Savor 2012). While the barrier was not assessed to determine if it was a barrier to all fish or if it would be navigable to some fish under some flow conditions, westslope cutthroat trout have been observed upstream of the barrier up to the confluence with Placer Creek (FWP 2012). The presence of migratory westslope cutthroat trout have been documented in the East Fork Bull River and the Rock Creek drainage, although resident fish likely compose the majority of the population in Rock Creek (Katzman and Hintz 2003; Avista 2011). The mainstem of West Fisher Creek has a partial barrier that exists at its mouth due to accumulated sediment that may limit the passage of large migratory fish in low water years, and Miller Creek also has intermittent flows near the mouth, limiting connectivity in this stream for much of the year.

Persistence and Genetic Integrity

In the Fisher River watershed within the analysis area, pure westslope cutthroat trout were collected from Miller Creek and West Fisher Creek, but westslope cutthroat/rainbow or westslope cutthroat/redband/coastal rainbow trout hybrids have also been collected from both streams (FWP

2012). Pure westslope cutthroat trout have not been found in any other stream in the Fisher River watershed within the analysis area. Unless barriers prevent rainbow and redband trout from accessing the upstream reaches of Miller Creek, the trout in the more upstream reaches of Miller Creek are vulnerable to hybridization.

Results of genetic analyses of trout in the East Fork Bull River indicate the westslope cutthroat trout population is pure, and seems to have a lower chance of hybridization occurring because no rainbow, redband, or Yellowstone cutthroat trout have been collected in the surveys of this stream. Population survey and weir trap data for the East Fork Bull River reported the collection of a small number of westslope cutthroat trout/rainbow trout hybrids in 2002, 2009, and 2011, generally from the downstream reaches of the river (FWP 2012). These fish may have been visually identified, as no data were provided to indicate genetic analyses were conducted. No physical barriers exist in the Bull River mainstem or the East Fork Bull River that prevent the rainbow trout and hybrid trout present elsewhere in the drainage from moving upstream to hybridize this population (Washington Water Power Company 1996).

Genetic analysis of trout from the Rock Creek and the Fisher River watersheds also were found to be pure westslope cutthroat trout, but a trout collected in 2010 from downstream of Rock Creek Meadows in East Fork Rock Creek was verified to be a westslope cutthroat trout/rainbow trout hybrid (Horn and Tholl 2011). Population survey and trapping data also indicated the presence of hybrid trout in the mainstem of Rock Creek, although these trout may have only been identified through their visible physical characteristics (FWP 2012). Additionally, several trout collected from an upstream section of East Fork Rock Creek near Rock Lake were found to be hybridized with Yellowstone cutthroat trout and rainbow trout in earlier years. Likewise, genetic analyses on trout collected from Rock Lake indicated that all trout collected were westslope cutthroat trout/Yellowstone cutthroat trout hybrids (FWP 2012).

The seasonally dewatered sections of Rock Creek at the confluence of the Clark Fork River (FWP 2012) may aid in protecting the purity of the westslope cutthroat populations somewhat by acting as a barrier to trout moving upstream during some parts of the year. Barriers to upstream fish passage in Rock Creek are in the upstream Rock Creek Meadows reach and at the outlet of Rock Lake. These barriers do not prevent the movement of fish in a downstream direction, indicating that hybridization of the pure trout within these reaches is possible (Washington Water Power Company 1996). The persistence of westslope cutthroat trout in these drainages is also threatened by the presence of brook trout and brown trout, which may outcompete westslope cutthroat trout for available resources or prey upon them. In the East Fork Bull River, brown trout appear to be flourishing, dominating the fish populations at downstream sites during most surveys (Washington Water Power Company 1996; FWP 2012). In 2007 through 2009, non-native salmonid suppression activities were conducted by Avista in the downstream reaches of East Fork Bull River (Moran and Storaasli 2008; Horn and Tholl 2011). While brown trout and other non-native fish were still present in the lower reaches following this effort, monitoring in 2009 and 2010 indicated a shift toward native species was occurring in this reach.

3.6.3.10.2 Redband Trout

The Forest Service, USFWS, FWP, and other parties entered into a Conservation Agreement in 2014 that outlines a process of cooperation, coordination, and data sharing among the parties with management responsibility and conservation interests for interior redband trout, their habitats and related aquatic community assemblages (California Department of Fish and Wildlife *et al.* 2014). An associated range-wide Interior Redband Trout conservation strategy will serve as a companion document to the agreement. The range-wide conservation strategy will contain site-specific details relating to conservation actions designed to accomplish the mission and goals in the agreement.

Description of the Population Area

Historically, redband trout were distributed throughout much of the analysis area. Based on fish distribution surveys, redband trout and their hybrids are the dominant trout species within the Libby Creek watershed as well as in the upstream segment of the Fisher River and West Fisher Creek. No records of redband trout in the Rock Creek and East Fork Bull River drainages have been recorded (Washington Water Power Company 1996; Chadwick Ecological Consultants, Inc. 2000; USDA Forest Service and DEQ 2001; May *et al.* 2012; FWP 2012). Results of genetic analyses indicate that redband trout are largely hybridized throughout the Libby Creek watershed, but genetically pure redband trout have been reported in segments of Libby, Ramsey, Poorman, Little Cherry, Bear, and Big Cherry creeks, and from the Fisher River (FWP 2012; May *et al.* 2012).

No spawning surveys were available for redband trout. Fish distribution surveys and genetic analyses (Western Resource Development Corp. 1989a; Kline Environmental Research 2004; Kline Environmental Research and Watershed Consulting 2005a; Leary 2006; Dunnigan *et al*. 2011) are the primary data for this subpopulation. Habitat surveys conducted in 1988 (Western Resource Development Corp. 1989a) and in 2005 (Watershed Consulting and Kline Environmental Research 2005) supplement the fish distribution data.

Subpopulation Size

While no redband trout redd surveys have been conducted in the Libby Creek or Fisher River watersheds, fish distribution surveys have shown that redbands and their hybrids are the dominant trout species within the analysis area in both watersheds, with densities over 130 trout/100 meters (Kline Environmental Research 2005a; Dunnigan *et al*. 2011). Based on these numbers, the mixed redband population is viable and thriving in the Libby Creek watershed, with small populations of pure redbands in all of Little Cherry Creek. Pure redband trout have also been collected in segments of Poorman Creek, Libby Creek, Bear Creek, and Ramsey Creek. While no abundance data were available for the Fisher River, the population in the upstream portion of this river consists of pure redband trout. No pure or hybrid redband trout populations occur in the East Fork Bull River or East Fork Rock Creek watersheds. An assessment of the status of redband trout in the Northwest (May *et al.* 2012) reported densities of more than 250 fish/kilometer in Big Cherry, Bear, Little Cherry, and Libby creeks and densities of 101 to 250 fish/kilometer in Poorman and Ramsey creeks. The same authors determined that over 70 percent of the populations were at least moderately healthy based on amount of habitat occupied, abundance within the population, habitat quality parameters, presence of non-native fish, and number of streams associated with the populations.

Growth and Survival

The Libby Creek watershed within the analysis area is mainly inhabited by young trout, as is typical for headwater streams with low productivity. Available data have shown stable numbers of fish over time on streams where data were collected. Ramsey Creek was the only project stream in which older redband trout were collected. Growth rates for all age classes were low, probably due to low nutrient concentrations in these streams. Data to determine survival rates for the Libby Creek drainage subpopulation are insufficient.

Life History Diversity and Isolation

The Libby Creek and Fisher River watersheds' redband populations likely have both resident and fluvial, migratory life history forms. Redband trout have been collected in recent surveys from the segment of Little Cherry Creek located upstream of a series of fish barriers, which are considered impassable for trout. The redband trout population in this stream appears to be genetically pure based on the recent 2005 genetic analyses (Leary 2006). Genetic analyses of redband trout in Poorman Creek and the Fisher River also indicate that these populations are pure, possibly also as a result of barriers that keep the trout isolated from downstream hybridized populations. In the case of the redband trout present in the Libby Creek mainstem and the Fisher River, complete isolation from other rainbow, westslope cutthroat, or hybrid trout is unlikely because these other trout species have been identified in tributaries within the analysis area (FWP 2012). Migratory redband trout probably persist in the remainder of the Libby Creek watershed not isolated through barriers, as well as in the Fisher River watershed.

Persistence and Genetic Integrity

Based on available data, the redband trout population within the Libby Creek watershed consists mostly of redband/cutthroat and redband/rainbow trout hybrids. Some genetically pure redband trout have been collected in Libby Creek. Rainbow trout are stocked annually in Howard Lake (FWP 2012) and likely access Libby Creek and its tributaries through Howard Creek. Genetic analyses have also shown that the redband populations in Ramsey Creek and Bear Creek are hybridized to a lesser extent with both rainbow and westslope cutthroat trout. Non-hybridized redband trout populations do persist in Poorman Creek and Little Cherry Creek, possibly due to the presence of barriers to fish moving upstream from Libby Creek. Leary (2006) reviewed the 1991, 1992, and 2005 genetic analyses results from trout in Little Cherry Creek and noted that substantial genetic changes had been observed in the redband trout population over a relatively short time period. These changes suggest there is a low effective population size for redband trout in Little Cherry Creek. Non-hybridized redband trout also inhabit the upstream segment of the Fisher River, but they are likely vulnerable to hybridization because westslope cutthroat trout, rainbow trout, and hybrid trout exist in tributaries to this segment of the Fisher River and in downstream segments.

3.6.3.10.3 Western Pearlshell

The western pearlshell mussel is native to western North America. Montana populations are becoming less viable with decreased streamflows, warming, and habitat degradation. The mussel prefers stable gravel and pebble substrates in small to medium cold-water rivers characterized as having Rosgen C channel morphology and moderate slopes (Stagliano 2010). Surveys conducted by the Montana Natural Heritage Program (MNHP) of streams in or near the analysis area, such as Fisher River and Big Cherry Creek, did not find any evidence of a mussel population (Stagliano 2010).

3.6.3.10.4 Torrent Sculpin

This species is difficult to differentiate morphologically from slimy sculpin, and both species occur within the streams potentially affected by the mine. The MFISH database lists torrent sculpin as being abundant in Libby Creek and Miller Creek and as occurring rarely or being of unknown abundance in East Fisher Creek, Standard Creek, and Flower Creek (FWP 2012). No specific surveys in which these fish were collected were documented in the database, although many surveys did not identify sculpin that were collected at the species level. Sculpin were common at the downstream Libby Creek site surveyed in 2005 (Kline Environmental Research and Watershed Consulting 2005a), and were also collected in small numbers at the Libby Creek sites further upstream and in Poorman Creek. These may have been torrent sculpin, but slimy sculpin are also stated to be present in the Libby Creek drainage (FWP 2012).

Torrent sculpin distribution is somewhat patchy (Tabor *et al*. 2007), and they are limited to the Kootenai River system in Montana (Hendricks 1997). They generally inhabit fast, clear streams, but may also be found in lake shores. They prefer cobble or gravel substrates, and they spawn in spring or early summer by laying their eggs on the underside of rocks (Brusven and Rose 1981; Hendricks 1997). These fish prey on a large variety of organisms, including insects, clams, crustaceans, and fish, and are in turn considered prey for some salmonids and other fish (Hendricks 1997, Tabor *et al*. 2007). High peak flows have been observed to have a deleterious effect on some sculpin species (Erman *et al*. 1988).

3.6.3.11 Existing Watershed Conditions

The potentially affected threatened and sensitive fish species in analysis area streams include bull trout, redband trout, westslope cutthroat trout, and torrent sculpin. This analysis will focus on their habitat needs. Section 3.11, *Surface Water Hydrology*, gives a more thorough review of the existing hydrologic conditions in the Libby Creek watershed.

The variables analyzed correspond to habitat indicators listed on the USFWS matrix for bull trout (USFWS 1998a), but these variables were also used to assess effects on other sensitive fish species in the analysis area. Existing conditions for each habitat indicator are described, with the assessment including the segments of the Libby Creek, Fisher River, East Fork Bull River, and Rock Creek watersheds that are within the analysis area. Major assessments of the Libby Creek drainage occurred for the 1992 Montanore Project Final EIS in 1988 (Western Resource Development Corp. 1989a) and as an update of the 1992 Final EIS data in 2005 (Kline Environmental Research and Watershed Consulting 2005a; Kline Environmental Research 2005a, 2005b, 2005d; Kline Environmental Research *et al.* 2005; Watershed Consulting and Kline Environmental Research 2005). Habitat surveys at selected sites also were conducted before and after the baseline surveys in 1988, as summarized by Kline Environmental Research (2004) and USDA Forest Service (2005b). Surveys were also conducted by MMC or the Forest Service in the East Fork Bull River, Rock Creek, East Fork Rock Creek, and West Fork Rock Creek in 2012 to provide additional baseline data on the aquatic habitat (Kline and Savor 2012; Salmon Environmental Services 2012).

3.6.3.11.1 Temperature

Riparian harvest and channelization (especially on Libby Creek) on National Forest System lands and other private lands along the mainstems of streams in the analysis area has occurred for mining, land development, and land management. Grazing occurs only on private property in the Libby Creek drainage. It is likely that there has been a noticeable change in temperature as a result of these actions on lands in the analysis area.

Water temperature monitoring occurred on both Libby Creek (two sites, upper and lower) and West Fisher Creek (at one site near the confluence with the Fisher River). Temperature data indicate that the lower and middle segments of Libby Creek and the lower segment of West Fisher Creek are warmer than 59ºF, a maximum limit for salmonids, for numerous days during the summer months and may create thermal barriers for bull trout and other species.

Temperature data collected in 2005 through 2007 in the Libby Creek watershed by Kline Environmental Research (2007b) ranged from 32°F to 70°F, with maximum 7-day average maximum temperatures at each site ranging from 50°F at a site on Libby Creek upstream of the Howard Creek confluence to 68°F at a site on Libby Creek downstream of the Crazyman Creek confluence over this time period. These data were from up to eleven temperature loggers placed at sites L1, L2, L9, L10, Be2, LC1, LC3, Po1, Po2, Ra2, and Ra3 (Figure 52). Temperatures were generally warmest in late July. A single temperature reading was also collected from multiple reaches in the headwaters of Libby Creek and Ramsey Creek in September 2012, with data at some sites in Libby Creek also collected in September 2010 and 2011 (Kline Environmental Research and NewFields 2012). Temperatures were often warmer at the more downstream sites, and ranged from 43°F to 50°F. Most of the sites where the temperature data were collected were upstream of the known bull trout distribution.

As part of the MPDES permitting process, synoptic temperature data were collected once or twice a month from February 2014 through April 2015 from two sites on Libby Creek—one upstream of the Water Treatment Plant discharge (LB-200) and one below (LB-300). Temperatures ranged from 33°F to 50°F over this time period, with the highest temperatures occurring in July through September. Temperature differences between the two sites were generally 2°F or less (DEQ 2015b).

Temperature data also were collected in 1994, 2002, and in May 2009 through September 2011 in the East Fork Bull River. Temperatures averaged 50°F, 37°F, 38°F, and 43°F in the summer, fall, winter, and spring of 1994, with maximum temperatures of 62°F and 59°F occurring in 1994 and 2002, respectively (Washington Water Power Company 1996; Liermann and Tholl 2003). Daily mean temperatures ranged from 32°F to 57°F in 2009 through 2011, and peaked in August of each year (USDA Forest Service 2011h, 2011i, 2011j).

Temperatures were monitored in Rock Creek in 1994, 2008, and 2011. In 1994, stream temperatures averaged 51°F in the summer, 43°F in the fall, 38°F in the winter, and 44°F in the spring, with a maximum temperature of 54°F (Washington Water Power Company 1996). Temperature data from various sources in 2008, 2011, and 2012 indicated that the maximum temperature reached was 64°F in August 2011 (Moran *et al*. 2009; Salmon Environmental Services 2012; Kline Environmental Research and NewFields 2012).

Bull trout require water temperatures ranging from 36°F to 59°F, with temperatures at the low end of this range required for successful incubation (USFWS 1998b USFWS 2014c). The other trout and sculpin species that occur in analysis area streams are also species that require cold water temperatures. Based on available data, the temperatures in many stream reaches were within this range for most of the year. Maximum water temperatures were occasionally above 59°F within the Libby Creek, Fisher River, East Fork Bull River, and East Fork Rock Creek watersheds, generally at the more downstream site locations during the summer months. The BA categorized temperature as a habitat parameter that was functioning either at risk or at unacceptable risk for Libby Creek, Bear Creek, Ramsey Creek, the Fisher River, and the East Fork Bull River. The BA categorized temperature as functioning appropriately in Poorman Creek and Rock Creek (USDA Forest Service 2013a).

3.6.3.11.2 Sediment

Substrate composition is dominated by cobble and gravel in most surveyed sites in the analysis area (Watershed Consulting and Kline Environmental Research 2005; Kline and Savor 2012). The mean percent fines (described in the report as fines less than 6.25 mm or 0.25 inches) in gravel at each site within the Libby Creek watershed ranged from 15 percent at the lowest Libby Creek site to 39 percent at the most upstream Little Cherry Creek site in 2005 (Table 68) (Watershed Consulting and Kline Environmental Research 2005). Surveys conducted in 2006 through 2008 indicated that the percent fines in low gradient riffle areas in the Libby Creek watershed were generally less than 10 percent at most sites, although the reach of Libby Creek upstream of the falls and the Little Cherry Creek reach had higher percentages during some surveys (Kline Environmental Research 2009). Fines at the Little Cherry Creek site were elevated up to 95 percent in 2008, potentially due to logging activity within the area.

Percent fines within core data collected in the Rock Creek watershed ranged from 0 percent to 34 percent during recent surveys, although the percentage within the pool crest areas was sometimes higher than this range (Carlson, pers. comm. 2012; Salmon Environmental Services 2012). Earlier surveys of this watershed in 1992 through 1994 measured fines as composing 43 percent of the substrate at one site on East Fork Rock Creek and up to 28 percent at two sites on West Fork Rock Creek (Table 68) (Washington Water Power Company 1996). Percent fines were measured in the East Fork Bull River during this time period as well, and ranged from 15 to 33 percent in spawning areas. Percent fines were measured in West Fisher Creek multiple times between 2006 and 2010, and ranged from 10 percent to 32 percent (Dunnigan *et al*. 2011).

Incubation of bull trout embryos begins to decrease substantially when more than 30 percent of the sediment is smaller than 0.25 inches in diameter, and other lethal, sublethal, and behavioral effects can occur when sediment levels are elevated above background levels. There is an inverse relationship between the percentage of fine sediment in the incubation habitat and survival until emergence (Weaver and Fraley 1991). Based on these data, sediment levels in many of the surveyed stream reaches are less than this level and are not currently a limiting factor. The percentage of fine sediment may be more of a risk factor in Little Cherry Creek, Libby Creek, and in the Fisher River watershed, as the percentage of fine sediment has been measured above or near the 30 percent threshold in these streams. Rock Creek also had fine sediment levels above this threshold in the past, but the more recent data indicates levels are near or below this threshold. The BA categorized this parameter as functioning at unacceptable risk for Libby Creek, Bear Creek, and the Fisher River (USDA Forest Service 2013a). Rock Creek and the East Fork Bull River were categorized as functioning at risk.

3.6.3.11.3 Nutrients and Contaminants

The Libby Creek reach from 1 mile upstream of the Howard Creek confluence to the US 2 bridge is included on Montana’s list for water quality impaired streams. Use as a drinking water supply is not supported as a beneficial use, and aquatic life support and cold-water fishery uses are only partially supported for this reach. In 2014, probable causes listed by the DEQ were alteration in stream-side vegetative cover, and physical substrate habitat alterations likely resulting from impacts from abandoned mine lands and placer mining. These impairments are not pollutants, and do not require development of a TMDL (DEQ and EPA 2014).

Generally, nutrient and most metal concentrations in analysis area streams are low. Nitrate/nitrite concentrations in Libby Creek downstream of the Libby Adit were elevated from 1990 through 1995 due to discharge from the adit (ERO Resources Corp. 2011c). Existing metal concentrations occasionally exceed the chronic ALS for aluminum, cadmium, copper, iron, and lead and the acute ALS for silver at various locations in the Libby Creek watershed, but most exceedances occur infrequently based on the available data (Appendix K) and likely do not pose significant risks to aquatic life inhabiting these streams under existing conditions. Metal concentrations in analysis area streams are often below the detection limit.

Copper concentrations could be of particular concern as increases in dissolved copper concentrations above ambient concentrations may result in interference with sensory systems in trout and other fish, and, thus with predator avoidance behaviors, juvenile growth, and migratory success (Baldwin *et al*. 2003; Hetch *et al*. 2007). Effects on mayflies and overall diversity in streams have also been attributed to elevated copper concentrations (Montz *et al*. 2010). While copper concentrations above the chronic ALS were documented infrequently in the Libby Creek watershed and East Fork Rock Creek, the majority of samples collected in these streams and throughout the analysis area had concentrations below detection limits (Appendix K). The presence of diverse size classes of fish in the Libby Creek watershed streams suggests concentrations of these metals are not contributing to acute toxic effects for fish populations. It is not known whether chronic metal toxicity may be contributing to low population densities in these streams. The BA categorized Libby Creek as functioning at unacceptable risk for nutrients and contaminants based on the impaired streams listing, while Bear Creek, Ramsey Creek, and Poorman Creek were classified as functioning appropriately or functioning at risk (USDA Forest Service 2013a).

Big Cherry Creek from Snowshoe Creek to the mouth is impaired due to alteration in stream-side vegetative cover, cadmium, lead, zinc, and physical substrate habitat alterations. Probable sources of impairment are forest road construction and use, mine tailings, impacts from abandoned mine lands, and habitat modification. This section of Big Cherry Creek is listed as not supporting aquatic life. A TMDL for cadmium, lead, and zinc was established in Big Cherry Creek; alteration in stream-side vegetative cover and physical substrate habitat alterations are not pollutants and did not require a TMDL (DEQ and EPA 2014).

The Fisher River from the confluence of the Silver Butte Fisher River and the Pleasant Valley Fisher River to the confluence with the Kootenai River is included on Montana’s list of impaired streams, with aquatic life support and cold-water fishery uses only partially supported. In 2014, probable causes for the Fisher River impairment were an altered flow regime and streambank modification and destabilization. Nutrients and contaminants were described as a parameter that was functioning between risk and unacceptable risk for this river (USDA Forest Service 2013a). In 2014, the DEQ and the EPA issued TMDLs and water quality improvement plan for the Kootenai River-Fisher River Project Area, which included the Fisher River. The DEQ performed updated assessments on the Fisher River for metals impairment and did not identify metals impairment conditions in the Fisher River in the reassessment. The remaining impairment, high flow regime, does not require development of a TMDL (DEQ and EPA 2014).

While no mining or other industrial activities currently exist within the East Fork Bull River that would be likely to result in contamination in this watershed, activities on private land were cited as resulting in this parameter being classified as functioning at acceptable risk as well. Nutrient and contaminant levels within Rock Creek were low and categorized as functioning appropriately.

Rock Creek from the headwaters (Rock Lake and East Fork Rock Creek) to the mouth below Noxon Dam is also listed as impaired, with aquatic life support and cold-water fishery uses only partially supported. Probable causes for the Rock Creek impairment are other anthropogenic substrate alterations, with probable sources of these impairments listed as silvicultural activities.

TMDLs are not required on Rock Creek because no pollutant-related use impairment has been identified (DEQ 2010a).

3.6.3.11.4 Physical Barriers

Presently, man-made barriers, natural barriers, intermittent flows, and the small stream size of many tributaries limit bull trout distribution and connectivity in the Libby Creek watershed. A natural 39-foot waterfall on Libby Creek upstream of the Howard Creek confluence is an upstream barrier to all fish under all flow conditions. This barrier isolates the bull trout population upstream of these falls to a portion of the watershed. Natural barriers on Little Cherry Creek, Poorman Creek, and Ramsey Creek cause portions of these tributaries to be inaccessible to fish from Libby Creek (Kline Environmental Research 2005a). Little Cherry Creek provides the least amount of habitat for fish moving from Libby Creek because of the close proximity of natural barriers to the confluence of Little Cherry Creek and Libby Creek. Culverts may limit the passage of juvenile fish on Little Cherry Creek and Poorman Creek. Thermal barriers also exist seasonally in some years within the Libby Creek watershed.

The BA categorized the presence of man-made physical barriers as a parameter that was functioning at risk in Libby Creek due to the thermal barriers and in Poorman Creek due to the culvert and intermittent reach that is present near the confluence with Libby Creek in some years (USDA Forest Service 2013a). The lack of any such barriers on Ramsey Creek and Bear Creek resulted in a classification of functioning appropriately for these streams. For the most part, the connectivity and availability of bull trout habitat is not significantly limited by man-made barriers in the portion of the Libby Creek watershed within the analysis area.

No man-made barriers have been described in the East Fork Bull River and the Fisher River, but no surveys specifically assessing fish passage were available. A natural barrier was documented over 1 mile upstream of the CMW boundary on the East Fork Bull River, but the navigability of this barrier was not assessed to determine if it is passable to some fish under some flow conditions (Washington Water Power Company 1996; USDA Forest Service and DEQ 2001; Kline and Savor 2012). Fish populations exist upstream of the barrier up to the confluence with Placer Creek (FWP 2012). Thermal barriers occur on the Fisher River seasonally. The East Fork Bull River and Fisher River were categorized as functioning appropriately and functioning at risk, respectively. In West Fisher Creek drainage, the mouth of the stream has become extremely braided. There are numerous small side channels connecting the Fisher River with West Fisher Creek. These channels allow minimal passage for large migratory fish. These fish stack up in the Fisher River under the US 2 bridge and wait for months until rain brings enough water to open up access into the drainage.

A natural barrier to upstream fish movement is present on East Fork Rock Creek 3 miles upstream of the confluence with West Fork Rock Creek (Washington Water Power Company 1996; USDA Forest Service 2013a). This barrier does not prevent downstream fish passage (Washington Water Power Company 1996). A waterfall that acts as barrier to upstream fish movement also exists on West Fork Rock Creek 2 miles upstream of the mouth. Two reaches of Rock Creek near the mouth, as well as reaches of West Fork Rock Creek, are periodically dry, which are barriers to fish during low flow periods (FWP 2012) and result in this parameter being categorized as functioning at unacceptable risk (USDA Forest Service 2013a).

3.6.3.11.5 Substrate Embeddedness

The dominant substrate classes in the Libby Creek watershed are cobble and gravel (Watershed Consulting and Kline Environmental Research 2005). Substrate embeddedness in low gradient riffle areas at most sites generally increased from 2006 through 2008 in the Libby Creek watershed. Embeddedness at most of the sites surveyed was scored as being less than 25 percent throughout 2006 and most of 2007, but was higher in fall 2007 and throughout 2008 (Kline Environmental Research 2009). Embeddedness in Little Cherry Creek in 2005 was low for most of the stream length, but high through a 1,000-foot reach about 3,300 feet upstream of the Libby Creek confluence (Kline Environmental Research 2005a). Embeddedness was also determined at a single site in Little Cherry Creek in 2007 and 2008, and varied from less than 10 percent to over 50 percent in low gradient riffle habitat (Kline Environmental Research 2009). Substrate embeddedness was also assessed for sites on Libby Creek in 2006 through 2008, and a site each on Poorman Creek, Ramsey Creek, and Bear Creek in 2007 and 2008. Embeddedness at most of the sites surveyed was scored as being less than 25 percent throughout 2006 and most of 2007, but was higher in fall 2007 and throughout 2008. Embeddedness was greater than 60 percent at two of the Libby Creek sites in October 2008.

Substrate in the East Fork Bull River is primarily gravel and cobble, while the substrate in Rock Creek is predominately cobble, gravel, and boulder (Washington Water Power Company 1996; Kline and Savor 2012). No data on embeddedness were available for these streams or streams within the Fisher River watershed. Based on these data, substrate embeddedness was categorized as functioning at acceptable risk for Libby Creek, Bear Creek, East Fork Bull River, and the Fisher River, and was functioning appropriately for Rock Creek and some of the Libby Creek tributaries (USDA Forest Service 2013a).

3.6.3.11.6 Large Woody Debris

The number of pieces of LWD per mile ranged from 22 to 338 within the Libby Creek watershed (Watershed Consulting and Kline Environmental Research 2005). LWD was most abundant in Little Cherry Creek, but was found at densities higher than 105 LWD/mile at all sites except for four of the Libby Creek sites (Table 65). Surveys indicated that adequate cover in the form of LWD was also available for bull trout within the East Fork Bull River and Rock Creek watersheds. An average of 243 pieces of LWD/mile and 274 pieces of LWD/mile were counted in the Rock Creek and East Fork Bull River reaches surveyed in 1992 through 1994 (Washington Water Power Company 1996). More recent surveys indicated that 115 to 754 pieces of LWD/mile were present in stream reaches within the Rock Creek watershed, and 59 to 96 pieces of LWD were present in reaches within the East Fork Bull River (Kline and Savor 2012; Carlson, pers. comm. 2012). Based on these data, the amount of large woody debris within the analysis area is sufficient to provide bull trout with adequate cover in most reaches. Streams in the analysis area generally met the RMO for LWD, with the exception of a few sites on Libby Creek and a site on West Fisher Creek (Table 66 and Table 69). The BA categorized this variable as functioning at risk in Libby Creek, Rock Creek, and the Fisher River, and functioning appropriately in Bear Creek and the East Fork Bull River (USDA Forest Service 2013a).

3.6.3.11.7 Pool Frequency and Quality

The streams within the analysis area are generally lacking in pools, with pool frequency less than the RMOs and the number of pools per mile recommended by the USDA Forest Service (1998b) during the sampling conducted in 2005 (Table 65) and other sampling events (Table 66, Table 69, and Table 70). With the past history of management in RHCAs, the high densities of roads in

RHCAs, and the large amounts of bedload transport in these streams, it is unlikely that many pools will be naturally generated in the mainstems of these drainages to satisfy this RMO. Pool generation in small streams is directly related to production of LWD in RHCAs. As trees fall into the stream, they modify streamflows in such a way that creates pools. The lack of LWD causes stream velocities to be faster and more direct, resulting in a lack of scoured pools. Although the RMO for LWD was met in many small streams, future production of LWD in RHCAs of larger streams will be limited due to the high densities of road and past timber harvest. Fine sediment will continue to be produced from timber management and road construction in the drainages under existing conditions, which will continue to negatively impact pools. Libby Creek, Bear Creek, the Fisher River, Rock Creek, and the East Fork Bull River were all rated as functioning at risk or functioning at unacceptable risk in the BA based on a low frequency or quality of pools (USDA Forest Service 2013a).

3.6.3.11.8 Large Pool Frequency

Quality pools are generally over 3 feet deep and have sufficient cover to hide fish. Measured pools during fisheries habitat surveys generally had adequate cover but lacked depth. Attempts to enhance pools in Libby Creek (mostly by FWP) have not been successful. Constructed pools were destroyed by high peak flows in the spring of 2007. The KNF also constructed some pools and completed bank stabilization work on 3,800 feet on West Fisher Creek in 1997. The project is showing signs of stress from high flows and will need future work to further stabilize the area. High rain-on-snow events and active channel migration in these streams will continue to move large amounts of bedload and create channel widening. Loss of LWD and impacts from private land will continue in the RHCAs of both drainages. As long as conditions do not change, this habitat characteristic will not meet RMOs.

The downstream Libby Creek site had the highest number of deep and large pools per mile of the analysis area streams based on data from surveys conducted in 2005 (Watershed Consulting and Kline Environmental Research 2005). No other site had a significant number of deep pools (described in this survey as pools with a maximum depth greater than 5.2 feet), although large shallower pools (with depths greater than 2.6 feet and covering an area of greater than 215 square feet) were found on several Libby Creek sites, the Bear Creek site, and the two downstream Ramsey Creek sites. Some stream reaches within the analysis area may provide poor cover for bull trout due to the limited number of pools of sufficient depth and area. The Libby Creek and Bear Creek watershed were categorized as functioning at unacceptable risk and functioning at risk, respectively, for large pool frequency in the BA (USDA Forest Service 2013a).

Pool quality data were collected in August 2012 for the Rock Creek and East Fork Bull River watersheds, and indicated that a higher number of deep pools occur in the downstream reaches of these streams compared to those in the Libby Creek watershed. The number of deep pools per mile(described as those greater than 3.3 feet in maximum depth) in these two watersheds ranged from 1 pool per mile in West Fork Rock Creek to 13 pools per mile in the Rock Creek mainstem and one reach of the East Fork Bull River (Kline and Savor 2012). Pool quality data were not available for the Fisher River watershed. This parameter was categorized as functioning at risk for Rock Creek, functioning appropriately for the East Fork Bull River, and functioning at unacceptable risk for the Fisher River in the BA (USDA Forest Service 2013a).

3.6.3.11.9 Off-Channel Habitat

Off channel habitat is found in overflow and other side channels, backwaters, wetlands, tributary streams, and springs in the RHCAs of the mainstems of analysis area streams, and provides additional habitat for fish. The availability and type of habitat varies by stream in the analysis area. The analysis area supports classic mountain streams with moderate gradients and moderate entrenchment ratios. This changes to deeply incised boulder/bedrock-dominated streams in the headwaters and gentler gradient wider floodplains with low incision ratios in the lower segments of the larger streams. The analysis area contains almost every type of stream channel on the KNF. The high densities of road in the RHCAs limit the streams' ability to make adjustments and create off-channel habitat, disrupting the long-term stability of this type of habitat.

Off-channel habitat is somewhat limited in some stream segments within the Libby Creek watershed. Several off-channel pools/backwaters were noted in Little Cherry Creek, primarily in the more upstream reaches (Kline Environmental Research 2005a). Multiple side channels were documented in Bear Creek during the 2005 survey, which could provide habitat for juvenile salmonid rearing (Watershed Consulting and Kline Environmental Research 2005). Side channels, springs, and tributary streams were observed during the habitat surveys conducted within the Rock Creek watershed in 2012 as well (Carlson, pers. comm. 2012), although this stream was described as naturally limited for this type of habitat in previous assessments (USFWS 2006). The upstream reaches of the East Fork Bull River have side channels and off-channel rearing areas present (Land and Water Consulting 2001), while the Fisher River watershed has limited amounts of this type of habitat, with much of the backwaters, wetlands, and overflow channels eliminated by the rechannelization that has occurred in the Fisher River (USDA Forest Service 2013a). No other off-channel habitat has been documented in analysis area streams.

Off channel habitat availability was categorized as functioning at risk in almost all streams within the analysis area in the BA (USDA Forest Service 2013a). This parameter was described as functioning appropriately in the East Fork Bull River.

3.6.3.11.10 Refugia/Prime Habitat

Very few areas of high quality (prime) habitat exist in the analysis area due to roads within the riparian areas, past mining practices, and timber harvest in the lower portions of analysis area streams. Surveys have found that many streams do not meet the RMOs for pool frequency, and deep pool habitat that would serve as refugia is generally lacking. Stream reaches in the CMW portion of the analysis area are considered prime habitat. No timber management has occurred on these streams and human impacts are almost non-existent.

Only limited areas of diverse and high quality habitat exist over most of the analysis area in the Libby Creek watershed. Availability of habitat in the tributaries for fish moving from Libby Creek is limited by barriers, particularly in Little Cherry Creek (Kline Environmental Research 2005b). In 2002, the FWP completed stream restoration work on a segment of Libby Creek downstream of the Howard Creek confluence. The goal for this restoration project was to increase habitat quality for salmonids throughout this reach by increasing sinuosity, excavating depositional areas, and installing structures to increase bank protection, bank stabilization, gradient control, and pool habitat. The riparian vegetation was also restored (Dunnigan *et al.* 2003; Kline 2004). Much of this habitat work was destroyed by a rain-on-snow event that occurred in 2006, but the habitat has continued to recover and has remained better than before based on monitoring through 2009 (Dunnigan *et al*. 2011).

A channel restoration project in East Fork Bull River was completed in 2001. About 1,200 feet of the stream were restored by returning a braided channel to a single channel through the construction of rootwad and log revetments (logs anchored against the streambank to buffer stream energy), the placement of large woody debris weirs, and the revegetation of the streambanks and floodplain. The goal of this restoration was to move the channel away from a landslide with the intent of reducing sediment contributions (Avista 2007; FWP 2012). The channel has migrated to the opposite bank, so this section is currently dry. Additional work has been completed upstream of this section that should reduce sediment and improve habitat in the lower reaches of the East Fork Bull River.

The BA categorized the amount of refugia and prime habitat as functioning at unacceptable risk in Libby Creek, and as functioning at risk in Bear Creek, Rock Creek, and the Fisher River (USDA Forest Service 2013a). This parameter was determined to be functioning appropriately in the East Fork Bull River based on the abundant large woody debris and side channel development in this stream.

3.6.3.11.11 Scour Pool Width/Depth Ratio

To be categorized as functioning appropriately, the average wetted width/maximum depth ratio in scour pools within a reach is expected to be ten or less (USFWS 1998b). Most measured pools on the lower segments of stream channels in the analysis area are shallow and wide, while pools measured in headwater reaches are narrow and deep. Pools in the mainstems of larger analysis area streams have high peak flows from spring runoff and rain-on-snow events. These high flows coupled with high bedload and the relatively wide floodplains make pool creation and maintenance extremely difficult.

Based on the data collected in 2005 (Watershed Consulting and Kline Environmental Research 2005), the average wetted width to average maximum depth ratio in scour pools within each reach in the Libby Creek watershed ranged from 6.5 to 11.2, with between six and 39 pools measured in each stream. All analysis area streams have ratios less than ten except for Ramsey Creek, indicating that, while pool frequency may be low, pools exist within the Libby Creek watershed in the analysis area of sufficient depth to provide refuge for larger migratory fish and rearing habitat for the young of year fish and sub-adults. The BA characterized scour pool width/depth ratios as functioning at acceptable risk for Libby Creek and Bear Creek (USDA Forest Service 2013a).

For the Fisher River watershed, no data were available for the Fisher River itself, but pools in Miller Creek had average width to average maximum depth ratios that were all 10 or lower, although all pools measured were not specifically scour pools. Habitat surveys conducted in 2012 in the Rock Creek and East Fork Bull River calculated the scour pool average width to maximum depth ratios as ranging from 5.8 in the Rock Creek mainstem to 7.8 in the middle reach surveyed on the East Fork Bull River. These values indicate that pools exist within these watersheds as well that are of sufficient depth to provide refuge for larger migratory fish and rearing habitat for the young of year fish and sub-adults. The width/depth ratios within scour pools were classified as functioning appropriately in the BA in the Fisher River, Rock Creek, and the East Fork Bull River (USDA Forest Service 2013a).

3.6.3.11.12 Streambank Conditions

Portions of Libby Creek and other analysis area streams have been cited as having accelerated bank erosion, altered riparian zones, and reduced high quality habitat for salmonids due to human-caused disturbances such as logging, mining, riparian road construction, and stream channel manipulation (Washington Water Power Company 1996; Dunnigan *et al.* 2004). Habitat restoration projects have focused on improving some of these segments. Additionally, the high spring peak flows and rain-on-snow events that occur within the analysis area have the capacity to destabilize banks, particularly in the larger streams. Based on the inability of the channel to contain peak flows and riparian disturbance, streambank stability within all of the larger streams within the analysis was categorized as functioning at risk in the BA (USDA Forest Service 2013a). The smaller streams are more armored, and less bank instability has been observed.

To be classified as functioning appropriately, 80 percent or more of the length of the streambanks within a reach should be at least 90 percent stable (USFWS 1998b). Despite the alterations that have occurred in some areas, habitat surveys conducted from 1998 through 2005 generally found that bank stability was high at many sites, with ratings of 90 to 100 percent stability in almost all stream reaches in the Libby Creek and Fisher River watersheds (Table 65, Table 66, and Table 69) (USDA Forest Service 2005a; Watershed Consulting and Kline Environmental Research 2005). Bank stability was also described as stable in Rock Creek and the East Fork Bull River in surveys completed in 1992 through 1994 (Washington Water Power Company 1996). Percent bank stability in the 2012 survey of three reaches of the East Fork Bull River ranged from 92 to 96 percent (Table 70). The high stabilities reported in these surveys indicate that this should not be a factor limiting available trout habitat, although the riparian disturbance and high peak flows in the analysis area suggest that the stability could be further affected by these factors in the future under current conditions.

3.6.3.11.13 Floodplain Connectivity

Braiding is common throughout the mainstems of Libby Creek, West Fisher Creek, and Fisher River. Braiding occurs in streams with wide floodplains and large amounts of bedload. The bedload is moved during high flows, and can cause channels and associated wetlands to become disconnected from the main channel during low flows. Significant changes in riparian value and function due to channelization, land development, timber harvest, road construction, and mining, have contributed to destabilization of stream channels in the analysis area.

No specific data on floodplain connectivity were available for analysis area streams. Habitat surveys in the Libby Creek watershed stated that the channel capacity for most streams in the analysis area was inadequate or barely contained peak flows, with overbank flooding occurring occasionally or frequently (Kline Environmental Research 2004; USDA Forest Service 2005b). Overbank flooding is considered necessary for maintaining wetland functions, riparian vegetation, and succession (USFWS 1998b). Assessing floodplain connectivity in headwater mountain streams is complicated by the fact that they are usually restricted by a narrow, frequently incised mountain valley configuration and may not have a classic “floodplain.” The BA characterized floodplain connectivity as functioning at unacceptable risk for Libby Creek and the Fisher River, and functioning at risk for Bear Creek, Rock Creek, and the East Fork Bull River (USDA Forest Service 2013a).

3.6.3.11.14 Change in Peak Flow and Baseflow

Peak streamflows occur annually between April and June, with the highest flows most often occurring in May, then in April. Section 3.11, *Surface Water Hydrology*, discusses peak flow in analysis area streams. Typically, smaller, short-term (several weeks or less) increases in streamflow occur in October through March due to precipitation and snowmelt events. Libby Creek has a highly variable flow regime, with flooding regularly occurring and resulting in annually high suspended sediment levels and bedload movement (USDA Forest Service 2013a).

As discussed in section 3.11, *Surface Water Hydrology,* few streamflow data from the upper reaches of most analysis area streams draining the CMW are available. Based on the agencies' review of long-term flow data from perennial stream reaches determined to be similar to lower stream reaches of the Montanore Project analysis area, it appears that perennial streams in the area with a baseflow component may flow at baseflow for about 1 to 2 months sometime between mid-July to early October. The stream hydrographs indicate that periods of baseflow also may occur during November through March, but these baseflow periods were not included in the baseflow estimate of 1 to 2 months.

Since the turn of the century, timber harvest, road construction, mining, and human development have changed watershed character and, as a result, the watershed's response to weather events. Various stream reaches have become intermittent in nature due in part to the large depositions of bedload, channel braiding, and widening, including reaches of Little Cherry Creek, Poorman Creek, Rock Creek, West Fork Rock Creek, and West Fisher Creek (Kline Environmental Services 2005b; Salmon Environmental Services 2012; USDA Forest Service 2013a). While many of the analysis area streams naturally have high peak flows during spring snow melt and rain-on-snow events, these past human activities may be intensifying the damage to these streams caused by peak flows. In addition, the current adit dewatering has likely resulted in a reduction in Libby Creek baseflow, but the effect is not detected because either the reduction is very small and/or there are insufficient baseline data (before the adit was constructed) for comparison to current conditions. The range of measured minimum and maximum streamflows is provided in Table 105. This parameter was categorized as functioning at unacceptable risk in Libby Creek, Bear Creek, Rock Creek, and the Fisher River due to these factors, and was categorized as functioning at risk in East Fork Bull River (USDA Forest Service 2013a).

3.6.3.11.15 Increase in Drainage Network

Drainage network refers to the network of streams within the watershed. This parameter accounts for any increases in active channel length that are correlated with human caused disturbances, with zero to minimum increases considered to be functioning appropriately (USFWS 1998b). There are no direct measurements of an increase in drainage network for analysis area streams.

Human-caused disturbances including riparian road construction and stream channel manipulation have been cited as causing accelerated bank erosion, altered riparian zones, and reduced high quality habitat for salmonids within some segments of analysis area streams (Washington Water Power Company 1996; Dunnigan *et al.* 2004). These data indicate that there has likely been an increase in the drainage network within the analysis area. Additionally, road densities in the Libby Creek and West Fisher Creek drainages are considered high, suggesting that increases in channel length to accommodate for construction of such roads has likely occurred in these watersheds to some extent. Road systems run parallel to or traverse every major tributary and the mainstems of Libby Creek and West Fisher Creek. Many of these roads have been in place for decades, having been constructed for access to mining locations in the late 1800s and early 1900s. Based on available data, the drainage network was rated as functioning at unacceptable risk or functioning at risk for all of the larger analysis area streams (USDA Forest Service 2013a).

3.6.3.11.16 Road Network

Roads and trails run parallel to most of the length of Libby Creek, Miller Creek, West Fisher Creek, the Fisher River, East Fork Rock Creek, East Fork Bull River, and their major tributaries. Many of these roads were constructed within the RHCAs. Some of these roads were originally constructed in the early 1900s to low standards and maintained infrequently. Impacts on streams associated with these roads include increased sedimentation, water routing down ditch lines, road stream crossing failures, hill side slumping, and removal of riparian vegetation due to road construction. Libby Creek, Bear Creek, and the Fisher River were categorized as functioning at unacceptable risk for this parameter in the BA, while the East Fork Bull River and Rock Creek were categorized as functioning at risk (USDA Forest Service 2013a).

3.6.3.11.17 Riparian Habitat Conservation Areas

Timber harvest, mining, livestock grazing, road construction, and other human-caused disturbances have altered the riparian zones in some areas of the Libby Creek, Rock Creek, East Fork Bull River, and Fisher River watersheds. Roads have been constructed within the RHCAs throughout the analysis area watersheds. RHCAs are shown in Figure 53. The BA classified this parameter as functioning at unacceptable risk within Libby Creek and the Fisher River, and functioning at risk for Bear Creek, Rock Creek, and the East Fork Bull River (USDA Forest Service 2013a).

3.6.3.11.18 Disturbance History and Regime

Disturbance regime refers to any natural disturbances that were present historically in the analysis area. Natural disturbance regimes are highly variable in analysis area drainages, and include large fluctuations in runoff, such as rain-on-snow events and high peak flows during snow melt. Catastrophic disturbances are common within analysis area streams, including flood events, high bedload movement, and deposition, channel braiding, and mass wasting. Analysis area streams are subject to periodic rain-on-snow floods. Windstorms resulting in blowdown have been minor and are generally associated with clearcutting activities. A large portion of the analysis area burned in 1889 and 1910; no major wildfires in the analysis area have occurred in several decades. The disturbance regime was categorized as functioning at unacceptable risk in Libby Creek and Fisher River, and as functioning at risk in Bear Creek, East Fork Rock Creek, and the East Fork Bull River (USDA Forest Service 2013a).

3.6.3.12 Integration of Species and Habitat Conditions

The quality of the bull trout habitat throughout the analysis area, especially in the larger tributaries, has been compromised by land development (particularly lower in the Libby Creek drainage), mining, and road construction in riparian areas along the mainstem of the streams. Natural disturbance has also occurred over the past 20 years and has included natural fires, large windstorms, 100-year flows, and rain-on-snow events. Impacts on stream channels and fish habitat have increased and include mass wasting, road culvert and bridge blowouts, bedload deposition, channel aggradation (buildup of bedload) and degradation (down cutting), and flooding. Historical data on bull trout abundance and distribution are fairly limited because, until recently, the major emphasis was on eliminating bull trout from local streams. Bull trout were viewed by some as undesirable as they prey upon small species of desirable sport fish.

The bull trout population in the Libby Creek drainage within the analysis area is currently at risk from the threat of hybridization and competition with the non-native brook trout moving into the area. Areas of high quality trout habitat in the Libby Creek watershed are limited. Bull trout have been routinely observed within the analysis area, but they persist only at low densities in the mainstem and most tributaries. Data on Bear Creek indicate stable or increasing bull trout populations are present in this tributary. The BA categorized the integration of species and habitat conditions as functioning at unacceptable risk in Libby Creek, and functioning at risk for Bear Creek, with most of the habitat factors resulting in the risk categorization in Bear Creek occurring in the downstream reach of this stream (USDA Forest Service 2013a).

Bull trout are found in higher densities in the Rock Creek and East Fork Bull River drainages, but, as with the Libby Creek population, they are at risk from hybridization and competition with brook trout. Brown trout are also present in the East Fork Bull River drainage, and while they present no risk of hybridization with bull trout, they can pose a risk to the bull trout population through competition for resources. Non-native suppression has been initiated to lessen this threat (Moran and Storaasli 2008). Logging, grazing, and wildfires have affected significant portions of the riparian zones in these streams (Washington Water Power Company 1996). Additionally, intermittent flows occur in some reaches of the Rock Creek drainage, limiting access for migratory bull trout, although it also limits access for nonnative fish. The integration of species and habitat conditions presented in the BA classified Rock Creek as functioning at unacceptable risk and the East Fork Bull River as functioning at risk (USDA Forest Service 2013a).

The Fisher River is a migratory corridor for populations of bull trout. Bull trout habitat quality within this stream is limited, with extensive amounts of road construction and other activities occurring in the riparian area of some reaches. Thermal barriers to upstream migration also exist in this watershed. West Fisher Creek is a priority watershed. Bull trout occur in the stream but are at risk from competition for resources. This stream was classified as functioning at unacceptable risk based on the integration of species and habitat conditions (USDA Forest Service 2013a). The two segments of designated critical habitat on West Fisher Creek have adequate habitat to support bull trout through these reaches.

Redband trout habitat has been similarly influenced by past mining efforts and other disturbances, but the largest threat to the redband trout is hybridization with introduced rainbow trout and native westslope cutthroat trout. Based on results from genetic analyses conducted in 1991 through 2009 (FWP 2012), most of the redband trout population within the Libby Creek watershed is at least slightly hybridized, with pure populations existing in small tributaries where barriers are thought to isolate them from mainstem populations. While they have been observed regularly within all the analysis area streams within the Libby Creek watershed, redband trout are found at relatively low densities.

Redband trout are not found in the Rock Creek or East Fork Bull River watersheds, but pure redband trout are found in the Fisher River drainage, including West Fisher Creek. As with the Libby Creek watershed, these fish are at risk from hybridization because the trout in the segment of the Fisher River downstream of the analysis area and in some of the tributaries are hybridized.

In the analysis area, pure westslope cutthroat trout are known to be present in the Rock Creek and East Fork Bull River watersheds and Miller Creek. In the Libby Creek drainage, westslope cutthroat trout are hybridized. As with redband trout, all populations are mainly at risk from hybridization and competition with introduced trout species. In East Fork Rock Creek, hybridization with rainbow trout and Yellowstone cutthroat trout is occurring in the upstream reaches, and no barriers have been identified that would protect the remaining genetically pure trout from these trout moving downstream. While the most recent genetic analysis in 2004 indicated that the westslope cutthroat population in the East Fork Bull River is pure, population surveys conducted in 2002, 2009, and 2011 reported hybrids were present. These fish were likely visually identified since no results of genetic analyses were presented. No barriers to protect these trout from hybridization have been observed. Westslope cutthroat trout densities are higher in these west side watersheds than bull trout densities, indicating that the westslope cutthroat trout population is less at risk of extirpation in these streams.

As discussed previously, while torrent sculpin are thought to inhabit analysis area streams, little data were available to determine the status and distribution of this species within the analysis area, possibly because of the difficulty in differentiating this species from slimy sculpin morphologically. Determining the current risks to the populations within the watershed was based on the best available information.

3.6.3.13 Climate Change

Changes in temperature and precipitation have occurred in Pacific Northwest and are likely to continue to occur in the future (Reclamation 2011a). Such changes are discussed under *Groundwater Hydrology* (section 3.10.3, *Affected Environment*, and section 3.10.4, *Environmental Consequences*), *Surface Water Hydrology* (section 3.11.3, *Affected Environment*, and section 3.11.4, *Environmental Consequences*), and *Water Quality* (section 3.13.3, *Affected Environment*, and section 3.13.4, *Environmental Consequences*). Weather data from the western United States have generally demonstrated a warming pattern, with the most consistent trends in streamflows observed being lower summer flows and shifts in the timing of spring runoff (Reclamation 2011c, Isaak *et al*. 2012). Precipitation is projected to remain relatively static during the early 21st century and then slightly increase during the last half of the 21st century (Reclamation 2011a). Much of the predicted effect on aquatic life is attributed to increased air temperatures that may result in increased stream and lake temperatures (Reclamation 2011c). Modeling conducted using the USDA Forest Service’s NorWeST project climate scenarios indicated that stream temperatures would be projected to increase by 3.8°F over baseline conditions in the Pacific Northwest within about 60 years (Isaak *et al.* 2015).

Climate change in northwest Montana has the potential to impact aquatic resources through rising stream temperatures, decreased summer streamflows, decreased snowpack, shifts in the timing of the runoff period, increased wildfire disturbance, and increased frequency of heavy precipitation events, including rain-on-snow events (US Global Change Research Program 2009; Herbst and Cooper 2010; USDA Forest Service 2010a; Wenger *et al*. 2011; Isaak *et al*. 2012). Drought periods could become more frequent or persist for longer time periods.

Warmer stream temperatures and changes in flow regimes would directly affect some cold water fish species, including bull trout, cutthroat trout, and other salmonids, by contracting and shifting the range of habitat suitable for such fish and increasing the risk of egg scour. Wenger *et al.* (2011) used a hydrological model to predict the effects of changes in the flow regime and stream temperatures resulting from climate change on cutthroat trout, brook trout, brown trout, and rainbow trout. These species were predicted to lose between 35 and 77 percent of their current habitat due to increased temperatures beyond the species' thermal limits, negative biotic interactions, and increases in winter flood frequency. Rieman *et al*. (2007) predicted that climate warming could result in 18 to 92 percent loss of thermally suitable habitat for bull trout. Isaak *et al.* (2015) used the NorWeST database to delineate the expected occurrence of cold-water stream habitats that could serve as climate refugia for bull trout and cutthroat trout in the Northern Rocky Mountains in the future under both moderate and extreme climate change scenarios. Analysis results suggested some climate refugia would persist for both species, but the stream length of suitable cold water habitat for cutthroat trout and bull trout in summer would decrease from 33 to 61 percent in these two scenarios relative to baseline conditions.

Summer stream temperatures within the analysis area were modeled using data from the NorWeST database to determine the expected extent and location of cold-water habitat for bull trout in 2080 under an extreme climate change scenario similar to the analysis included in Isaak *et al.* (2015). Comparison of baseline conditions from 1993 through 2011 to the conditions projected to occur by 2080 suggested that the length of stream providing appropriate cold-water habitat for these fish species would decrease in Libby Creek, East Fork Rock Creek, East Fork Bull River, and other analysis area streams. Based on the modeled predictions, stream temperatures in some headwater and tributary reaches in 2080 would remain less than the 52°F temperature established as the cold-water criterion for native trout occupancy in Isaac *et al.* (2015). This analysis accounted only for changes in stream temperature expected to occur in summer, specifically in August, due to the limited data available for other seasons, and the analysis did not evaluate other aspects of the habitat other than temperature that are necessary to support bull trout and cutthroat trout populations. Additionally, as noted in Isaak *et al.* (2015), the 2080 date associated with this climate change scenario should not be emphasized as significant uncertainty exists in the timing of predicted future changes.

Effects on macroinvertebrate assemblages from climate change have been documented, but are not always consistent. Observed response of these communities are often specific to species, taxa with certain traits, or those that inhabit certain areas within the stream (Burgmer *et al*. 2007; Chessman 2009; Lawrence *et al*. 2010; Poff *et al*. 2010; Domisch *et al*. 2011; Sheldon 2012). For example, Sheldon (2012) focused on potential effects of increasing temperatures on stoneflies in the southern Appalachians, and observed strong and consistent evidence for a shift in distribution of one common stonefly species, although data for the second stonefly species was inconclusive based on confounding factors such as detectability and landscape change. A study of streams in Australia over a 13-year period determined that invertebrate families that favored cold water and faster flowing water were more likely to show a decline over this time period in comparison to those that favored warmer, slower water (Chessman 2009). Domisch *et al*. (2011) modeled impacts of climate change on almost 40 macroinvertebrate species, and predicted that significant declines in the abundance and distributions would be particularly noticeable for species that inhabit headwater reaches, which are often dominated by taxa that favor colder stream temperatures and faster flowing water.

The Intergovernmental Panel on Climate Change (2007) determined that changes in temperature and precipitation have occurred in northwest Montana and are likely to continue to occur in the future. Weather data from the western United States have generally demonstrated a warming pattern, with the most consistent trends in stream flows observed being lower summer flows and shifts in the timing of spring runoff (Isaak *et al*. 2012). Within regions and across species, the effects of these trends are anticipated to differ among streams and populations (USDA Forest Service 2010a). Additionally, many studies have not been conducted over sufficient time periods or diverse locations to determine the outcome of small, incremental changes on fish and invertebrate populations, and the complex responses of aquatic organisms to such changes is further confounded by changes in land use (Barbour *et al*. 2010; USDA Forest Service 2010a; Isaak *et al*. 2012). Predictions of the loss of trout habitat associated with climate change in the studies discussed ranged from 18 percent to 92 percent over a range of locations, and the hydrological models used for such predications were noted to be limited in terms of fine scale resolution or the ability to account for all possible factors (Rieman *et al*. 2007; Wenger *et al*. 2011 Isaak *et al.* 2015). Based on these limitations, the magnitude and extent of the effects of climatic and hydrologic trends on fish and other aquatic organisms and their habitat are unclear (USDA Forest Service 2010a).

3.6.4 Environmental Consequences

3.6.4.1 Alternative 1 – No Mine

In this alternative, MMC would not develop the Montanore Project. Any existing exploration-related or baseline collection disturbances by MMC would be reclaimed in accordance with existing laws and permits. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150, would remain in effect. The DEQ's approval of revisions to DEQ Operating Permit #00150 (revisions 06-001, 06-002, and 08-001) also would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System land.

Without mine development, aquatic populations and stream habitat would remain unchanged from existing conditions. Productivity of fish and other aquatic life in analysis area streams would continue to be limited by past natural and human-caused adverse habitat changes, by naturally low nutrient concentrations, and by natural habitat limitations from climatic and geologic influences.

Bull trout populations would continue to be marginal and the habitat in need of restoration work. They would be susceptible to decline or disappearance due to hybridization with introduced salmonids, competition with brook trout and other trout present in the analysis area, or from land use disturbances. Redband trout and westslope cutthroat trout also would continue to be subject to population declines, mainly due to the threat of hybridization from introductions of non-native salmonids. Limited data are available on the status of the torrent sculpin within the analysis area to predict what trends would occur in these populations under existing conditions. Improvements in habitat quality and productivity due to natural processes over time would potentially be adversely affected by the cumulative effects of continued forestry activities. Past, current, and future placer mining, continued recreational use, and other reasonably foreseeable actions would continue to affect fish populations.

3.6.4.2 Alternative 2 – MMC's Proposed Mine

Development of the Montanore Project would require construction of project facilities, including a mill, tailings impoundment, adits, access roads, and transmission lines. For Alternative 2, MMC's proposal, the mill and mine production adits would be located in the upper Ramsey Creek drainage, about 0.5 miles from the CMW boundary. An additional existing adit on private land held by MMC in the upper Libby Creek drainage and an adit on MMC's private land east of Rock

Lake would be used for ventilation. The proposed Rock Lake Ventilation Adit would be on a steep, rocky slope about 800 feet east of and 600 feet higher than Rock Lake. Because the total disturbance area for this adit would be small (about 1 acre), any effects would be minor and are not discussed further. A tailings impoundment would be constructed in the Little Cherry Creek drainage, and would require the diversion of Little Cherry Creek. Two LAD Areas between Poorman Creek and Ramsey Creek would be used for discharge of water through land application.

Potential impacts on fish and other aquatic life in the Libby Creek, Rock Creek, and East Fork Bull River drainages from the various proposed alternatives for the Montanore Project can be grouped under six general categories: changes in sediment delivery, changes in water quantity, changes in water quality (nutrient concentrations, metal concentrations, and stream temperature), changes in toxic metal concentrations in fish tissues, effects on fish passage, and effects on threatened, endangered or sensitive species. These effects will be addressed individually for each alternative.

3.6.4.2.1 Sediment

Evaluation, Construction, and Operations Phases

Streams

Section 3.13.4 in the *Water Quality* section discusses anticipated effects of the alternatives on sediment delivery to analysis area streams. This discussion was used to qualitatively assess the effects of any predicted increases in sediment on aquatic life and aquatic habitat.

Effects on Riparian Habitat Conservation Areas. Alternative 2 would disturb 266 acres within Riparian Habitat Conservation Areas (RHCAs) on National Forest System land; 152 acres of other riparian areas on private land would be disturbed (Table 75). Portions of LAD Area 2, the tailings impoundment, the Ramsey Plant Site, and the Libby Adit would be within RHCAs or riparian areas on private land under this alternative (Figure 53). Roads would be constructed or reconstructed within the RHCAs of Little Cherry, Libby, Poorman, and Ramsey creeks, as well as other unnamed tributaries within the mine permit area boundary. Adverse direct effects on fish habitat could occur where roads and facilities were constructed in RHCAs and particularly where roads crossed streams. Effects of roads on RHCAs is discussed in the following section.

Table 75. RHCAs and Other Riparian Areas within Mine Disturbance Areas.

Ownership of Riparian Area	Alternative 2 – MMC's Proposed Mine	Alternative 3 – Agency Mitigated Poorman Impoundment Alternative	Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative
RHCAs on National Forest System land	266	256	236
Other riparian areas on private land	152	9	147
Total	418	265	383

All units are acres.

RHCAs are found only on National Forest System land.

Source: GIS analysis by ERO Resources Corp. using KNF data.

The potential for sediment increases to occur from Alternative 2 would mainly exist in analysis area streams within the Libby Creek and Big Cherry Creek watersheds. The total disturbance area within the Rock Creek drainage (for the ventilation adit) would be small (less than 1 acre). The potential for any increase in sediment delivery to the Rock Creek drainage from these activities is minimal. No surface disturbances would occur in the East Fork Bull River drainage.

Most of the roads planned for reconstruction are existing roads that cross a RHCA only at a stream crossing, but segments of existing roads parallel the RHCAs along Ramsey and Libby creeks. Any new or altered culverts and bridges at stream crossings would be designed to avoid stream flow constriction and streambed scouring. New bridges that would cross Poorman Creek and Ramsey Creek are proposed.

Effects within the Mine Operating Permit Boundary. Most of the effects on RHCAs would be within the impoundment site disturbance area and other sites within the mine permit area boundary. MMC would request an amendment to its MPDES permit for Alternative 2. Within the mine permit area boundary, all stormwater runoff from roads and mine facilities would be captured by ditches and sediment ponds designed for the 10-year/24-hour storm of 2.4 inches and directed to MPDES-permitted outfalls. The Seepage Collection Pond associated with the tailings impoundment on Little Cherry Creek would be designed to accommodate a larger 100-year/24-hour storm event. Precipitation and runoff from the Libby Adit pad area would be collected and directed to Outfalls 001, 002, or 003. Discharges from the outfalls to Libby, Ramsey, and Poorman creeks would be monitored, and would be required to meet applicable effluent limits for sediment. Infrequent discharges from the sediment ponds and traps associated from the plant Site and LAD Areas would be directed into Ramsey and Poorman creeks. Such discharges would occur only during high flow events when sediment delivery to streams would already be naturally elevated. Ponds within the mine operating permit area could discharge during storm events greater than the 10-year/24-hour storm when sediment delivery to streams would already be naturally elevated. Distinguishing the additional sediment input from any discharges that occurred from existing conditions may not be feasible. Sediment from such discharges would be deposited into flood plains or low gradient stream reaches, or would be carried to the Kootenai River. Discharges from the Seepage Collection Pond would not occur as excess water would be pumped back into the impoundment and to the Water Treatment Plant if necessary for treatment.

Increases in sediment delivery to diverted Little Cherry Creek and Libby Creek would occur during the construction of the Diversion Dam and Diversion Channel that would be used to divert water around the Little Cherry Creek impoundment. The Diversion Channel would transport higher loads of sediment temporarily into diverted Little Cherry Creek and Libby Creek until it stabilized under the new flow regime, particularly when heavy precipitation events occurred. For activities not covered by a MPDES or general permit, MMC may request and the DEQ may approve a 318 authorization for short-term increases in turbidity and total suspended solids discussed on p. 705.

A failure modes effects analysis completed for the Little Cherry Creek impoundment estimated catastrophic failure as having a 0.1 to 1 percent chance of occurrence (Klohn Crippen 2005). The risk of failure of the tailings pipeline is also small, with proposed containment structures in place at the Ramsey Creek and Poorman Creek stream crossings where such an occurrence would pose the greatest risk. If such a failure occurred, the greatest effect to aquatic life would result from the large masses of sediment that would flow to Little Cherry Creek, Poorman Creek, Ramsey Creek, or Libby Creek, and from there into the Kootenai River. Depending on the magnitude and duration, such a failure could cause substantial alterations to the stream channel and aquatic life habitat, and could cause extensive adverse impacts on bull trout and other aquatic life populations. Portions of this sediment mass likely would remain within the Libby Creek channel for an undefined period following the failure, while the rest would be carried downstream to the Kootenai River. The amount of sediment transported into area streams and the effect on aquatic life would depend on the volume of water associated with the failure, and the initial volume and character of the sediments. The effect could be substantial, and result in a large-scale loss of aquatic populations (Klohn Crippen Berger 2009).

Roads Outside the Mine Operating Permit Boundary. Road construction and reconstruction is often considered the largest source of sediment in mining and timber harvest areas due to the removal of vegetation and construction of cut and fill slopes that expose large areas subject to erosion (Belt *et al.* 1992). In a literature review associated with the development of the Inland Native Fish Strategy (INFS) Belt *et al.* (1992) reported that non-channelized sediment flow rarely travels more than 300 feet, and that 200- to 300-foot riparian buffers are generally effective at protecting streams by preventing sediment from reaching streams via non-channelized overland flow. Results of the WEPP:Road Batch model indicated that smaller buffer widths would prevent sediment from reaching project-area streams. For example, the model results for new transmission line roads showed that buffer widths of 40 to 60 feet were adequate to reduce sediment leaving the buffers to zero.

In all mine alternatives, the Bear Creek Road (NFS road #278) would be completely paved and the road widened to 20 to 29 feet in Alternative 2. The WEPP:Road Batch model predicted that paving and widening all of the Bear Creek Road would increase the amount of sediment leaving the forested buffer adjacent to the road (Table 132). The WEPP:Road Batch model predicted that paving and widening all of the Bear Creek Road would increase the amount of sediment leaving the buffer. Other users of the model have found it over-predicts erosion from paved roads (Breibart *et al.* 2007), and research indicates that paved roads generate the least sediment and typically have the shortest distance of sediment transport away from a road bed compared to gravel or unimproved roads (Riedel *et al.* 2007). High erosion rates typically occur during the first years of vegetation establishment after disturbance (Megahan and Kidd 1972, Grace 2007). The estimated sediment increases from the Bear Creek Road would be small in comparison to the estimated existing sediment load of 1,621 tons/year and the estimated future sediment load of 1,102 tons/year in the upper Libby Creek watershed, and may not assist in achieving the Libby Creek TMDL. The movement of sediment from Alternative 2 roads to RHCAs would be minimized through the use of BMPs to reduce road sediment erosion and flow velocities (MMC 2008). Because the BMPs were not specified, they cannot be modeled using the WEPP:Road Batch model, but they would further reduce sediment leaving the roads and buffers. MMC did not propose any improvements on the Libby Creek Road (NFS road #231) or NFS road #2316, so existing sediment yield from the Libby Creek Road would not change.

Effects of Mitigation. Additionally, as part of Alternative 2, one of the fisheries mitigation projects proposed by MMC would be to conduct a sediment-source inventory in the watershed, and stabilize, recontour, and revegetate priority source areas, which are typically roadcuts in Libby, Hoodoo, Poorman, Midas, and Crazyman creeks. If implemented, this project would reduce the contribution of sediment from priority source areas to the Libby Creek watershed. Because specific priority source areas have not been identified, the effects of the mitigation were not quantified. MMC also may rehabilitate habitat upstream from the mouth of Howard Creek through creation of pool and hiding cover habitat, stabilization of old mining spoils, and channel narrowing. The installation of grade control structures in streams to improve aquatic habitat may increase sediment concentrations in streams temporarily. After the activities were completed, and the improvements stabilized, sediment delivery to area streams would decrease below existing levels, improving fish habitat.

Mitigation and Monitoring. The MPDES permit requires MMC to implement a SWPPP to minimize erosion and sedimentation from disturbed areas during construction and operations. The plan would address stormwater runoff from mine-related facilities for soil stockpiles, access/haul roads, adit pads, and parking lots. The plan would describe the potential sources of stormwater pollution, pollution prevention practices, sediment and erosion control measures, runoff management, inspections, and reporting. BMPs would include ditches, sediment traps, and sediment retention ponds.

All point source discharges containing sediment from the Montanore Project via stormwater outfalls or the Water Treatment Plant would be monitored and reported to DEQ, and Water Treatment Plant Outfall 003 would also be subject to daily and monthly sediment limits. The DEQ and EPA established as a TMDL an average annual sediment load of 4,234 tons for Libby Creek from the US 2 bridge to the confluence with the Kootenai River (DEQ and EPA 2014). As part of this TMDL, the Montanore facility was assigned a sediment wasteload allocation of 24 tons/year. MMC's point source and nonpoint source discharges containing sediment would be a small contribution to the estimated existing sediment load of 1,621 tons/year and the estimated future sediment load of 1,102 tons/year in the upper Libby Creek watershed.

Sediment (as percent fines) would be monitored within the Libby Creek drainage to detect any potential sediment increases. Sediment sampling would occur at a station on Libby Creek downstream of the Little Cherry Creek confluence. Sampling would occur daily during the Construction Phase, as most potential increases in sedimentation is expected to occur then. During initial mine operations, sampling would occur on alternate days, and frequency would then be reduced to once per week for the remainder of the Operation and Closure phases. Based on the sampling schedule, any increases in sediment within the Libby Creek system would be detected quickly, allowing for prompt action and remediation.

Effects Summary. Any sedimentation, if it were to occur from sediment pond discharges or other mine activity sources, would have the potential to alter aquatic habitat by decreasing pool depth and habitat complexity, changing substrate composition by filling in interstitial spaces, and increasing substrate embeddedness (Rieman and McIntyre 1993; Waters 1995). These changes to stream habitat can affect salmonid reproductive success by degrading and decreasing spawning and rearing habitat, and by increasing egg and juvenile mortality (Shepard *et al.* 1984; Fraley and Shepard 1989; Weaver and Fraley 1991; Waters 1995; Watson and Hillman 1997; Montana Bull Trout Scientific Group 1998; Muck 2010). Optimal bull trout spawning and rearing areas should have less than 20 percent of the substrate consisting of fine particles of 6 mm or less for the habitat to be functioning appropriately (USFWS 1998b), and less than 30 percent fines (<6.35 mm) has been reported to be necessary for successful bull trout incubation (Parametrix 2005). Behavioral effects can also result from increased suspended or deposited sediment as fish may avoid stream reaches with high sediment levels, or their migration, foraging, or predation behaviors may be altered, resulting in population declines or mortality over time (Muck 2010).

Benthic macroinvertebrate communities can be affected by increases in fine sediment, with decreases in abundance, taxa richness, EPT taxa richness, and diversity observed as fine sediment increases and substrate suitability for many taxa decreases (Angradi 1999; Kaller and Hartman 2004; Harrison *et al*. 2007; Larsen *et al*. 2009; Bryce *et al*. 2010). Changes in invertebrate metrics were associated with percent fine sediment increases as low as less than 5 percent to 30 percent of the substrate composition. A reduction in macroinvertebrate abundance or changes in the composition of the macroinvertebrate population can also indirectly have deleterious effects on fish populations by causing slower growth rates, higher mortality, and reduced fecundity (Berkman and Rabeni 1987; Waters 1995; USFWS 2003a; Muck 2010). Large increases in suspended sediment can directly result in mortality of fish and invertebrates by clogging gills and causing respiratory impairment (Muck 2010).

The existing levels of fine sediment in spawning areas in analysis area streams within the Libby Creek watershed were measured one or more times per year in 2005 through 2008. The mean percent fines (described in the report as fines less than 6.25 mm or 0.25 inches) in gravel at each site within the Libby Creek watershed ranged from 15 percent at the lowest Libby Creek site to 39 percent at the most upstream Little Cherry Creek site in 2005 (Table 68) (Kline Environmental Research 2005). Surveys conducted in 2006 through 2008 indicated that the percent fines in low gradient riffle areas in the Libby Creek watershed were generally less than 10 percent at most sites, although the reach of Libby Creek upstream of the falls and the Little Cherry Creek reach had higher percentages during some surveys (Kline Environmental Research 2009). Fines at the Little Cherry Creek site were elevated up to 95 percent in 2008, potentially due to logging activity within the area. These data indicate that most surveyed stream reaches currently have levels below the 30 percent fine sediment threshold (Parametrix 2005), which begins to substantially decrease successful bull trout incubation.

It is anticipated that the levels of sediment generated through Alternative 2 would be small in volume and duration based on implementation of the BMPs and design features of the mine facilities. Any introduction of limited amounts of additional small gravels and fine sediment from construction or operation of the mine would likely have few if any effects on macroinvertebrate and fish populations, and annual snowmelt runoff would likely flush any accumulation of fine sediments downstream each spring. MMC’s point source and nonpoint source discharges containing sediment would be a small contribution to the estimated existing sediment load and the estimated future sediment load in the upper Libby Creek and Big Cherry Creek watersheds (Table 123, p. 722). These factors make it unlikely that effects from Alternative 2 would result in detectable adverse changes in existing levels of sediment, quality of fish habitat, or sustainability of aquatic populations over the long-term. Effects would only be greater if required BMPs did not have the anticipated result of eliminating or reducing the existing sediment input into analysis area streams or if the Little Cherry Creek impoundment or tailings line were to fail. Beginning on the effective date of the MPDES permit, MMC would monitor all discharges to surface water for sediment, and report sediment concentrations to DEQ monthly (see Appendix C). Any failures of the sediment BMPs detected through monitoring would require MMC to implement corrective measures in accordance with the MPDES permit.

The DEQ and the EPA established water quality restoration goals for sediment in Libby Creek on the basis of fine sediment levels in trout spawning areas and aquatic insect habitat, stream morphology and available instream habitat as it relates to the effects of sediment, and the stability of streambanks. Meeting the TMDL, of which Montanore’s wasteload allocation of 24 tons per year is a part, will satisfy the water quality restoration goals. The DEQ believes that once the water quality restoration goals are met, all beneficial uses currently affected by sediment will be restored (DEQ and EPA 2014).

Lakes

No sediment increases are projected for analysis area lakes during construction or operation of the mine because no mine facilities or activities would be located near any of the lakes.

Closure and Post-Closure Phases

Streams

The potential for increased sedimentation in streams during the Closure and Post-Closure phases would be small and the effects on aquatic habitat and populations would be minimal in most analysis area streams. MMC would remove facility structures and reslope and revegetate disturbed areas. Revegetation would reduce erosion potential by providing a stabilizing cover, and BMPs would be used until vegetation has been established to minimize sediment movement to streams.

The Little Cherry Creek tailings impoundment is expected to be reclaimed incrementally to minimize potential erosion and maximize tailings dam stability. Surface runoff from the tailings impoundment would be directed toward Bear Creek, and may cause some increases in stream sedimentation during construction of the check dam and diversion channel. The check dam would be sized to hold flows from a 100-year storm event, and the channel would be designed to minimize sediment delivery. Any stream sedimentation that occurs would have a brief adverse effect on fish and invertebrate populations due to increased sediment in the water column. An increase in fine sediment would alter substrate composition and increase substrate embeddedness, and may affect fish and macroinvertebrate habitat as previously discussed. These increases would be temporary, with most of the sediment flushed out of the system during high flow events, such as during snowmelt runoff or rain-on-snow events.

Lakes

No sediment increases are projected for analysis area lakes after the completion of mining. No mine closure activities would be located near any of the lakes.

3.6.4.2.2 Water Quantity

The agencies' analysis of streamflow effects is described in section 3.11, *Surface Water Hydrology.* This section discusses streamflow effects on aquatic life. The agencies used the facilities and mitigation in the agencies' preferred alternative, Alternative 3, to model changes in streamflow. Therefore, the quantitative portion of the evaluation of effects on aquatic life was also specific to this alternative, and is based on the impact analysis included in the BA conducted (USDA Forest Service 2013a). This analysis estimated the maximum effects that would occur to bull trout passage and habitat availability in Alternative 3 as a result of the changes to low flows from the project (Table 77) (USDA Forest Service 2013a). The effects on other aquatic populations are also discussed. Further details about the data and analyses used are provided in the BA.

As the quantitative portion of the impact analysis for effects on aquatic life from changes in streamflows was based on effects in Alternative 3, effects from Alternatives 2 and 4 used the results from this analysis as a guideline, but were assessed qualitatively. Without mitigation, the effects on west side streams (East Fork Rock Creek and East Fork Bull River) would be the same for Alternatives 2 and 4 as Alternative 3. The effects on east side streams would be similar between all alternatives, but would differ in some streams based on facility locations and other factors.

Evaluation, Construction, and Operations Phases

East Side Streams

Effects to streamflow during the low flow period of the year in Alternative 2 for east side streams, would be similar to effects in Alternative 3 during the Evaluation, Construction, and Operations phases (Table 109, p. 658 and Table 111, p. 662). The resulting effects predicted to occur from these streamflow changes on aquatic life are discussed in more detail under Alternative 3, but are summarized below, with differences between Alternatives 2 and 3 emphasized.

In Alternative 2, discharges of treated wastewater from the LAD Areas or the Water Treatment Plant would occur in all phases and would result in increased flow in portions of the Libby Creek watershed. The increased flow would potentially provide more thermal refuge areas as well as deeper pool areas during the low flow period of the year that could benefit fish populations. When the LAD Areas were in use, these discharges would be less than those under Alternative 3 as much of the water discharged to the LAD Areas would evapotranspire. Water that percolated to groundwater would flow to Ramsey, Poorman, and Libby Creeks, and increase flows in those streams downstream of the LAD Areas. These discharges would partially offset the decreases predicted to occur in Libby, Ramsey and Poorman creeks from mine inflows, which would be greatest at the end of the Operations Phase. Low flows in Ramsey Creek at RA-600 and in Poorman Creek at PM-1200 were estimated to decrease by 2 and 12 percent, respectively, in Alternative 3 (Table 111), and decreases would be similar in magnitude to Alternative 2. The magnitude of these decreases suggests that aquatic habitat in Ramsey Creek would be minimally affected, while habitat availability would likely decrease more in Poorman Creek. MMC did not propose to discharge treated water to Libby Creek to prevent adverse effects on senior water rights in Alternative 2 as was included in the other Alternatives.

Effects on low flows in Libby Creek upstream of the Water Treatment Plant at LB-300, a reach used by the resident bull trout population, would be slightly less than in Alternative 3, while effects on Ramsey Creek low flows would be slightly greater. These effects differ from those in Alternative 3 due to differences in the locations of the adits. Decreased streamflow, especially under low flow conditions, would decrease available salmonid habitat.

Peak flows in Ramsey Creek would increase by 8 percent as a result of timber clearing for the mine facilities. Peak flows and average annual flows in Libby Creek at LB-300 would increase by 5 percent or less. These changes in peak flows are within the error of peak flow measurement, as discussed in more detail in section 3.11, *Surface Water Hydrology*, and would be unlikely to adversely affect aquatic habitat.

Alternative 2 would adversely affect fish habitat in Little Cherry Creek due to the construction of the tailings impoundment and Diversion Channel. The impoundment would remove about 15,600 feet of fish habitat in the existing Little Cherry Creek from the Diversion Dam to the mouth of the former Little Cherry Creek. The agencies anticipate that the engineered Diversion Channel would not provide any fish habitat, while Drainages 10 and 5, which have intermittent flows under existing conditions, would eventually provide marginal fish habitat. The time frame over which this habitat would develop is uncertain, but changes in various habitat parameters would continue to occur within these drainages for many years following the diversion. Flow in the original Little

Cherry Creek downstream of the tailings impoundment would be substantially reduced, as only 13 percent of the watershed would continue to contribute to this stream channel.

Alternative 2 would result in an irreversible loss of genetic diversity from the redband trout found in Little Cherry Creek if proposed efforts to collect and transfer fish from the affected segment of Little Cherry Creek to the diversion drainage were not entirely successful or if flow was not adequate to support the population. Hybridization of the pure redband trout population in Little Cherry Creek may occur in Alternative 2 if barriers predicted to develop did not develop in the diversion drainage and the redband trout came in contact with non-native trout in the Libby Creek drainage.

Flows would not be affected in Bear Creek during the Evaluation and Construction Phases. During operations, streamflow would be reduced in this stream by the pumpback well system and interception of surface runoff. The change in streamflow was not quantified. Aquatic habitat in lower Bear Creek would be reduced, which could adversely affect salmonid populations.

West Side Streams

The effect on streamflows and aquatic habitat in west side streams would be the same as Alternative 3 without mitigation, and are discussed in more detail in section 3.6.4.3.2, Water Quantity. Streamflow reductions during the low flow period of the year would either not occur or be minimal in East Fork Rock Creek, Rock Creek, and East Fork Bull River during the Evaluation and Construction Phases and would not likely affect aquatic habitat. During the Operations Phase, the effect would be larger, with the greatest effect occurring at the end of mining operations in the upstream reaches of East Fork Rock Creek. Trout habitat would be reduced during low flows. This habitat loss would be detrimental to the resident westslope cutthroat trout populations in the higher elevations of East Fork Rock Creek. Given the minimal decrease in low flow (≤ 1.0 percent) predicted for RC-3 near the West Fork confluence and for the mainstem of Rock Creek near the mouth for Evaluation through Operations Phases (Table 109, Table 110, and Table 111, pp. 658-662), trout habitat in the downstream portion of East Fork Rock Creek and the mainstem of Rock Creek would not be substantially affected. Decreases in flow may exacerbate intermittent flows near the mouth, restricting movement of migratory and resident fish.

No effects to low flows are predicted to occur within the East Fork Bull River during the Evaluation and Construction Phases (Table 109). The slight reduction in streamflow in this stream during the Operations Phase would not be likely to substantially affect aquatic habitat in the river either within or outside of the CMW.

Lakes

Changes in Rock Lake and St. Paul Lake levels would be negligible during the Evaluation, Construction, and Operations phases and any effect on aquatic life would be minimal.

Closure and Post-Closure Phases

East Side Streams

Most effects to aquatic habitat and populations for east side stream during the Closure and Post-Closure phases would be similar to those discussed for Alternative 3 without mitigation. In Libby Creek, discharges for the Water Treatment Plant and LAD Areas would increase streamflow and offset the effects of the pumpback wells in lower Libby Creek. The higher flows below the Water

Treatment Plant discharge point would benefit aquatic habitat in Libby Creek within this reach and for some distance downstream, but to a lesser extent than in Alternative 3 based on use of the LAD Areas. Less of an increase in flows would occur in the Post-Closure Phase compared to the Closure Phase. Farther downstream in Libby Creek near LC-2000 and the confluence of Bear Creek, streamflow and aquatic habitat would not be affected by activities in the Closure and Post-Closure Phases. The effects of reduced baseflow in the reach of Libby Creek upstream of LC-300 would be greater than in the Operations Phase, but would be slightly less than in Alternative 3. After the pumpback well system ceased operations, discharges were discontinued, and the groundwater table reached steady state conditions, streamflow in Libby Creek would return to pre-mine conditions.

In Poorman and Ramsey creeks, changes in streamflow would be minor and would likely not impact aquatic life in these phases. When groundwater levels in the mine area reached steady state conditions, streamflow in Ramsey and Poorman creeks would return to pre-mine conditions. The increase in peak flows predicted to occur in Ramsey Creek as a result of timber clearing would be less in the Closure Phase.

The tailings impoundment and Diversion Channel on Little Cherry Creek would remain in place. Flow in the diverted Little Cherry Creek channel would be about one-half the flow in the original channel. The pumpback well system would potentially eliminate flow in the Diversion Channel and Drainage 10 as long as it operated. At most, marginal fisheries habitat would be exist to support fish populations.

The watershed area of the former (original) Little Cherry Creek channel would be about one-fourth of the original watershed area. The pumpback well system would reduce flow in the former Little Cherry Creek channel as long as it operated. Any surface water flow below the tailings impoundment entering the former lower Little Cherry Creek channel would not support a viable fish population and redband trout populations would continue to be impacted as in the Operations Phase.

Runoff from the impoundment surface would be directed toward Bear Creek in to a riprapped channel post-mining. Downstream of where runoff flowed into Bear Creek, average annual streamflow would increase as a result of the increase in watershed area, and would benefit fish habitat.

West Side Streams

The effect on streamflows in west side streams would increase from the Operations Phase and be greatest during the Post-Closure Phase (Table 113, p. 669). The effects on aquatic habitat would be the same as described for Alternative 3 without mitigation. Decreased low flows would reduce salmonid and macroinvertebrate habitat in East Fork Rock Creek. Without mitigation, all baseflow would be eliminated in the reach of East Fork Rock Creek near the CMW boundary. Further downstream near the confluence with West Fork Rock Creek at RC-3, low flows would be predicted to decrease by an estimated 9 percent during the Post-Closure phase (Table 110). The effects on aquatic habitat in upper East Fork Rock Creek would be substantial and last for hundreds of years, and westslope cutthroat trout and bull trout populations would be adversely affected by the loss of habitat. The reduced streamflow would acerbate the chronic dewatered condition during low flow in Rock Creek.

After groundwater levels in the analysis area reached steady state conditions, reduced streamflow would have a slight adverse effect on aquatic habitat. At steady state conditions without mitigation, streamflow in the East Fork Rock Creek and Rock Creek would be slightly reduced and habitat conditions would likely be indistinguishable from pre-mining conditions. At steady state conditions with mitigation, streamflow in the East Fork Rock Creek would return to pre-mine conditions, and at Rock Creek at the mouth would increase slightly, and aquatic life conditions would return to pre-mining conditions.

Decreased low flow in the East Fork Bull River would likely reduce available salmonid habitat until the mine void filled and groundwater levels reached steady state conditions, with the maximum effect occurring in the stream reaches near and upstream of the CMW boundary. Predicted percent decreases in low flows would be less than for East Fork Rock Creek. Decreased habitat availability could result in impacts on the bull trout and other salmonids inhabiting the East Fork Bull River. At steady state conditions, habitat conditions would likely return to pre-mining conditions at sites from the CMW boundary. At EFBR-500 at the CMW boundary, a slight permanent flow reduction of 1 percent or less (Table 114, p. 670) would be predicted to occur, and would likely not affect aquatic habitat at that time.

Lakes

Effects to lake levels and volumes and the corresponding changes to aquatic habitat in Rock Lake would be the same for Alternative 2 as discussed in Alternative 3 without mitigation. Groundwater flow into Rock Lake would continue to decline after mining ceased. Reductions in lake levels and volume would be 5 percent or less and would probably not have a detectable effect on the aquatic biota of Rock Lake. While the lake level is projected to be permanently reduced by 2 percent without mitigation, aquatic habitat changes would likely be difficult to separate from those caused by natural variability in lake levels. This would be due to in part to the large influxes of surface water runoff that occur every year to Rock Lake during spring snowmelt and storm events, which would not be affected by the mine. When groundwater levels reached steady state conditions, lake levels and volume would, with mitigation, return to pre-mine conditions.

St. Paul Lake may be affected similarly by the mine as Rock Lake, but the much greater natural fluctuations that occur in St. Paul Lake would make habitat changes more difficult to separate from those caused by natural variability in lake levels.

Climate Change

The predicted effects of climate change are described above for the affected environment. The combined impacts of Alternative 2 and climate change were not quantified because of the possible range in effects of climate change on aquatic resources. The effects of the reduced low flows on aquatic resources combined with the effects of climate change may be greater than those estimated to occur in Alternative 2 alone.

3.6.4.2.3 Water Quality-Nutrients

All Phases

Streams

Section 3.13, *Water Quality* discusses anticipated effects of the alternatives on nutrient concentrations in area streams. This section discusses the effects of the predicted changes in nutrient concentrations on aquatic life.

In Alternative 2, increases in nutrient concentrations as a result of discharges would occur in the Libby Creek drainage from the LAD Areas or Water Treatment Plant to Ramsey, Poorman, and Libby creeks. These discharges may occur in all phases, and water quality effects would be similar. Therefore, predicted impacts are discussed collectively rather than divided into phases. The uncertainties associated with the predictions of changes in water quality in the analysis area as a result of the alternatives are discussed in section 3.13.4.5; these uncertainties also result in a level of uncertainty in the magnitude and location of effects on aquatic life from changes in nutrient concentrations in surface water.

Reductions in groundwater discharge due to mine inflows may reduce nutrient concentrations in waters in the East Fork Bull River and East Fork Rock Creek drainages, particularly during the low flow period of the year during the Operations, Closure, and Post-Closure Phases. The magnitude of the reduction in nutrient concentrations is not known and may not be detectable. Decreases in nutrient concentrations would not be directly deleterious to fish and macroinverte-brates, but primary productivity could decrease and adversely affect fish and invertebrate assemblages if an insufficient amount of nutrients were available to support these assemblages. If mine void water flowed to the East Fork Bull River or East Fork Rock Creek after mine closure, it is not likely that changes in nutrient concentrations in the river would be detectable.

As discussed in section 3.6.2.3.3, *Water Quality*, the BHES Order set a limit of 1 mg/L for TIN in Libby, Ramsey, and Poorman creeks (Appendix A). The DEQ has developed seasonal numeric standards between July 1 to September 30 in wadeable streams of 0.025 mg/L for total phosphorus and 0.275 mg/L for total nitrogen. If these standards were exceeded, they may not protect beneficial uses, and could result in nuisance levels of bottom-attached algae.

DEQ’s total nitrogen and total phosphorus standards are based on regional stressor-response studies within each ecoregion and studies from outside the region, as well as scientific literature that has a more general application, such as nutrient ratio preferences of nuisance algal species. The goal of some of the studies used was to maintain an in-stream chlorophyll-*a* concentration of less than the 150 mg/square meter’ threshold considered acceptable for river recreation by the Montana public (Suplee *et al.* 2009; Suplee and Watson 2013).

If significant increases in algal growth occurred as a result of the project alternatives, dissolved oxygen concentrations could decrease in streams as a response, particularly during early fall low flow periods, and aquatic life would be adversely affected. Increased algal growth may also result in higher daily pH values, but it is difficult to determine if the pH standard would be exceeded due to instream factors such as chemical buffering and re-aeration rates (Suplee, pers. comm. 2014). Such increases in algal growth may not occur in response to an increased total nitrogen concentration because phosphorus concentrations may limit algal growth when nitrogen is already present in surplus supply (Allan 1995, Steinman and Mulholland 1996). Co-limitation is also common in flowing waters, with additions of both total nitrogen and total phosphorus resulting in increases in algal growth of a larger magnitude than either nutrient separately (Suplee and Watson 2013). Other factors such as light, temperature, and length of the growing season can be important factors determining algal growth (Suplee *et al.* 2008; Lewis and McCutchan 2010). In streams with heavy canopy cover, systems become "light limited" and can attenuate algal growth, while elevation often controls stream temperature and length of the growing season in unpolluted or minimally polluted streams. High flow events can also affect algal growth by scouring algae from the streambed by high stream velocities alone or in combination with bedload movement. The effects of scouring depend on the timing, magnitude, and frequency of the high flow event (Suplee *et al.* 2008). total nitrogen and total phosphorus concentrations can also vary seasonally based on stream discharge or the proportion of groundwater discharge contributing to streamflow, and can increase following storm events (Suplee and Watson 2013). How these site-specific factors would combine with nutrient concentrations to affect algal assemblages in stream reaches in the analysis area has not been quantified.

The surface waters of the Libby Creek watershed have generally low nitrate+nitrite, ammonia, and phosphorus concentrations (Table 76). Low nutrient concentrations contribute to limited aquatic productivity. The mass balance calculations completed to evaluate effects on water quality (Appendix G) predict increases in nitrate, ammonia, total nitrogen, and total phosphorus concentrations above ambient concentrations during periods of low flow in Ramsey, Poorman, and Libby creeks from the LAD Areas without pre-treatment (Table 76). Discharges from the Water Treatment Plant would also increase nitrate, ammonia, total nitrogen, and total phosphorus concentrations in Libby Creek downstream of the discharge point (slightly upstream of LB-300) without pre-treatment.

Assuming MMC discharges 130 gpm of untreated water at the LAD Areas and 370 gpm from the Water Treatment Plant, TIN concentrations would exceed the BHES Order limit of 1.0 mg/L at RA-600 and PM-1200 (Table 76). Total nitrogen concentrations in Libby, Ramsey, and Poorman creeks would increase (Table 125, Table 126, and Table 127, pp. 732-734). The predicted total phosphorus concentration would increase and exceed the nonsignificance criterion, but not the standard, at RA-400, RA-600, PM-1200, and LB-1000. If exceedances of any treatment requirement, applicable standard, nonsignificance criterion, or limit occurred, less water would be sent to the LAD Areas, and additional water would be sent to the Water Treatment Plant.

Table 76. Maximum Projected Changes in Total Inorganic Nitrogen and Total Phosphorus Concentrations in Alternative 2.

Condition	Units	RA-600	PM-1200	LB-1000
Ammonia chronic aquatic life standard[1]	mg/L	6.29	5.91	6.12
Total nitrogen standard[2]	mg/L	0.275	0.275	0.275
BHES Order TIN limit	mg/L	1	1	1
Total phosphorus standard	mg/L	0.025	0.025	0.025
Ambient Surface Water Quality[3]				
Field pH	s.u.	6.8	7.0	6.9
Ammonia	mg/L	<0.052	<0.050	<0.030
Nitrate, as N	mg/L	<0.081	<0.053	<0.034
Total inorganic nitrogen (TIN)	mg/L	<0.13	<0.10	<0.064
Total nitrogen	mg/L	<0.25	<0.22	<0.11
Total phosphorus	mg/L	<1.5	<0.012	<0.009
Predicted Surface Water Quality during Low Flow[4]				
Ammonia	mg/L	<0.22	<0.16	<0.17
Nitrate, as N	mg/L	<1.4	<0.95	0.62
TIN	mg/L	<1.5	<1.0	<0.72
Total nitrogen	mg/L	<1.63	<1.1	<0.93
Total phosphorus	mg/L	<0.013	<0.012	<0.0082

mg/L = milligram per liter; s.u. = standard units; < = less than.
Concentrations presented with a < symbol had at least one sample with a reported concentration less than the detection limit used in calculating representative values; detection limit used in calculating representative value when reported concentration was below the detection limit.
[1]Ammonia chronic aquatic life standard value is pH and temperature dependent. To calculate the standard values, field pH values for each site were used and temperature was assumed to be 57°F.
[2]The DEQ preliminarily granted a variance of 15 mg/L for total nitrogen in the draft renewal MPDES permit.
[3]Representative values in analysis area streams are presented in Appendix K.
[4]Predicted TIN concentrations are based on discharging 130 gpm of untreated water at the LAD Areas and 370 gpm from the Water Treatment Plant; water would be sent to the Water Treatment Plant as necessary to prevent exceedances of applicable standards outside of a mixing zone.

Whether increased nitrogen concentrations would actually increase algal growth to the extent that it would be considered "undesirable aquatic life" is unknown based on the other factors that influence such growth. Libby Creek from the US 2 bridge to the Kootenai River is on Montana's list of impaired streams for sedimentation/siltation, a factor that could increase total phosphorus availability in the stream channel. Although projected TIN concentrations would be greater than existing conditions, the ammonia component of TIN would remain well below the applicable ammonia aquatic life standard (Table 76), indicating no potential toxicity from increased ammonia concentrations in analysis area streams.

If algal growth occurred from project discharges, significant seasonal dissolved oxygen decreases along a stream could result, which would be harmful to fish (Suplee and Suplee 2011) and macroinvertebrates. Adverse changes in the composition of macroinvertebrate assemblages to favor those taxa that are tolerant of nutrients or low dissolved oxygen, or those that feed directly on periphyton such as grazers, could also occur. Because TIN concentrations in Ramsey Creek and Poorman Creek are predicted to be greater than 1 mg/L and total nitrogen concentrations could increase without further treatment, effects on aquatic life may occur in these streams during low flows periods. Increased algal growth could stimulate productivity rates for aquatic insects and, consequently, stimulate populations of trout and other fish populations. Small increases in aquatic macroinvertebrate richness were associated with increases in nutrients in small, closed canopied streams in the western U.S.; decreases in richness were observed in larger, open-canopied systems in the same study (Yuan 2010). Increased algal growth could also reduce habitat availability for macroinvertebrates (Suplee, pers. comm. 2014).

The BHES Order discussed protection of beneficial uses. On page 5, the Order states "surface water and groundwater monitoring, including biological monitoring, as determined necessary by the Department [DEQ], will be required to ensure that the allowed levels are not exceeded and that beneficial uses are not impaired." Further on page 7, the Order indicates that the limit of 1 mg/L for TIN "should adequately protect existing beneficial uses. However, biological monitoring is necessary to insure protection of beneficial uses and to assure compliance with …applicable standards." The applicable standards include the existing narrative standard prohibiting undesirable aquatic life, or nuisance algal growth. According to the reopener provisions of MPDES permits described in ARM 17.30.1361(2)(b), "permits may be modified during their terms if…the department [DEQ] has received new information …indicating that cumulative effects on the environment are unacceptable, or (c) the standards or requirements on which the permit was based have been changed by amendment or judicial decision after the permit was issued." Consequently, the TIN limit for ambient surface waters set in the BHES Order could be modified in the MPDES permit issued by DEQ at any time if nuisance algal growth caused by MMC's discharge was observed. To address the uncertainty regarding the response of area streams to increased TIN concentrations, MMC would implement the water quality and aquatic biology monitoring described in Appendix C. This includes monitoring for periphyton and chlorophyll-a monthly between July and September.

Lakes

Mine dewatering and the resulting drawdown of bedrock groundwater may subtly change the water quality of Rock Lake and St. Paul Lake. Reducing the source of deeper groundwater may reduce nutrient concentrations. If such a change occurred, it would be detectable only during low flow periods when bedrock groundwater is the major source of supply to surface water. Even at low flows, the changes in water quality may be difficult to measure. The reduced nutrient availability may decrease algal and macroinvertebrate production in both lakes, and potentially reduce the fishery in Rock Lake. Data confirming the presence or absence of fish populations in St. Paul Lake were not available in the FWP (2012) database.

3.6.4.2.4 Water Quality-Metals

All Phases

Section 3.13, *Water Quality* discusses anticipated effects of the alternatives on metal concentrations in area streams. This section discusses the effect of changes in predicted metal concentrations on aquatic life. Changes in metal concentrations are expected during all phases. Predicted impacts are discussed collectively rather than divided into phases because the effects to aquatic life would be similar during all mine phases. Potential sources of elevated metals in the Libby Creek watershed include waste rock, ore, and tailings. Additional evaluation and characterization of the waste rock would be conducted during mine development and operations to minimize the potential for the waste rock to become a source of any increased metal concentrations. In addition, discharges from the LAD Areas would increase concentrations of some metals in Alternative 2.

Detectable changes in metal concentrations would not occur during all mine phases in the East Fork Rock Creek and East Fork Bull River, except potentially during the late Post-Closure Phase, when flow may occur from the mine void toward the East Fork Bull River or East Fork Rock Creek. As discussed in Section 3.13.4, *Water Quality*, it is unlikely that this flow would affect water quality or aquatic habitat. The west side streams are not discussed further with regard to effects of changing metal concentrations.

Streams

Section 3.13, *Water Quality* provides estimated concentrations of various parameters for streams affected by discharges of wastewater from the LAD Areas after mixing at RA-600, PM-1200, and LB-1000 (Table 125, Table 126, and Table 127). Effects at other locations are provided in Appendix G. Concentrations of most metals included in the mass balance analysis are predicted to increase over ambient conditions. Increases in these metal concentrations above ambient conditions could adversely affect aquatic life without additional primary treatment before land application occurred, but all metals would be estimated to remain below the acute and chronic criteria for aquatic life during all phases of mine activity. Predicted manganese concentrations at all locations would remain well below 1.04 mg/L.

The BHES Order would allow total copper concentrations up to 0.003 mg/L in all surface waters affected by the project (BHES 1992). The total copper concentration outside of a mixing zone resulting from project discharges could not exceed the chronic aquatic life standard (ALS) of 0.00285 mg/L. If the discharges at the LAD Areas resulted in exceedances of the ALS, MMC would treat the water to be discharged at these areas at the Water Treatment Plant instead of using the LAD Areas.

Increases in dissolved copper concentrations above ambient conditions in surface water can disrupt fish behaviors by interfering with their sensory systems and thus affecting predator avoidance, juvenile growth, and migratory success (Hetch *et al*. 2007). Potential effects on aquatic life from an increase in copper concentrations in the analysis area are difficult to determine given recent uncertainties regarding the protectiveness of the hardness-modified copper standard and the variability of existing instream copper concentrations. Since the 1996 release of hardness-modified copper criteria recommendations (EPA 1996), additional research has shown that water quality parameters other than hardness and ionic composition affect copper toxicity. In 2007, the EPA released new water quality recommendations for copper toxicity using the biotic ligand model (BLM). The BLM uses multiple water quality parameters when determining the appropriate copper standard (EPA 2007c). The detailed water chemistry data needed for BLM predictions are not available for the Libby Creek watershed. Preliminary analysis with the BLM indicates dissolved organic carbon and pH can be the primary drivers that influence copper toxicity (HydroQual, Inc. 2008). Typical groundwater and snowmelt-fed mountain streams is expected to have low dissolved organic carbon concentrations that make dissolved copper bioavailable and potentially toxic. Predicted increases in nitrogen and phosphorus concentrations may increase primary productivity, potentially resulting in increases in dissolved organic carbon concentrations, which could then possibly offset potential toxic responses due to increased copper concentrations. Furthermore, most measured instream copper concentrations are either at or near minimum laboratory detection limits, creating some uncertainty with any change in concentration from existing conditions (Appendix K-1).

The low concentrations of dissolved minerals in surface waters of the Libby Creek drainage cause these waters to tend toward acidic pH levels and to have extreme sensitivities to fluctuations in acidity. For most metals, the percentage of the metal occurring in the dissolved form increases with increasing acidity. Generally, dissolved metals are the most bioavailable fraction and have the greatest potential toxicities and effects on fish and other aquatic organisms. Any increase in metal concentrations could increase the potential risk for future impacts on fish and other aquatic life in some reaches. Metal concentrations near the ALS could result in physiological stress, such as respiratory and ion-regulatory stress, and mortality.

Predicting potential impacts on fish and other aquatic life in the Libby Creek watershed is significantly complicated by the fact that the very low hardness and total alkalinity occurring in these waters naturally cause potential ion-regulatory difficulties and stress in fish. These problems are exacerbated by the low nutrient and productivity levels in the streams that permit only minimal production of food organisms for fish, causing additional stress to fish and other aquatic life.

The design criteria for the tailings impoundment and seepage collection system would result in a low risk of exposure of aquatic life to any residual metals in the tailings. Catastrophic failure of the tailings impoundment would release tailings with elevated metal concentrations into the diverted Little Cherry Creek and Libby Creek. The release of metals would cause severe adverse effects on the aquatic biota that would persist for an undetermined period of time depending upon the type of failure, size of the impoundment at the time of failure, volume of water, and volume and character of sediments.

The agencies analyzed the risk and potential effects of water collection and treatment system failure (ERO Resources Corp. 2015c). In Alternative 2, MMC committed to implementing seepage control measures, such as pumpback recovery wells, if required to comply with applicable standards. The pumpback well system could fail to operate as designed because of a power failure or pump failure. A prolonged power outage or equipment failure would be necessary before groundwater levels recovered sufficiently to allow tailings seepage to reach surface water.

The effect on metal concentrations in Alternative 2 would not be detectable if metals were attenuated. If no metal attenuation occurred, predicted concentrations of cadmium, copper and lead in the former Little Cherry Creek would exceed chronic aquatic life standards; the acute aquatic life standard for copper in former Little Cherry Creek is also predicted to be exceeded. Nitrogen and phosphorus compounds would not be expected to be attenuated and total nitrogen and total phosphorus standards in former Little Cherry Creek are predicted to be exceeded. No exceedances of aquatic life standards are predicted for Libby Creek in Alternative 2. Exceedances of standards would adversely affect aquatic life in former Little Cherry Creek.

MMC would use the Water Treatment Plant at the Libby Adit Site to treat all wastewater discharges. The agencies concluded that two scenarios—discharge of untreated mine, adit, or tailings water because of a loss of all power and discharge of untreated mine, adit, or tailings water because of inadequate capacity—are not supported by credible scientific evidence (ERO Resources Corp. 2015c). The only plausible Water Treatment Plant failure scenario for which credible scientific evidence exists is a brief failure of the Water Treatment Plant to operate as designed. The draft renewal MPDES permit (DEQ 2015b) requires weekly sampling and analysis of some parameters and monthly sampling and analysis for metals. Any exceedances of the effluent limits would not last longer than about a month.

During plant malfunction, chronic aquatic life standards for total nitrogen, total phosphorus, cadmium, copper, and lead are predicted to be exceeded in Libby Creek at and below LB-300 in all alternatives. Exceedances of total phosphorus, cadmium, copper, and lead would extend to LB-2000. No acute aquatic life standards are predicted to be exceeded. Chronic aquatic life standards are based on a 96-hour exposure and can only be exceeded, on average, once in a 3-year period (DEQ 2012a). Depending on the duration of the plant malfunction, aquatic life below the Water Treatment Plant outfalls could be adversely affected. The draft renewal MPDES permit requires MMC to notify the DEQ as soon as possible, but no later than 24 hours from the time MMC first became aware of the circumstances of any serious incident of noncompliance with the MPDES effluent limits. In all alternatives, the Water Treatment Plant operator would have a Montana Water and Wastewater Operator Certification. The operator would oversee the daily operation of the plant. The MPDES permit conditions and required certification would reduce the potential for exceedances of water quality standards from a Water Treatment Plant malfunction.

Lakes

Metal concentrations in Rock and St. Paul lakes may decrease due to less deep bedrock groundwater entering the lakes. With mitigation, at steady state post-mining, water from the mine void is predicted to flow at a rate of 0.01 cfs toward Rock Lake. Because the net result would be no change in the lake volume, lake level, or surface area at steady state, effects to aquatic habitat are not anticipated. The barrier pillars with access opening bulkheads included in the mitigation would be designed to minimize post-mining changes in East Fork Rock Creek and East Fork Bull River streamflow and water quality. The mitigation of increasing the buffer zones near Rock Lake and the Rock Lake Fault, which was not modeled, may eliminate effects on Rock Lake during and after mining.

3.6.4.2.5 Temperature

All Phases

The mine project may affect stream temperatures by vegetation clearing, discharge of treated water from the Water Treatment Plant, decreased streamflows due to direct diversions, and changes in groundwater discharge to area streams and lakes. As discussed in Section 3.13, *Water Quality*, temperature changes as a result of the alternatives were not included in the mass balance calculations. Due to the numerous factors naturally affecting stream temperatures and the constantly changing stream temperature regime that occurs, predictions as to how the project alternatives would alter stream temperatures and affect aquatic assemblages are difficult to determine.

The fish assemblages within the analysis area streams are dominated by salmonid species that are adapted to cold water temperatures. Bull trout are found in the coldest waters and among the most limited range of temperatures (Mebane 2002), and generally require water temperatures ranging from 36°F to 59°F, with temperatures at the low end of this range required for successful incubation (USFWS 1998b, USFWS 2014c). Constant temperatures greater than 61°F have been shown to be intolerable to bull trout (Maret *et al*. 2005). Based on limited data, the temperatures in many stream reaches appear to be within this range for most of the year, but some exceedances occur in the summer (see section 3.6.3.11.1, *Temperature*). Cutthroat trout, rainbow trout, brook trout, and sculpin are also categorized as moderately or strongly stenothermal (Mebane 2002), indicating that they also require cold water temperatures. These fish could also be affected by any increasing stream temperatures. An increase in temperature, even within the thermal range of each species, can be associated with an increase in food demand, an increase in physiological stress, or a decrease in competitive fitness (Taniguchi *et al*. 1998; Morgan *et al*. 1999). In addition, some macroinvertebrates also have narrow thermal ranges and would only be present in streams with cold temperatures, with 66°F designated as the maximum average daily temperature considered suitable for cold aquatic life in Idaho (Grafe *et al*. 2002). Changes in temperature above the optimal range for the fish and macroinvertebrate species within the analysis area could result in decreases in diversity or abundance, changes in taxa composition, or other adverse effects to these assemblages.

In Alternative 2, water would be discharged from the LAD Areas and the Water Treatment Plant. Water discharged from the LAD Areas would cool as it flowed via the subsurface to nearby streams. Water discharged from the Water Treatment Plant, if discharged to the percolation pond or drainfield next to Libby Creek, also would cool as it flowed from the percolation pond or drainfield via the subsurface to the creek. Discharges to either the percolation pond, or drainfield, or directly to Libby Creek would cool further when mixed with receiving creek water in an approved surface water mixing zone. As part of the MPDES permitting process, synoptic temperature data were collected monthly or bi-monthly from February 2014 to April 2015 from one site upstream and one site downstream of the permitted outfalls (DEQ 2015b). Since 2006, discharge has only occurred from one of the three permitted outfalls (the percolation pond). The difference in stream temperatures between these two sites was less than 1°F during most months, with a maximum temperature difference of 2.7°F occurring in August 2014. The thermal effect from discharges from two of the three outfalls currently permitted are attenuated by discharging through groundwater. Direct discharges to Libby Creek from the percolation pond, if they were to occur, would be infrequent when the pond reached its full capacity. During final design, MMC would evaluate the size of the percolation pond at the Libby Adit, and enlarge it, if necessary, to accommodate higher discharge rates during operations. Stream temperatures would be monitored upstream and downstream of the outfalls in Libby Creek.

The decrease in low flows from reduced groundwater inflows that would occur in some portions of the Libby Creek watershed and in the west side streams as a result of the alternatives could result in increased stream temperatures during the low flow period in late summer and early fall, as well as possibly narrower daily temperature ranges. These decreases in flow and any associated effects on stream temperature that occurred would be greatest in the Closure and Post-Closure Phases for most streams.

The BA categorized stream temperatures as a habitat parameter that was currently functioning either at risk or unacceptable risk for most streams within the analysis area (USDA Forest Service 2013a). In general, multiple factors such additional inflow of groundwater as water travels downstream, the increase in average air temperature as elevation decreases, the influence of channel geometry, and the generally higher percentage of canopy cover on narrower streams would all play a role in determining the magnitude of any temperature increases. The extent of canopy coverage within the Rock Creek, East Fork Bull River, and Libby Creek drainages varies widely (Kline Environmental Research and NewFields 2012). Given the multiple factors that can affect stream temperature, the effect on aquatic life or the potential for stream temperature standards to be exceeded is uncertain.

Rock Lake and St. Paul Lake would be impacted by reduced groundwater inflows during some phases of the project, but the small predicted change in lake level, volume and surface area in the lakes would suggest that any water temperature changes would likely be minimal.

3.6.4.2.6 Metals in Fish

All Phases

Increases in metal concentrations above ambient conditions were predicted to occur from discharges from the Water Treatment Plant and LAD areas in the Libby Creek watershed in Alternative 2 (Table 125, Table 126, and Table 127). Any increased metal concentrations in surface water would potentially increase metal concentrations in fish. MMC has committed to treating water before discharge at the LAD areas, if necessary, to meet water quality standards or BHES Order limits. With treatment, the risk of increasing metal concentrations in fish would decrease for all east side streams.

Changes in metal concentrations in fish within the East Fork Rock Creek drainage are not predicted with any of the alternatives because surface disturbance near this stream would be limited to the construction of the Rock Lake Ventilation Adit, and there would be no discharges of water to the East Fork Rock Creek. At steady state conditions post-mining, without mitigation, water from the mine void is predicted to flow at a rate of 0.07 cfs to the East Fork Bull River, and could undergo changes in chemistry along this flow path. It is not likely that changes in water quality would be detectable or result in increased metal concentrations in fish tissues. The effect cannot be accurately quantified without additional information from the underground mine, which would be collected during the Operations Phase. With mitigation, the loss of water from the mine void to the East Fork Bull River may be minimized.

3.6.4.2.7 Fish Passage and Fish Loss

Evaluation, Construction, and Operations Phases

Streams

Proposed road reconstruction between US 2 and the Ramsey Plant Site would include new bridges over Ramsey and Poorman creeks and a new culvert on Little Cherry Creek. Bridge and culvert construction so as to meet INFS guidelines, along with implementation of MMC’s proposed BMPs, would minimize effects on fish passage. Based on these measures, no additional barriers to fish passage in east side streams from stream crossings would be created in Alternative 2. No additional stream crossings are proposed in the East Fork Rock Creek and East Fork Bull River drainages; therefore, no effects on fish passage from road or bridge construction is expected to occur in west side streams.

Effects on bull trout passage as a result of decreases in flow during the low flow period of each year were evaluated in the BA (USDA Forest Service 2013a), and the results of this analysis are summarized in section 3.6.4.3.2, *Water Quantity* as part of the discussion on the effects of mine dewatering in Alternative 3. Effects in Alternative 2 would be the same for west side streams and similar for east side streams.

Decreased streamflow predicted to occur in the upper East Fork Rock Creek and East Fork Bull River drainages may reduce available salmonid habitat and fish passage. The reduction in habitat may affect bull trout more severely than westslope cutthroat trout because they spawn during low-flow times of the year from August through November. Additionally, dry reaches of Rock Creek have been observed during low flow time periods under existing conditions, and these reaches might remain dry for longer time periods or the length of dry channel may increase. Because these reaches are near the mouth of Rock Creek, they may further reduce migratory bull trout from accessing any significant portion of the Rock Creek drainage for spawning. The bull trout population in Rock Creek is composed primarily of resident fish, but migrant bull trout also have been observed. To some extent, the dry reaches may be protecting the resident bull trout population in Rock Creek from hybridization or competition with non-native fish by limiting non-native fish access to Rock Creek from the lower Clark Fork River.

The Little Cherry Creek diversion would not alter fish passage because the creek currently has a series of permanent barriers thought to prevent upstream fish passage under all flow conditions. These barriers limit access to Little Cherry Creek from fish in Libby Creek to the most downstream 950 feet of Little Cherry Creek (Kline Environmental Research 2005b). Downstream fish passage would be unrestricted by the diversion, but the amount of habitat available for the redband trout that inhabit the diverted Little Cherry Creek would substantially decrease.

Flow in the diverted Little Cherry Creek would be substantially reduced during operations, as the pumpback well system, if implemented, would likely eliminate $7Q_{10}$ flows. The loss of available habitat in the diverted Little Cherry Creek would adversely affect the redband trout population in the diverted creek because the remaining habitat would not support the population at its current numbers, if at all. To mitigate the fisheries impacts associated with the Little Cherry Creek diversion and the riprapped tailings impoundment overflow channel to Bear Creek, MMC would implement a Fisheries Mitigation Plan. Before any other mitigation work was attempted, and immediately before closure of the Little Cherry Creek Diversion Dam, MMC would collect all fish in the existing stream section and move the fish to the newly constructed diversion channel. MMC would design the Little Cherry Creek Diversion Channel, to the extent practicable, for fish habitat and passage. MMC's survey of Drainage 10, the drainage that would receive diverted water, indicates that most of the drainage could develop habitat comparable to Little Cherry Creek over time.

Lakes

Changes in the outflow of Rock Lake could create a barrier to fish leaving the lake and moving into East Fork Rock Creek during the low flow period of the year, and would be more likely to occur in dry years when precipitation was limited. Barriers to upstream fish passage into Rock Lake are already present and would not be affected by mine activities. No surface outlet exists at St. Paul Lake; therefore, no effects on fish passage would occur.

Closure and Post-Closure Phases

Streams

Negligible effects on aquatic populations would occur due to stream crossings once the mine was closed and reclamation completed. Predicted decreased fish habitat and possible flow barriers in the East Fork Rock Creek and Rock Creek drainages from reduced low flow are expected to continue during the post-operational phases. When groundwater levels in the mine area reached steady state conditions, fish passage would be similar to pre-mine conditions. The pumpback well system would substantially reduce flow and habitat potential in the Diversion Channel as long as it operated. Flow from the tailings impoundment at closure would be directed toward Bear Creek, with flow in the diverted Little Cherry Creek estimated to be 45 percent less than existing flow. No additional direct unmitigated losses of fish are expected during the post-operational phases.

Lakes

Reductions in groundwater inflows into Rock Lake would continue during the Closure and Post-Closure Phases, and would be greatest 16 years after mining ceased. The natural barriers that prevent upstream fish movement into Rock Lake would persist, and downstream fish movement out of Rock Lake could be affected during the low flow period of the year. As discussed previously, while these limitations decrease available trout habitat in the Rock Creek drainage, they may help reduce hybridization of the westslope cutthroat trout population in East Fork Rock Creek. When groundwater levels in the mine area reached steady state conditions, fish passage would be similar to pre-mine conditions.

3.6.4.2.8 Threatened and Endangered Species

Evaluation, Construction, and Operations Phases

East Side Streams

Alternative 2 would affect bull trout and their habitat in analysis area streams. The BA (USDA Forest Service 2013a) analyzed effects to bull trout populations under Alternative 3, but most effects, including the changes in habitat availability resulting from altered low flows, would be similar between the alternatives. Section 3.6.4.3.2, *Water Quantity*, and section 3.6.4.3.6, *Threatened and Endangered Species*, discusses these effects and summarizes the results of the BA analysis in more detail, and also provides quantitative estimates of the maximum loss of bull trout habitat that would result from the project (Table 77).

In all mine alternatives, the Bear Creek Road (NFS road #278) would be completely paved and the road widened. The effects of Bear Creek Road reconstruction is discussed under Alternative 3. In Alternative 2, the width would be 20 to 29 feet. MMC did not propose any improvements on the Libby Creek Road (NFS road #231) or NFS road #2316. The increased traffic on the Bear Creek Road during the Evaluation Phase and the first year of the Construction Phase would slightly increase sediment delivery to Libby Creek. Increases in sediment in Libby, Bear, and Big Cherry Creek watersheds may adversely affect bull trout, but the use of BMPs to reduce sediment delivery to the streams and the implementation of habitat mitigation would be designed to minimize adverse effects to bull trout.

Bull trout populations in Libby Creek and the rest of the tributaries would not be directly affected by the loss of habitat in Little Cherry Creek because they do not have access to that habitat as a result of barriers to fish passage near the mouth. Most changes in flow within the Libby Creek drainage are expected to be minimal during Evaluation and Construction Phases and would not impact the bull trout populations within the drainage. Predicted flow increases when wastewater was treated and discharged in Libby Creek during the Evaluation, Construction, and Operations phases would be substantial during the time of the year when flows are typically low, and would result in increases to juvenile, adult, and spawning habitat for bull trout downstream of the Water Treatment Plant in these phases.

Upstream of the Water Treatment Plant, decreases in flow would occur during operations in Libby Creek and would decrease salmonid habitat, potentially adversely affecting the resident bull trout population that inhabits Libby Creek upstream of Libby Falls. Decreases in low flows would also occur in Poorman and Ramsey creeks, but bull trout abundances are low in these streams, and spawning has been documented infrequently or not at all. Changes to peak flows in analysis area streams would be minimal and would have a negligible effect on bull trout populations.

Vegetation clearing and other disturbances are proposed within RHCAs. If riparian shading decreased significantly, increases in stream temperatures would result and would potentially adversely affect bull trout populations. The temperature of the discharge of mine and adit water is expected to be between 51° and 60°F based on measured temperatures of the Water Treatment Plant effluent from February 2014 to May 2015 (DEQ 2015b). Increases in stream temperature between sites upstream and downstream of the Water Treatment Plant discharges were less than 1°F in most months in the 2014 and 2015 data, and stream temperatures at both sites were less than 51°F.

Effects of the disturbance and discharges could be exacerbated by decreases in groundwater inflows to streams resulting from mine dewatering. Low flow decreases would be minimal during these phases in the Rock Creek mainstem, East Fork Bull River, and Ramsey Creek, and increased flows would occur in the reaches of Libby Creek downstream of the Water Treatment Plant discharges. Decreases in low flows would be more substantial during the Operations Phase in Poorman Creek, Little Cherry Creek, and East Fork Rock Creek, ranging up to 21 percent. The effect on stream temperature is uncertain based on the many factors that influence this parameter, as discussed in section 3.6.4.2.5, *Temperature*. Bull trout require water temperature ranging from 36°F to 59°F, with temperatures at the low end of this range required for successful incubation (USFWS 1998b, USFWS 2014c). Water discharged from the Water Treatment Plant, if discharged to the percolation pond or drainfield next to Libby Creek, would cool as it flowed from the percolation pond or drainfield via groundwater to the creek. Discharges to either the percolation pond, drainfield, or directly to Libby Creek would cool further when mixed with receiving creek water in an approved surface water mixing zone. Direct discharges to Libby Creek from the percolation pond, if they were to occur, would be infrequent when the pond reached its full capacity. During final design, MMC would evaluate the size of the percolation pond at the Libby Adit, and enlarge it, if necessary, to accommodate higher discharge rates during operations. Temperatures in Libby Creek upstream and downstream of the discharges would be monitored.

Low flow in Bear Creek would also be reduced during the Operations Phase by diversions and a pumpback well system at the Little Cherry Creek impoundment. The effect was not quantified but would impact bull trout habitat in Bear Creek.

Under Alternative 2, bull trout populations in the Libby Creek watershed would continue to be marginal and their habitat in need of restoration work from existing, non-project impacts. Bull trout populations would continue to be susceptible to decline or disappearance due to hybridization with introduced brook trout, competition with brook trout and other trout present in the analysis area, or from other land use disturbances. Based on available survey data, brook trout abundances appear to be increasing within the Libby Creek drainage, and habitat degradation generally favors brook trout when competing with bull trout (Rieman and McIntyre 1993). The effect of any habitat change from mine activities in Alternative 2 may indirectly be magnified by giving brook trout an additional competitive advantage.

The small resident bull trout population upstream of Libby Falls would be protected from the threat of hybridization or competition with brook trout because the falls prevent access to this segment of Libby Creek from fish downstream. Decreases in low flows were not quantified for most of the upstream portion of this segment as part of the surface water impact analysis, but predicted changes to baseflow at the end of operations were included in the groundwater analysis under Alternative 3. An estimated 20 percent reduction in baseflows would occur in the reach near LB-100 at the CMW boundary with mitigation in the Operations Phase (Table 99, p. 595). The decreased baseflows would result in decreases in habitat availability for bull trout during the low flow part of the year and would result in adverse impacts on this population without mitigation.

Components of MMC's Fisheries Mitigation Plan would benefit bull trout populations and habitat in the Libby Creek watershed. The mitigation plan includes habitat restoration projects in Libby Creek and its tributaries, evaluation of potential habitat restoration or enhancement, replacement of culverts and removal of bridges, stabilization of sediment sources, and the potential exclusion of livestock from areas where grazing and bull trout distributions overlap. The proposed restoration and enhancement projects would be aimed at creating high quality habitat necessary to sustain wild trout populations. Mitigation projects involving habitat restoration and enhancement would be assessed further before being initiated to determine which of the proposed options would likely result in the greatest benefits to fish habitat and populations. The mitigation projects in bull trout-occupied streams, such as Libby and Poorman creeks, if implemented, would improve the bull trout population and habitat.

West Side Streams

Bull trout populations in the East Fork Rock Creek, Rock Creek, and East Fork Bull River drainage would be adversely affected by mine activities in Alternative 2 in the Evaluation, Construction, and Operations Phases. Only minimal changes in habitat availability would occur in the Rock Creek drainage in the reaches inhabited by bull trout, with an estimated 1 percent decrease in low flows within the reach of East Fork Rock Creek upstream of West Fork Rock Creek in the Operations Phase (Table 77). Habitat availability would decrease more in the East Fork Bull River, with a 7 percent decrease in low flows estimated to occur at EFBR-2 near the confluence with Isabella Creek in the Operations phase. Changes in streamflow would reduce bull trout habitat, and may create barriers by reducing low flow within these drainages. Because bull trout spawn from August through November when low flow conditions often occur, available spawning habitat in these streams would decrease. Additionally, bull trout prefer to spawn in areas with groundwater discharge because these areas tend to remain open throughout winter, maintain appropriate incubation temperatures, and increase the water exchange rate (Montana Bull Trout Scientific Group 1998). Because the East Fork Bull River is considered the most important bull trout stream in the lower Clark Fork River drainage (Montana Bull Trout Scientific Group 1996), decreased levels of bull trout spawning within this stream could have long-term adverse effects on the bull trout population within the lower Clark Fork River drainage.

Lakes

Bull trout do not inhabit any of the analysis area lakes; the hydrological effects on these lakes would not directly affect bull trout populations.

Closure and Post-Closure Phases

Streams

Within the Libby Creek watershed, the flow effects and associated changes in habitat availability for bull trout in Libby Creek upstream of the Libby Adit and in lower Ramsey Creek would be similar to those in the Operations Phase and would gradually return to pre-mine conditions when steady state groundwater conditions were reached. The greatest reduction in flows would occur immediately after the adits were plugged. Reduced bull trout habitat availability would continue to have the potential to adversely affect bull trout populations without mitigation, including the resident population that inhabits the reach of Libby Creek upstream of the falls. Predicted flow increases when wastewater was treated and discharged in Libby Creek would provide additional flow during spawning season. Unrelated to mine activities, hybridization with brook trout would continue to threaten the bull trout populations in the Libby Creek watershed.

Surface runoff from the Little Cherry Creek tailings impoundment would be directed toward Bear Creek after operations ceased. The design of the diversion channel and other BMPs would minimize the amount of sediment reaching Bear Creek. The effect of any increases in sediment on bull trout in Bear Creek would be negligible. The pumpback well system would reduce low flow and bull trout habitat in the Bear Creek as long as it operated. After pumpback well operation ceased, average annual streamflow would increase in Bear Creek as a result of the increase in watershed area, and would slightly benefit bull trout habitat.

Within the west side streams, the maximum effects from decreased low flows would occur during the Post-Closure Phase, and would be similar to the effects in Alternative 3 without mitigation. Access to the Rock Creek drainage for migratory bull trout could be further impacted by the decreases in flows if they increase the length, duration, or frequency of occurrence of the seasonally dry reaches. The decreased flows would potentially decrease the possibility of brook trout accessing Rock Creek as well, which could benefit the resident bull trout population in the Rock Creek drainage by decreasing the possibility of hybridization or competition. Unrelated to mine activities, hybridization with brook trout would continue to threaten the bull trout populations in the East Fork Bull River watershed.

Lakes

Bull trout do not inhabit Rock Lake or any of other analysis area lakes; the hydrological effects on these lakes would not directly affect bull trout populations.

Effects on Critical Habitat

The USFWS has designated critical habitat in the Clark Fork River and Kootenai River drainages within the following streams in the analysis area: Rock Creek, East Fork Bull River, Libby Creek, Bear Creek, and West Fisher Creek (Figure 55). Alternative 2 would affect bull trout critical habitat in all of these streams except West Fisher Creek. None of the mine alternatives, including Alternative 2, would affect designated critical habitat in West Fisher Creek. Effects on designated critical habitat in West Fisher Creek are discussed in section 3.6.4.9.3, *Threatened, Endangered, or Sensitive Species* for the transmission line Alternative E-R. No roads or other facilities are proposed in any designated segment in Alternative 2.

Predicted flow increases when wastewater was treated and discharged in Libby Creek during all phases would provide additional flow during spawning season. Synoptic temperature data indicates that temperature increases to Libby Creek as a result of the wastewater discharges would be minimal when mixed with the receiving water, with an increase of less than 1°F expected most months. Decreases in low flow in the reach of Libby Creek upstream of the Water Treatment Plant would occur in the Operations, Closure, and Post-Closure phases and may be substantial enough to adversely affect bull trout critical habitat. Increased nutrient and metal concentrations could occur within the critical habitat in Libby Creek during all phases as well, but if discharges to the LAD Areas resulted in exceedances of BHES Order or ALS limits, MMC would treat the water to be discharged at these areas at the Water Treatment Plant instead, minimizing the risk of effects occurring. The pumpback well system would reduce low flow and bull trout critical habitat in Bear Creek as long as it operated.

Alternative 2 may affect critical habitat in East Fork Bull River, East Fork Rock Creek, and Rock Creek. Changes in streamflow may affect bull trout habitat, and create barriers by reducing low flow within these drainages. Because bull trout spawn from August through November when low flow conditions often occur, available spawning habitat in these streams may decrease.

3.6.4.2.9 Forest Service Sensitive Species and State Species of Concern

Evaluation, Construction, and Operations Phases

Streams

Alternative 2 would adversely impact the redband trout population that inhabits the Libby Creek drainage within the analysis area. The diversion of Little Cherry Creek to accommodate placement of the tailings impoundment would result in a loss of 15,600 feet of pure redband trout habitat. Because barriers to fish passage exist near the confluence of Little Cherry Creek and Libby Creek, this loss of habitat would not affect the hybrid redband trout populations in Libby Creek and the remaining tributaries within the analysis area. The purity of the redband trout population within Little Cherry Creek has likely persisted due to the location of these barriers, which effectively block the entry of rainbow trout and hybrid trout from Libby Creek into Little Cherry Creek.

MMC's proposed mitigation in Alternative 2 would include the removal of all trout inhabiting Little Cherry Creek and their subsequent transfer to the diversion drainage. These efforts would minimize any immediate loss of trout resulting from the proposed alterations to Little Cherry Creek. In the 1993 ROD (U.S. Forest Service 1993), the Forest Service and FWP concluded the mitigation options had a near certain probability of success in replacing the functions and values projected to be lost in Little Cherry Creek due to Montanore. The effects analysis did not consider the likely need for a pumpback well system to prevent tailings seepage from reaching surface water. Flow in the diverted Little Cherry Creek would be substantially reduced during operations, as the pumpback well system, if implemented, would likely eliminate $7Q_{10}$ flows. The loss of available habitat in the diverted Little Cherry Creek would adversely affect the redband trout population in the diverted creek because the remaining habitat would not support the population at its current numbers, if at all. While the loss of this population would represent a loss of genetic diversity and individual trout, the reduction in the redband trout population and habitat would not likely cause a trend to federal listing or cause a loss of viability to the population or species. An assessment of the status of redband trout in the Northwest (May *et al.* 2012) determined that over 70 percent of the populations were at least moderately healthy based on amount of habitat occupied, abundance within the population, habitat quality parameters, presence of non-native fish, and number of streams associated with the populations.

Alternative 2 may impact westslope cutthroat trout. A pure westslope cutthroat trout population is present in East Fork Bull River, and pure and hybrid westslope cutthroat trout exist in the Rock Creek drainage. These trout are present in relatively high densities, particularly in the East Fork Bull River. As with bull trout, reduced low flow in the upstream reaches of these streams during certain times of the year would decrease the amount of available habitat to westslope cutthroat trout populations. While these effects would adversely impact the westslope cutthroat populations in these streams, the higher numbers of westslope cutthroat trout indicate that the populations are at less risk than the bull trout populations. Additionally, this species spawns during the spring, rather than during the low flow time period when analysis area streams would be most affected by decreased groundwater input. The effects on the westslope cutthroat trout would not likely cause a trend to federal listing or cause a loss of viability to the population or species. The main risk to westslope cutthroat populations would likely continue to be hybridization and competition with non-native trout.

Alternative 2 may impact torrent sculpin populations, but little data were available to determine their existing status in the analysis area. While the changes in low flows and other effects associated with the project may adversely impact this abundance of this species, predictions of effects from the alternatives could not accurately be made based on the limited data available. Western pearlshell mussels have not been documented to occur in streams within the analysis area. Alternative 2 would not likely impact this species.

Lakes

Pure populations of redband or westslope cutthroat trout do not inhabit any analysis area lakes; thus, the hydrological effects on these lakes would not directly affect redband or westslope cutthroat trout populations.

Closure and Post-Closure Phases

The flow effects and associated changes in habitat in Libby Creek in the Closure and Post-Closure phases would be similar to those in the earlier phases and would gradually return to pre-mine conditions when steady state groundwater conditions were reached. Flow in the diverted Little Cherry Creek would likely be eliminated as long as the pumpback well system operated. The diverted creek would not be capable of supporting redband trout. Flow from the tailings impoundment at closure would be directed toward Bear Creek, with flow in the diverted Little Cherry Creek estimated to be 45 percent less than existing flow. Reestablishment of the redband trout population in Little Cherry Creek would not likely occur after the pumpback wells ceased operating and flows increased.

As the mine void filled, westslope cutthroat trout populations in East Fork Rock Creek and the East Fork Bull River would also continue to be affected by decreased flows in these streams. The decreased flows are predicted to persist until after mine operations ceased and be similar to pre-mine conditions when groundwater levels in the analysis area reached steady state conditions. Hybridization would continue to be the primary threat to both the redband trout and the westslope cutthroat trout populations in these watersheds.

3.6.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Alternative 3 would incorporate the agencies' proposed modifications and mitigating measures that would reduce or eliminate impacts on area streams. Four major mine facilities would be located in alternative locations, which would reduce effects on aquatic life. The tailings impoundment would be at the Poorman Impoundment Site, eliminating the need for a diversion of Little Cherry Creek. Additionally, the plant site would be between Libby and Ramsey creeks, avoiding construction in a RHCA. Two additional adits would be constructed in the upper Libby Creek drainage, eliminating most construction in the Ramsey Creek watershed. The LAD Areas would not be used and all wastewater would be treated and discharged from the Water Treatment Plant. The Water Treatment Plant would be modified to treat nitrogen compounds and phosphorus, and possibly dissolved metals. The unmitigated effects of flow changes in Alternative 3 on aquatic life in area lakes (Rock Lake and St. Paul Lake) and west side streams (East Fork Rock Creek and East Fork Bull River) would be the same as Alternative 2. The discussion of effects in these areas is limited to the effects of the agencies' mitigation, except for changes to water quantity resulting from the project, as these changes were modeled specifically for this alternative.

3.6.4.3.1 Sediment

Evaluation, Construction, and Operations Phases

Effects on Riparian Habitat Conservation Areas. The locations and structures of the plant and impoundment site in Alternative 3 would decrease disturbance within RHCAs. Alternative 3 would affect 256 acres of RHCAs on National Forest System land and 9 acres of other riparian areas on private land, substantially less than Alternative 2 (Table 75). Because RHCAs are designed to act as a buffer to protect the streams from sediment as well as other impacts, fewer disturbances within these areas would reduce the potential for sediment to reach streams, particularly during the Construction Phase when sediment impacts have the greatest probability of occurring. Road closure mitigation in the Libby Creek, Fisher River, and East Fork Rock Creek watersheds also may allow the reestablishment of RHCAs along these roads.

Effects within the Mine Permit Area Boundary. Effects within the mine permit area boundary would be similar to Alternative 2. Sediment and runoff from all disturbed areas would be minimized through the use of BMPs developed in accordance with the Forest Service's *National Best Management Practices for Water Quality Management on National Forest System Lands* (USDA Forest Service 2012a) and the BMP requirements in the MPDES permit.

Because the tailings impoundment in Alternative 3 would not require diversion of a perennial stream and would be located within a smaller watershed, the amount of disturbance and subsequent erosion potential would be less than in Alternative 2. The sediment ponds containing mine drainage or process water associated with the other mine facilities in Alternative 3 would be designed to accommodate a 100-yr/24-hour storm event, compared to a 10-yr/24-hr storm event under Alternative 2. These structures would be less likely to discharge and cause increased sediment to occur temporarily in Poorman, Ramsey, and Libby creeks. Within the mine permit area boundary, all stormwater runoff from roads would be captured by ditches and sediment ponds sized to contain the 10-year/24 hour storm. Any discharges of stormwater would be from MPDES permitted outfalls 004, 005, 006, 007, or 008. Discharges from the outfalls to Libby, Ramsey, and Poorman creeks would be monitored, and would be required to meet applicable effluent limits for sediment (DEQ 2015b). Temporary increases in sediment delivery to streams would result if large storm events occurred, but the high flows associated with this type of event would likely distribute the sediment downstream in flood plains or low gradient stream reaches, or carry the excess sediment to the Kootenai River. The Seepage Collection Pond would be designed to accommodate up to 30 days of drain flow plus runoff from a 6-hour PMP event, in comparison to the pond associated with Alternative 2, which was designed to accommodate the smaller 100-year/24-hour storm event. As in Alternative 2, excess water in the Seepage Collection Pond would be pumped back to the impoundment and to the Water Treatment Plant if necessary for treatment. The capacity of the Water Treatment Plant would be enlarged to ensure adequate capacity to treat excess water.

The Poorman Impoundment has a similar risk profile to the Little Cherry Creek Impoundment. The probability of catastrophic failure of the tailings impoundment or sediment ponds is low and the effect would be the same as Alternative 2. The tailings pipeline would be buried for most of its length where practical rather than being on the surface as in Alternative 2, which would reduce the risk of tailings reaching streams. The creek crossings at which the pipeline would not be buried would have secondary containment built into the crossings and would be designed to minimize the quantity of tailings that would reach the streams if a rupture were to occur.

The Libby Plant site would be located more than 500 feet from the stream channel, reducing the potential for overland flow carrying sediment to reach Libby Creek, and there would be no LAD Areas, eliminating those as a source of erosion. Flow increases as a result of Water Treatment Plant discharges would occur in Libby Creek under Alternative 3, but are not expected to alter the physical substrate composition or affect sediment transport. Measures would be taken by MMC in Alternative 3 in addition to those described for Alternative 2 to incrementally stabilize soil stockpiles and begin revegetation of these stockpiles immediately to reduce erosion rather than waiting until capacity was reached. Furthermore, replacement of soils in the impoundment area would be based on their erodibility and slope steepness to minimize erosion potential. All permanent cut and fill slopes on roads would be seeded, fertilized, and stabilized.

Roads Outside the Mine Operating Permit Boundary. Road construction and reconstruction is often considered the largest source of sediment in mining and timber harvest areas due to the removal of vegetation and construction of cut and fill slopes that expose large areas subject to erosion (Belt *et al.* 1992). In a literature review associated with the development of the Inland Native Fish Strategy (INFS) Belt *et al.* (1992) also reported that non-channelized sediment flow rarely travels more than 300 feet, and that 200- to 300-foot riparian buffers are generally effective at protecting streams by preventing sediment from reaching streams via non-channelized overland flow. Results of the WEPP:Road Batch model indicated that smaller buffer widths would prevent sediment from reaching streams. For example, the model results for new transmission line roads showed that buffer widths of 40 to 60 feet were adequate to reduce sediment leaving the buffers to zero.

In all mine alternatives, the Bear Creek Road (NFS road #278) would be completely paved and the road widened (to 26 feet in Alternative 3). The WEPP:Road Batch model predicted that paving and widening all of the Bear Creek Road would increase the amount of sediment leaving the forested buffer adjacent to the road. Most of the sediment increase (40 pounds per year) is predicted to occur at one crossing of an unnamed, intermittent tributary of Big Cherry Creek. The crossing would be 600 feet from Big Cherry Creek. Forty pounds of sediment is 0.24 cubic feet; this small volume may not reach Big Cherry Creek but remain in the channel of the unnamed tributary. Other crossings at which the WEPP:Road Batch model predicted sediment increases were the bridge over Bear Creek and at Little Cherry Creek. BMPs in addition to paving at these crossing would be evaluated during final design.

In Alternatives 3 and 4, MMC would implement road improvements on the Libby Creek Road (NFS road #231) or NFS road #2316, such as reducing road lengths contributing sediment at stream crossings, installing, removing, or cleaning culverts, and improving the roads' surface. The WEPP:Road Batch model provided results for the reduction in road length and predicted a decrease in the amount of sediment leaving the forested buffer adjacent to the road. Road improvements would benefit aquatic life in Libby, Midas, and Hoodoo creeks.

Effects of Mitigation. The stream mitigation plan proposed by MMC for Alternative 3 (see section 2.5.7.1) includes stream enhancement or restoration projects, removal of culverts or bridges, and riparian planting that would improve aquatic habitat along Swamp Creek, Poorman Creek, and Little Cherry Creek. MMC's analysis of the potential credits of these projects using the Corps' Montana Stream Mitigation Procedure (Corps 2013a) is described in MMC's revised Preliminary Mitigation Design Report (MMC 2014a).

In Alternatives 3 and 4, MMC would implement or fund access changes on 32 roads totaling 52 miles, some of which would be completed before the Evaluation Phase and some before the Construction Phase (Table 28 and Table 29 in Chapter 2). Other roads would be closed at the end of operations. The roads with access changes would be covered by a Road Management Plan. The plan would describe requirements for pre-, during-, and post-storm inspections and maintenance; implementation and effectiveness monitoring plans for road stability, drainage, and erosion control; and mitigation plans for road failures. Eight of the roads totaling 16.3 miles are currently open to motorized traffic; the roads would be barriered and motorized traffic eliminated.

Six roads totaling 14.9 miles with access changes may be decommissioned and converted to trails (Table 28 and Table 29 in Chapter 2). Decommissioned roads would be monitored for stability, drainage, and erosion control. To minimize sediment movement from decommissioned roads to RHCAs, MMC may decompact the road surface, move any unstable road fill to a more stable location, re-establish natural surface drainage patterns (such as by removing culverts and reshaping stream banks), and recontour and revegetate the former road area. An analysis of decommissioning treatments on forest roads in northern Montana and Idaho showed a reduction in fine sediment delivery to streams of 97 percent (Cissel *et al.* 2011). Roads that would be barriered and may be converted to trails would benefit aquatic life in Libby, Poorman, Ramsey, Standard, and East Fork Rock creeks.

Fisheries mitigation proposed for Alternative 3 may include the instream activity in Copper Gulch, Libby Creek, and Flower Creek described in section 2.5.7.3.2, *Conceptual Mitigation Actions* for bull trout mitigation. Mitigation implemented in Flower Creek would be a contingency to failed mitigation in Upper Libby Creek. Short-term effects (2 days or less) of these mitigations would be increased turbidity and sediment concentrations downstream of the activity during construction. Appropriate BMPs would be identified during final design and implemented with each project. Long-term effects to stream water quality and aquatic habitat would be beneficial because of improved channel stability and decreased downstream sediment concentrations.

Short-term effects (2 days or less) of these mitigations would be increased turbidity and sediment concentrations downstream of the culvert removals, bridge removal, and channel reconstruction and stabilization during construction. Placing straw bales in the stream below the construction area would significantly reduce sediment concentrations in the stream below the bales (Foltz *et al*. 2008). An effective way to prevent brief turbidity and sediment concentration increases, if practicable, would be to route stream water around the construction area until completion (Wegner 1999). When completing instream work within a 0.25-mile of a bull trout occupied stream, MMC would place straw bales in the stream where practicable, minimize the duration of instream work to the extent practicable, and conduct all instream work between July 15 to September 1. Work could be completed outside of that time period if it could be implemented in a dry portion of the stream channel and all other potential impacts were fully mitigated. Long-term effects to the streams would be beneficial. Fine sediment in streams below mitigation sites has been shown to decrease, spawning areas increased, and monitoring of instream aquatic macroinvertebrate communities for several years after culvert removals showed increases in their populations and number of species (Wegner 1999).

Proposed instream activities would be subject to three permitting processes: a 310 permit, a 318 authorization, and a 404 permit. Installation of culverts, bridges, or other structures at perennial stream crossings would be specified in accordance with a 310 permit following on-site inspections with DEQ, Forest Service, FWP, landowners, and the local conservation district. Installation or removal of culverts or other structures in a water of the State would be in accordance with DEQ 318 authorization conditions. For activities not covered by a MPDES or general permit, MMC may request and the DEQ may approve a 318 authorization for short-term increases in turbidity and total suspended solids discussed on p. 705. All installation or removal of culverts or other structures in a water of the United States if they resulted in a discharge of fill would be in accordance with the Corps' 404 permit conditions.

Mitigation and Monitoring. The MPDES permit requires MMC to implement a SWPPP to minimize erosion and sedimentation from disturbed areas during construction and operations. The plan would address stormwater runoff from mine-related facilities for soil stockpiles, access/haul roads, adit pads, and parking lots. The plan would describe the potential sources of stormwater pollution, pollution prevention practices, sediment and erosion control measures, runoff management, inspections, and reporting. BMPs would include ditches, sediment traps, and sediment retention ponds.

All point source discharges containing sediment from the Montanore Project via stormwater outfalls or the Water Treatment Plant would be monitored and reported to DEQ, and Water Treatment Plant Outfall 003 would also be subject to daily and monthly sediment limits. The DEQ and EPA established as a TMDL an average annual sediment load of 4,234 tons for Libby Creek from the US 2 bridge to the confluence with the Kootenai River (DEQ and EPA 2014). As part of this TMDL, the Montanore facility was assigned a sediment wasteload allocation of 24 tons/year. MMC's point source and nonpoint source discharges containing sediment would be a small contribution to the estimated existing sediment load of 1,621 tons/year and the estimated future sediment load of 1,102 tons/year in the upper Libby Creek watershed.

Monitoring of BMPs and instream sediment would be more extensive than proposed by MMC. Appendix C.10.5.4, *Stormwater, Suspended Sediment, and Best Management Practices Monitoring* discusses the agencies proposed monitoring. Appendix C.11, *Aquatic Biology,* discusses the agencies proposed instream monitoring. The monitoring would increase the effectiveness of stormwater and sediment controls. Beginning on the effective date of the MPDES permit, MMC would monitor all discharges to surface water for sediment, and report sediment concentrations to DEQ monthly (see Appendix C). Any failures of the sediment BMPs detected through monitoring would require MMC to implement corrective measures in accordance with the MPDES permit.

Sediment (as percent fines) would be monitored within the Libby Creek drainage to detect any potential sediment increases. Sediment sampling would occur at a station on Libby Creek downstream of the Little Cherry Creek confluence. Sampling would occur daily during the Construction Phase, as most potential increases in sedimentation is expected to occur then. During initial mine operations, sampling would occur on alternate days, and frequency would then be reduced to once per week for the remainder of the Operation and Closure phases. Based on the sampling schedule, any increases in sediment within the Libby Creek system would be detected quickly, allowing for prompt action and remediation.

Effects Summary. Any sedimentation, if it were to occur from sediment pond discharges or other mine activity sources, would have the potential to alter aquatic habitat by decreasing pool depth and habitat complexity, changing substrate composition by filling in interstitial spaces, and increasing substrate embeddedness (Rieman and McIntyre 1993; Waters 1995). These changes to stream habitat can affect salmonid reproductive success by degrading and decreasing spawning and rearing habitat, and by increasing egg and juvenile mortality (Shepard *et al.* 1984; Fraley and Shepard 1989; Weaver and Fraley 1991; Waters 1995; Watson and Hillman 1997; Montana Bull Trout Scientific Group 1998; Muck 2010). Optimal bull trout spawning and rearing areas should have less than 20 percent of the substrate consisting of fine particles of 6 mm or less for the habitat to be functioning appropriately (USFWS 1998b), and less than 30 percent fines (<6.35 mm) has been reported to be necessary for successful bull trout incubation (Parametrix 2005). Behavioral effects can also result from increased suspended or deposited sediment as fish may avoid stream reaches with high sediment levels, or their migration, foraging, or predation behaviors may be altered, resulting in population declines or mortality over time (Muck 2010).

Benthic macroinvertebrate communities can be affected by increases in fine sediment, with decreases in abundance, taxa richness, EPT taxa richness, and diversity observed as fine sediment increases and substrate suitability for many taxa decreases (Angradi 1999; Kaller and Hartman 2004; Harrison *et al*. 2007; Larsen *et al*. 2009; Bryce *et al*. 2010). Changes in invertebrate metrics were associated with percent fine sediment increases as low as less than 5 percent to 30 percent of the substrate composition. A reduction in macroinvertebrate abundance or changes in the composition of the macroinvertebrate population can also indirectly have deleterious effects on fish populations by causing slower growth rates, higher mortality, and reduced fecundity (Berkman and Rabeni 1987; Waters 1995; USFWS 2003a; Muck 2010). Large increases in suspended sediment can directly result in mortality of fish and invertebrates by clogging gills and causing respiratory impairment (Muck 2010).

The existing levels of fine sediment in spawning areas in analysis area streams within the Libby Creek watershed were measured one or more times per year in 2005 through 2008. The mean percent fines (described in the report as fines less than 6.25 mm or 0.25 inches) in gravel at each site within the Libby Creek watershed ranged from 15 percent at the lowest Libby Creek site to 39 percent at the most upstream Little Cherry Creek site in 2005 (Table 68) (Kline Environmental Research 2005). Surveys conducted in 2006 through 2008 indicated that the percent fines in low gradient riffle areas in the Libby Creek watershed were generally less than 10 percent at most sites, although the reach of Libby Creek upstream of the falls and the Little Cherry Creek reach had higher percentages during some surveys (Kline Environmental Research 2009). Fines at the Little Cherry Creek site were elevated up to 95 percent in 2008, potentially due to logging activity within the area. These data indicate that most surveyed stream reaches currently have levels below the 30 percent fine sediment threshold (Parametrix 2005), which begins to substantially decrease successful bull trout incubation.

It is anticipated that the levels of sediment generated through Alternative 3 would be small in volume and duration based on implementation of the BMPs and design features of the mine facilities. Any introduction of limited amounts of additional small gravels and fine sediment from construction or operation of the mine would likely have few if any effects on macroinvertebrate and fish populations, and annual snowmelt runoff would likely flush any accumulation of fine sediments downstream each spring. MMC's point source and nonpoint source discharges containing sediment would be a small contribution to the estimated existing sediment load and the estimated future sediment load in the upper Libby Creek and Big Cherry Creek watersheds (Table 123, p. 722). These factors make it unlikely that effects from Alternative 3 would result in detectable adverse changes in existing levels of sediment, quality of fish habitat, or sustainability of aquatic populations over the long-term. Effects would only be greater if required BMPs did not have the anticipated result of eliminating or reducing the existing sediment input into analysis area streams or if the Poorman impoundment or tailings line were to fail. Beginning on the effective date of the MPDES permit, MMC would monitor all discharges to surface water for sediment, and report sediment concentrations to DEQ monthly (see Appendix C). Any failures of the sediment BMPs detected through monitoring would require MMC to implement corrective measures in accordance with the MPDES permit.

The DEQ and the EPA established water quality restoration goals for sediment in Libby Creek on the basis of fine sediment levels in trout spawning areas and aquatic insect habitat, stream morphology and available instream habitat as it relates to the effects of sediment, and the stability of streambanks. Meeting the TMDL, of which Montanore's wasteload allocation of 24 tons per year is a part, will satisfy the water quality restoration goals. The DEQ believes that once the water quality restoration goals are met, all beneficial uses currently affected by sediment will be restored (DEQ and EPA 2014).

Closure and Post-Closure Phases

Once the mine closed, the risk of increased sediment to streams within most of the analysis area would be low. The existing bridge across Poorman Creek on Little Cherry Loop Road (NFS road #6212) would be removed at closure and the road revegetated. Bridge removal would result in some brief increases in sedimentation, but the longer-term effect would be beneficial for aquatic habitat and biota compared to existing conditions.

When the impoundment was no longer needed to store water, a channel would be excavated to route runoff from the site toward a tributary of Little Cherry Creek. Modifications to the final channel design would be made to minimize erosion and sedimentation of Little Cherry Creek. The reclaimed impoundment would be designed to retain peak flows in the impoundment and allow dissipation of runoff from extreme storm events. Runoff from the reclaimed impoundment would increase mean monthly flows by less than 1 percent during April, May, and June, and would not increase mean monthly discharge for the remainder of the year. The influence of the increased flow to Little Cherry Creek on channel stability was assessed using information on stream habitat and bank characteristics (Kline Environmental Research 2015). It is expected that given the low occurrence of unstable banks in Little Cherry Creek and the small increases in stream flow, changes to bedload transport and streambank erosion would be insignificant in Little Cherry Creek.

3.6.4.3.2 Water Quantity

Evaluation, Construction, and Operations Phases

East Side Streams

Without mitigation, the primary difference between Alternatives 2 and 3 regarding effects on streamflows would be the location of the tailings impoundment between Poorman and Little Cherry creeks. Flow in Bear Creek would not be affected by Alternative 3. Operation of the pumpback wells would reduce streamflow and available habitat in Libby and Poorman creeks. Discharges from the Libby Creek Water Treatment Plant would occur in all phases, and would be greater in Alternative 3 compared to Alternative 2 because the LAD Areas would not be used.

The Forest Service has a year-round 40 cfs instream flow right for a segment of Libby Creek from the Bear Creek confluence downstream to above the Hoodoo Creek confluence, as discussed in section 3.12, *Water Rights*. This right is used to provide adequate flows for bull trout to migrate from Libby Creek into Bear Creek and spawn. In Alternative 3, MMC would monitor the flow at

LB-2000, and whenever flow was less than 40 cfs at LB-2000, would treat and discharge water from the Water Treatment Plant at a rate equal to its Libby Creek watershed appropriations to avoid adversely affecting this senior water right. Typically, flows less than 40 cfs occur within this reach between August and March. Up to 2.5 cfs would be diverted from Libby Creek upstream of Little Cherry Creek in the intervening months if necessary. Effects on aquatic habitat from this diversion would not occur or be minimal, as the diversions would only occur during the high flow period of the year. Stored and treated water would be released into Libby Creek from the Water Treatment Plant when flow at LB-2000 was less than 40 cfs. Likewise, discharges to Ramsey Creek equaling MMC's baseflow changes to Ramsey Creek would occur if flows at RC-300 were less than 1 cfs to avoid adversely affecting water rights in this stream.

The analysis of effects to aquatic life from changes to water quantity in Alternative 3 was based on the impact analysis presented in the BA (USDA Forest Service 2013a). This analysis used data presented in USGS studies (Maret *et al*. 2005, 2006; Sutton and Morris 2004, 2005) to establish passage criterion for adult migratory bull trout in riffle areas that could be applied to analysis area streams. It also used these data to evaluate the relationship between habitat availability and flow for bull trout at different discharges to assess possible impacts on bull trout populations as a result of the changes in low flows projected to occur in Alternative 3. Further details on the methods used and the applicability of the USGS data are provided in the BA (USDA Forest Service 2013a).

The criteria used to determine if decreases in low flows would result in restrictions on adult migratory bull trout passage were a minimum depth of 0.6 feet for at least 25 percent of the stream width, with 10 percent of this stream width of at least this minimum depth being contiguous habitat (USDA Forest Service 2013a). For all stream reaches likely to be affected by decreased water quantity during low flows, the existing $7Q_{10}$ flows (Table 109 and Table 110) were determined to be unlikely to allow passage by adult migratory bull trout through riffle habitat based on the minimum depth criteria and habitat data from the analysis area streams (USDA Forest Service 2013a). Therefore, under all action alternatives and phases, these reaches would continue to potentially act as low flow barriers to adult migratory bull trout. The stream length, duration, and frequency of the existing passage restrictions would possibly increase in all bull trout occupied stream reaches within the analysis area except for the reaches of Libby Creek downstream of the Water Treatment Plant discharges. Flows in this portion of Libby Creek are predicted to increase under all alternatives during all phases, which could increase the likelihood of bull trout being capable of moving into and out of this reach or the time period in which they could do so. Redband trout are typically smaller in size than adult migratory bull trout, which would suggest that their movement would be likely be less affected by the decrease in low flows projected to occur in some analysis area streams.

Flow in Libby Creek in the reach upstream of the Water Treatment Plant discharges would decrease, which could affect fish movement throughout this reach during the low flow period of the year. The only salmonid species present within this portion of Libby Creek upstream of Libby Falls are resident bull trout. Resident bull trout are generally smaller than migratory forms, ranging in size from six to 12 inches compared to 24 inches or more for adult migratory bull trout (Riemann and McIntyre 1993). Thus their movement might be impacted less by the decreases in low flows.

The impact analysis included in the BA evaluated the maximum changes to habitat availability that would occur in Alternative 3 using bull trout life history information and the habitat-flow relationships developed from the USGS data (USDA Forest Service 2013a). For every one percent decrease in low flows resulting from the project, a corresponding 0.4 percent, 0.5 percent, and 1 percent decrease was predicted to occur in adult, juvenile, and spawning bull trout habitat (Table 77).

Effects on low flows would not occur or would be minimal during the Evaluation Phase, and impacts on aquatic habitat would not be expected and are not addressed further. Changes to water quantity would occur during the Construction Phase but would be of a lesser magnitude than those occurring in later phases for all analysis area streams. The analysis presented in the BA (USDA Forest Service 2013a) focused on evaluating effects to habitat availability for bull trout when these effects would be the greatest in each stream reach. Based on this, changes to habitat availability for bull trout were not quantified for the Construction Phase, but are instead addressed qualitatively based on the estimated changes in low flows in each analysis area stream.

Within the east side streams, low flows during the Construction Phase are predicted to increase slightly in the downstream reaches of Poorman Creek and Little Cherry Creek (3 percent), and to decrease slightly in Ramsey Creek (-1 percent) (Table 77). Changes of this magnitude would likely have negligible or minor impacts on aquatic habitat that would be difficult to detect. Upstream of the Water Treatment Plant discharges, baseflow reductions in Libby Creek near the CMW boundary were estimated to be 9 percent (section 3.11.4, *Surface Water Hydrology*), which would decrease the available aquatic habitat to a greater extent than estimated for the tributaries. The resident bull trout population within this portion of Libby Creek may be adversely affected by the reduction in available habitat.

Table 77. Estimated Impacts on Bull Trout Habitat Availability based on Changes Predicted to Occur to Low Flows in Analysis Area Streams in Alternative 3.

Stream Site Location	Maximum Percent Change in Habitat Availability at Low Flow			
	Phase	Adult	Juvenile	Spawning
Libby Creek Watershed				
LB-100	Operations	-8	-10	-20
LB-300	Operations	+55	+69	+139
LB-2	Operations	+4	+5	+10
LB-2000	Operations	+4	+5	+9
RA-600	Operations	-1	-1	-2
PM-1200	Operations	-5	-6	-12
Rock Creek Watershed				
RC-3	Post-Closure	-4	-4	-9
RC-2000	Post-Closure	-3	-4	-7
East Fork Bull River Watershed				
EFBR-2	Post-Closure	-4	-5	-11
EFBR-500	Post-Closure	-4	-5	-11
EFBR Near Mouth	Post-Closure	-2	-2	-9

Source: USDA Forest Service 2013a, except for RC-2000; EFBR=500, and EFBR near mouth. The BA reported cumulative impacts for these sites; this table discusses direct and indirect effects of Montanore only.

Site locations are shown on Figure 76.

Water treatment plant discharges to Libby Creek would result in large flow increases downstream of LB-300 (79 percent), which would lessen farther downstream near the Bear Creek confluence to an estimated 7 percent increase. These discharges would increase available habitat within a small portion of the Libby Creek reach used by the resident bull trout population, which may offset the habitat reductions that occur from the decreased flows upstream of the discharges to some extent. While the resident bull trout population is limited in distribution to the portion of Libby Creek above Libby Falls, the increased flows and corresponding habitat availability would continue for some distance downstream, with smaller increases estimated to occur further downstream. These increases would benefit the bull trout and other fish species within this section of Libby Creek, including the redband trout population. Higher flows resulting from the Water Treatment Plant discharges would increase the depth of the pool habitat and provide more thermal refuge areas for salmonids and other fish during the times of year when flows are lowest. Macroinvertebrate populations may also be beneficially affected, as the increased flow would result in greater wetted area and thus potential habitat within the affected reaches of Libby Creek.

Toward the end of the Operations Phase (Table 99, p. 595), impacts resulting in decreased low flows would be greater to all east side streams in Alternative 3 compared to impacts during the Construction Phase, although Ramsey Creek would continue to be minimally affected by any changes. Low flow in Little Cherry and Poorman creeks were estimated to decrease by 19 and 12 percent, respectively. Such decreases would result in substantial reductions in habitat availability and quality for fish populations. Bull trout have not been collected in Little Cherry Creek in any survey or in Poorman Creek since 1994 (FWP 2012), but redband trout and their hybrids are present in both streams. The impact analysis presented in the BA was not specifically calibrated to account for habitat preferences of redband trout, but reduced flows and bull trout habitat availability would indicate decreases in habitat availability for redband trout and other salmonids. Thus, the redband trout populations in Poorman and Little Cherry creeks would potentially be adversely impacted by the decreases in low flows predicted to occur in the Operations phase.

Upstream of the Water Treatment Plant discharges to Libby Creek, baseflows would decrease to their maximum extent (20 percent) at the end of the Operations phase, resulting in decreased habitat availability for the resident bull trout that inhabit a portion of this reach up to the near the CMW boundary. Based on the BA analysis, habitat availability for these trout would decrease in this reach of Libby Creek by an estimated 8, 10, and 20 percent for adult, juvenile, and spawning habitat, respectively (Table 77) (USDA Forest Service 2013a). The proposed bull trout mitigation plan (USDA Forest Service 2013a) includes habitat restoration in this portion of Libby Creek to mitigate for the potential for detrimental effects to occur to the resident bull trout population in this portion of Libby Creek. The mitigation plan is further discussed in section 3.6.4.3.6, *Threatened and Endangered Species*.

Macroinvertebrate populations in Little Cherry Creek, Poorman Creek, and the upstream Libby Creek reach could be adversely affected by the decreases in low flows, but effects on these assemblages may not be detectable in analysis area streams. Macroinvertebrate populations would also be present in headwater stream reaches that do not support fish populations, and could be impacted by the reduced low flows in these areas. Baseflows at the end of the Operations Phase at near or upstream of the CMW boundary on Ramsey and Libby Creeks were predicted to be reduced by 8 and 11 percent (Table 99, p. 595), respectively. The reach of Poorman Creek near the CMW boundary would not be affected by reductions in baseflow. Results of some studies have demonstrated that flow reductions, even when substantial, have resulted in no or variable changes in metrics used to assess macroinvertebrate assemblages (Dewson *et al*. 2007; Poff and

Zimmerman 2010). Invertebrate taxa differ in their sensitivity to environmental stressors and their habitat requirements, which may have resulted in the lack of a consistent response to flow changes in these studies. Additionally, peak flows would not be measurably affected in the analysis area; therefore, flushing of any accumulated sediment would still occur under a similar regime as existing conditions. Based on this, substrate composition would not be altered.

As in the Construction Phase, increases in low flows would occur in Libby Creek in the reaches downstream of the Water Treatment Plant discharge point during the Operations Phase. These increases would be greater than in any other phase (Table 111), with low flows estimated to increase by 138 percent at LB-300 and by 9 percent further downstream at LB-2000. The KNF (2013a) determined that such an increase would affect adult, juvenile, and spawning habitat availability for bull trout in the reach near LB-300 by increasing it by an estimated 55, 69, and 139 percent (Table 77). Bull trout habitat availability for adults and juveniles further downstream near LB-2 and LB-2000 would benefit to a lesser extent, with juvenile and adult bull trout habitat availability estimated to increase by 5 percent or less during this phase, while spawning habitat would increase by 9 to 10 percent. Use of this reach by spawning bull trout is questionable. While other existing factors unrelated to streamflow may continue to limit bull trout populations in this reach of Libby Creek, such substantial increases in habitat availability would be beneficial to bull trout populations, as well as other fish and macroinvertebrate populations. Bull trout abundance in all reaches of Libby Creek downstream of Libby Falls near LB-300 is low based on recent survey data. Redband trout and their hybrids are more abundant within this reach, and should benefit from the increased habitat as a result of increased low flows. Flow in Bear Creek, which supports the highest densities of bull trout within the Libby Creek watershed, would not be affected in Alternative 3.

West Side Streams

Predicted changes in low flows in west side streams in the Construction Phase in Alternative 3 are estimated to be three percent or less. Changes in low flows are predicted to continue to be minimal in the Operations Phase at RC-3, RC-2000, EFBR-2, and EFBR-500 but a decrease of 21 percent was estimated for the reach of East Fork Rock Creek at the CMW boundary (EFRC-200) (Table 111). Bull trout do not inhabit this reach of the stream near the Rock Lake outlet, but hybridized westslope cutthroat trout have occasionally been collected and would be adversely affected by the decrease in habitat availability and quality during the low flow time of the year within this reach. During the Operations Phase, predicted decreases in low flow and wetted perimeter at RC-3 (Figure 76), a stream reach that supports bull trout and pure westslope cutthroat trout populations, are 1 percent (Table 110). Effects on aquatic populations from these minimal decreases would likely not be measurable within this reach or farther downstream in the Rock Creek mainstem. The intermittent flows that occur in the mainstem of Rock Creek under existing conditions could be exacerbated by the slight decreases in low flows, and, if so, would further restrict movement of migratory and resident fish. A decrease in low flow of 2 percent was predicted for the most upstream reach inhabited by bull trout on the East Fork Bull River (EFBR-2), although the estimated change in wetted perimeter (7 percent) was greater than for the East Fork Rock Creek site (Table 110).

Lakes

Changes in Rock Lake levels would be negligible during the Evaluation, Construction, and Operations phases, and any effect on aquatic habitat and populations would be minimal. St. Paul

Lake may be affected similarly by mining, so any effect on aquatic habitat and populations is expected to be minimal.

Closure and Post-Closure Phases

East Side Streams

In east side streams, most effects on aquatic habitat from decreased low flows in the Closure and Post-Closure phases would be similar to or less than those predicted to occur during the Operations Phase, and little to no difference in these effects is expected to occur with or without mitigation (Table 112 and Table 113). The magnitude of the decrease (-12 percent) in low flow predicted to occur in Poorman Creek during operations would remain the same during the Closure and Post-Closure phases. The decrease in low flow predicted to occur in Little Cherry Creek would also be the same in the Closure Phase as in the Operations Phase (-19 percent). An increase in low flow would occur in Little Cherry Creek during the Post-Closure Phase as a result of reclamation of the impoundment and routing of the surface water runoff into an unnamed tributary of Little Cherry Creek. Any increased flow in Little Cherry Creek would be a long-term benefit to aquatic habitat and thus the pure redband trout population in this stream. The decrease in low flow in Ramsey Creek would continue to be minimal in these two phases (-1 percent). During the Closure and Post-Closure phases, decreases to aquatic habitat described for the Operations Phase would continue to occur in Poorman Creek, and during the Closure Phase in in Little Cherry Creek.

Within the portion of Libby Creek within the analysis area, the increases in flows observed in the earlier phases in the reach immediately downstream of the Water Treatment Plant discharges would continue, but be less in the Closure and Post-Closure phases (Table 112 and Table 113). The benefits to bull trout and other aquatic assemblages resulting from the increases in flow would still occur, but be less in these phases. In Libby Creek near the Bear Creek confluence, the additional flow provided by the Water Treatment Plant discharge would result in a net zero change in low flow.

Upstream of the Water Treatment Plan discharge in the reach of Libby Creek near the CMW boundary, the decrease in baseflow and corresponding decrease in bull trout habitat availability that occurred in the Operations Phase would continue to occur in the Closure and Post-Closure phases, but would lessen over time (USDA Forest Service 2013a). With mitigation, the effects of changes on aquatic biota would be the same as or similar to unmitigated effects in the Libby Creek watersheds during all phases.

After the pumpback well system ceased operations and the groundwater table reached steady state conditions, streamflow in Libby Creek and most tributaries would return to pre-mine conditions (Table 114). Low flow conditions in Little Cherry Creek would be permanently higher by an estimated 44 percent based on the increase in drainage area, with benefits to the aquatic habitat.

West Side Streams

The reduction in low flows and aquatic habitat would increase in the west side streams in the Closure and Post-Closure phases compared to the previous phases (Table 112 and Table 113). Effects on aquatic habitat would be greatest in the headwater reaches of these streams, including those stream reaches near and upstream of Rock Lake and St. Paul Lake. A maximum reduction of 97 percent is estimated at EFBR-300. Westslope cutthroat trout have been occasionally collected near the outlet of Rock Lake, and could potentially use the reach immediately upstream of the lake (Kline Environmental Research and NewFields 2012). The streams that flow into St. Paul Lake are isolated from the East Fork Bull River by a moraine below the lake, and likely do not support fish populations. Macroinvertebrate populations are present throughout these reaches, and would be affected by the reduction or elimination of flow that are predicted during low flow periods. Headwater streams also perform important ecological functions in terms of transport of organic matter, invertebrates, nutrients, and woody debris to downstream waters (Meyer *et al*. 2007; Wipfli *et al*. 2007; Freeman *et al*. 2007), as discussed in Kline Environmental Research and NewFields (2012). Reductions in flow could adversely affect the ability of these headwater reaches to perform such functions.

In the Rock Creek drainage downstream of Rock Lake, low flows would be decreased by an estimated 62 percent during the Closure Phase and 100 percent during the Post-Closure Phase in the reach near the CMW boundary (EFRC-200) without mitigation (Table 112 and Table 113). With mitigation, the reduction in flow is estimated to be 59 percent in the Post-Closure phase. The mitigation actions simulated in MMC's 3D model included partial grouting and bulkheads, as discussed further in the effects analysis in section 3.11.4.2, *Surface Water Hydrology*. The reduction in low flow in East Fork Rock Creek following closure of the mine would decrease aquatic habitat and adversely affect hybridized westslope cutthroat populations within this reach, with habitat utilization potentially eliminated seasonally in at least some years during the Post-Closure period without mitigation. The composition of the aquatic macroinvertebrate assemblages within this reach would also be affected, though likely to a lesser extent. Some macroinvertebrates have adaptations that allow them to tolerate periods of drought or quickly recolonize reaches. With mitigation, the Post-Closure effects on aquatic habitat and assemblages in this portion of East Fork Rock Creek would be less, but may still be substantial.

Effects on low flow in East Fork Rock Creek would lessen farther downstream in both phases, with such decreases estimated to be 9 percent within the reach near the West Fork Rock Creek confluence (RC-3) and 7 percent near the mouth of the mainstem of Rock Creek (RC-2000) (Table 110 and Table 113) in the Post-Closure Phase. Wetted perimeter was estimated to decrease by 9 percent at RC-3. Decreases in adult, juvenile, and spawning habitat availability for bull trout in East Fork Rock Creek as a result of flow decreases in the Post-Closure Phase when these effects would be greatest were estimated to be 4 percent for adult and juvenile bull trout, with spawning habitat decreasing by 9 percent (Table 77) (USDA Forest Service 2013a). Similar changes to bull trout habitat would occur at the mouth of Rock Creek near RC-2000 (Table 77), and this reach might be further affected by increasing the length, duration, or frequency of intermittent flow that occurs in the mainstem. Westslope cutthroat trout and other salmonid populations within this drainage would also be adversely affected by decreasing flow and corresponding loss of habitat in East Fork Rock Creek and the mainstem of Rock Creek. These effects would be reduced with hydrology and fisheries mitigation. The agencies' hydrology mitigation would include grouting, installing barriers in the mine void, using multiple adits during closure, or other measures as discussed in section 3.11.4.2, *Surface Water Hydrology*. Mitigation measures would be further evaluated after additional data were collected during the Evaluation Phase. The agencies' fisheries mitigation is discussed section 3.6.4.3.6, *Threatened and Endangered Species*.

At steady state conditions without mitigation, streamflow in East Fork Rock Creek at EFRC-200 is estimated to be permanently reduced by 10 percent (Table 114). With mitigation at steady state conditions, streamflow and habitat conditions in East Fork Rock Creek at EFRC-200 would return to pre-mine conditions. With or without mitigation, streamflow in the Rock Creek mainstem near the mouth would be affected by less than 1 percent, and habitat conditions would likely be indistinguishable from pre-mine conditions.

Predicted reductions in flow in the East Fork Bull River would also be greater during the Closure and Post-Closure phases compared to previous phases as the mine void filled (Table 112 and Table 113), and aquatic habitat for bull trout and other salmonids would be adversely affected. Low flows at EFBR-500 are estimated to decrease by 4 percent and 11 percent during the Closure Phase and Post-Closure phases, respectively, with or without mitigation. Decreases in bull trout habitat availability would be similar for the reach near the Isabella Creek confluence (EFBR-2) and the reach near the CMW boundary (EFBR-500) with decreases of 4 to 5 percent predicted in both reaches for adult and juvenile bull trout habitat and 11 percent in spawning habitat (Table 77). Effects would be less at the mouth. East Fork Bull River is considered a stronghold for bull trout populations within the Lower Clark Fork River Core Area, and surveys indicate that the affected reach supports much of the bull trout spawning. Wetted perimeter at EFBR-2 was estimated to decrease by 26 percent, which indicates that aquatic habitat for other salmonids and macroinvertebrates would be adversely affected. Available habitat in the East Fork Bull River would essentially return to pre-mine conditions when the mine void filled and the potentiometric surface reached steady state conditions (Table 114), with a 1 percent or less reduction in low flow with mitigation.

Lakes

Groundwater flow into Rock Lake would continue to decline after mining ceased. Reductions in lake levels and volume would probably not have a detectable effect on the aquatic biota of Rock Lake. While the lake volume is projected to be decreased by 2 percent post closure with mitigation and up to 5 percent without mitigation, aquatic habitat changes would likely be difficult to separate from those caused by natural variability in lake levels that occur in part due to large influxes of surface water into the lake during snowmelt and storm events. Surface water influxes to the lake would not be affected by the project alternatives. Adverse effects on the hybrid cutthroat trout population in Rock Lake would not likely occur.

When groundwater levels reached steady state conditions, lake levels and volume would, with mitigation, return to pre-mine conditions. St. Paul Lake may be affected similarly by the mine as Rock Lake, so effects to the aquatic biota of St. Paul Lake would likely be immeasurable. In addition, much greater natural fluctuations in St. Paul Lake would make habitat changes virtually inseparable from those caused by natural variability.

Climate Change

The combined impacts of Alternative 3 and climate change were not quantified because of the possible range in effects of climate change on aquatic resources. Quantifying the combined effects would not improve the proposed designs and mitigation in light of climate change over the designs already incorporated into the agencies' alternatives. The effects of the reduced low flows on aquatic resources combined with the effects of climate change may be greater than those estimated to occur in Alternative 3 alone. In Alternative 3, collection of data at benchmark sites unaffected by mine and before any mine construction or activity would provide comparative data to evaluate whether any changes detected in aquatic assemblages were related to impacts from mine activities.

3.6.4.3.3 Water Quality-Nutrients, Metals, and Temperature

All Phases

The modifications and mitigations included in Alternative 3 would decrease the impacts on water quality from the project. During all phases in Alternative 3, excess water would be treated at the Water Treatment Plant and discharged to an MPDES permitted outfall. No LAD Areas would be used, so there would be no discharge to Ramsey or Poorman creeks. Discharges would meet ALS or BHES Order limits at the end of the mixing zone in Libby Creek (Table 129 and Table 130). Increases in water quality parameters in Libby Creek would be less than predicted under Alternative 2 because no LAD Areas would be used. The effect on aquatic life of any increase in nutrient or metal concentrations up to the ALS or BHES Order limits would be the same as discussed for Alternative 2. TIN and TN concentrations would increase over ambient conditions, but remain less than the 1.0 mg/L limit set as the BHES Order limit in Libby Creek in all phases. Total phosphorus concentrations would increase, but the increases would remain lower than the standard. During mining, Alternative 3 would not affect the existing water quality in Little Cherry Creek and, therefore, would have no effect on its aquatic life. During the Closure and Post-Closure phases, the potential for the diluting effect to streams due to a reduction in groundwater inflows would still exist, but would be less than in Alternative 2 for most stream reaches, except the effect would be slightly greater in upper Libby Creek due to the difference in adit locations. Baseflow reductions in Libby Creek at the CMW boundary would be -22 percent during Closure and -13 percent during Post-Closure.

As in Alternative 2, increases in stream temperature could occur as a result of riparian disturbance, Water Treatment Plant discharges, and decreased groundwater inflow to streams. The maximum decreases in low flows are predicted to occur in the upstream reaches of East Fork Rock Creek and the East Fork Bull River during the Post-Closure Phase as the mine void filled. Low flow decreases would also occur in the upper Libby Creek watershed; flow increases would occur in the Libby Creek reach downstream of the Water Treatment Plant discharges. The temperature of the discharge of mine and adit water is expected to be between 51° and 60°F based on measured temperatures of the Water Treatment Plant effluent from February 2014 to May 2015 (DEQ 2015b). Increases in stream temperature between sites upstream and downstream of the Water Treatment Plant discharges were less than 1°F in most months in the 2014 and 2015 data, and stream temperatures at both sites were less than 51°F. Bull trout require water temperature ranging from 36°F to 59°F, with temperatures at the low end of this range required for successful incubation (USFWS 1998b, USFWS 2014c). Water discharged from the Water Treatment Plant, if discharged to the percolation pond or drainfield next to Libby Creek, would cool as it flowed from the percolation pond or drainfield via groundwater to the creek. Discharges to either the percolation pond, drainfield, or directly to Libby Creek would cool further when mixed with receiving creek water in an approved surface water mixing zone. Direct discharges to Libby Creek from the percolation pond, if they were to occur, would occur infrequently when the pond reached its full capacity. Temperatures in Libby Creek upstream and downstream of the discharges would be monitored. Water Treatment Plant effluent is not expected to adversely affect stream habitat in Libby Creek. As with Alternative 2, factors such as air temperature, topography, weather, shade, streambed substrate, stream morphology, and the amount of subsurface streamflow also affect stream temperature.

The agencies analyzed the risk and potential effects of water collection and treatment system failure (ERO Resources Corp. 2015c). In Alternative 3, MMC would operate a pumpback well system designed to capture tailings seepage that reached groundwater beneath the impoundment.

A prolonged power outage or equipment failure would be necessary before groundwater levels recovered sufficiently to allow tailings seepage to reach surface water. In the event of a prolonged power outage or equipment, the predicted concentrations of all metals in Libby Creek would be below acute and chronic aquatic life standards. Total nitrogen and phosphorus standards in Libby Creek are also not predicted to be exceeded (ERO Resources Corp. 2015c).

3.6.4.3.4 Metals in Fish

As in Alternative 2, any increased metal concentrations in surface water would potentially increase metal concentrations in fish. All metal concentrations would be estimated to remain below the acute and chronic criteria for aquatic life during all phases of mine activity, including the chronic aquatic life standard for manganese adopted in Colorado. In Alternative 3, the LAD areas would not be used, and all discharges would be through the Water Treatment Plant, which may be modified to treat dissolved metals under this alternative. The risk of any increasing metal concentration in fish would be reduced under Alternative 3 in comparison to Alternative 2 based on these factors. Changes in metal concentrations in fish within the East Fork Bull River and East Fork Rock Creek drainage are not predicted with any of the alternatives as discussed in Alternative 2.

3.6.4.3.5 Fish Passage and Fish Loss

All Phases

The effects on bull trout passage due to changes in low flows were discussed in section 3.6.4.3.2, *Water Quantity*. The effects on the fisheries in Little Cherry Creek resulting from construction and use of the tailings impoundment in Alternative 2 would not occur in Alternative 3. During construction and operation of the mine, many of the same roads would be used for access to mine facilities in Alternative 3 as in Alternative 2. Alternative 3 would require one new road crossing across a perennial and a smaller stream (Table 108). The Seepage Collection Pond would affect 2.3 acres of designated 100-year floodplain of Libby Creek.

All bridges and other road work would comply with INFS standards and guidelines and Forest Service guidance (USDA Forest Service 2008a, 2015b), and would not affect fish passage. The agencies' proposed stream mitigation plan, discussed in section 2.5.7.1.2, would include the replacement of two culverts on Little Cherry Creek, one culvert on Poorman Creek, and bridge removal on Poorman Creek, which would improve fish passage. A detailed analysis of the potential credits of these projects using the Corps' Montana Stream Mitigation Procedure (Corps 2013a) is described in the revised Preliminary Mitigation Design Report for impacts on waters of the U.S. (MMC 2014a).

3.6.4.3.6 Threatened and Endangered Species

All Phases

The BA (USDA Forest Service 2013a) concluded that the project may affect, and is likely to adversely affect, bull trout in Libby Creek, Big Cherry Creek, Bear Creek, Cable Creek, Midas Creek, Poorman Creek, Ramsey Creek, West Fisher Creek, Fisher River, Rock Creek, East Fork Rock Creek, and the East Fork Bull River under Alternative 3. Effects to the Fisher River drainage and some of the Libby Creek drainage streams would be affected by the transmission line alternatives, as discussed in those sections of the BA. The bull trout mitigation proposed in Alternatives 3 and 4 may affect, but is not likely to affect, bull trout in Flower Creek, West Fork Rock Creek, and Copper Gulch. These streams have been proposed as potential mitigation sites, and bull trout populations are expected to benefit from the proposed mitigation projects where enacted. As with Alternatives 1 and 2, bull trout populations in analysis area streams would continue to be marginal and their habitat in need of restoration work from existing, non-project impacts in Alternative 3 without mitigation. Bull trout populations would continue to be susceptible to decline or disappearance due to hybridization with introduced brook trout, competition with brook trout and other trout present in the analysis area, or from other land use disturbances.

The analysis presented in the BA (USDA Forest Service 2013a) concluded that potential impacts from peak flow changes, water quality changes, and fish passage were considered to be negligible or beneficial to bull trout habitat and populations. The extent of these impacts was discussed in previous sections. The actual magnitude and direction of any such impacts would be confirmed through monitoring, and mitigated for if necessary. The TIN limit set in the BHES Order could be modified in the MPDES permit at any time if bull trout populations or other aquatic life were determined to be adversely affected by TIN concentrations below this limit. The BA concluded the adverse impacts determined to likely affect bull trout populations in east and west side streams would mainly be from the brief increases in sediment delivery to streams and the decreases in low flows that would be predicted to occur as a result of the project.

As discussed in section 3.6.4.2.1 *Sediment*, brief sediment increases may be associated with construction in or near streams. Such construction would be subject to three permits or approvals. The effects of construction would be less than in Alternative 2 because the tailings impoundment would not require a stream diversion in Alternative 3, and fewer disturbances in RHCAs and other riparian areas would occur. Road access changes would decrease sediment delivery to nearby streams. The DEQ and the EPA established water quality restoration goals for sediment in Libby Creek on the basis of fine sediment levels in trout spawning areas and aquatic insect habitat, stream morphology and available instream habitat as it relates to the effects of sediment, and the stability of streambanks. MMC's point source and nonpoint source discharges containing sediment would be a small contribution to the estimated existing sediment load of 1,621 tons/year and the estimated future sediment load of 1,102 tons/year in the upper Libby Creek watershed. Meeting the TMDL, of which Montanore's wasteload allocation of 24 tons per year is a part, will satisfy the water quality restoration goals. The DEQ believes that once the water quality restoration goals are met, all beneficial uses currently affected by sediment will be restored (DEQ and EPA 2014).

The sediment decreases would potentially benefit brook trout populations in the Libby Creek and Rock Creek watersheds, but would be detrimental to bull trout populations due to an increased risk of competition and hybridization with brook trout. The benefits of sediment decreases are expected to be greater than the potential impacts from increasing brook trout populations.

The magnitude of effects on bull trout habitat availability within analysis area streams from the streamflow reductions during low flow conditions were discussed in section 3.6.4.3.2, *Water Quantity*. The largest estimated reductions were to spawning habitat availability in the Libby Creek, Rock Creek, and East Fork Bull River watersheds (Table 77) during the Operations or Post-Closure phases. Juvenile and adult habitat availability was also reduced in these watersheds.

Decreased low flows during the late summer/early fall months would result in fewer deep pools, which are limited in most analysis area streams under existing conditions. The presence of deep pools is a habitat requirement for adult and juvenile bull trout (Parametrix 2005). Deep pools help moderate stream temperatures, serving as thermal refuge and cover during the warm summer months. Reduced low flows would continue to occur during the winter months, when deep pools and runs serve as important features of the overwintering habitat for bull trout (Jakober *et al*. 1998; Muhlfeld and Morotz 2005; Al-Chokhachy *et al*. 2010), as well as other trout species. Spawning habitat has also been associated with areas of groundwater upwelling, as these tend to remain open through the winter, reducing the risk of redd freezing or dewatering (Fraley and Shepard 1989; Parametrix 2005). Decreases in groundwater upwelling associated with the project could adversely affect the quality of spawning habitat for bull trout and reduce egg survival.

The decreases in habitat availability in the Libby Creek watershed would be offset to some degree by the increases in streamflow due to discharges from the Water Treatment Plant, which are predicted to increase all types of habitat for bull trout substantially for some distance downstream of LB-300. The habitat for the resident bull trout population upstream of Libby Falls would be adversely affected by the decreases in low flow in the headwaters of Libby Creek upstream of the Water Treatment Plant discharge.

Decreased streamflow during low flow conditions would affect bull trout populations in Rock Creek and the East Fork Bull River. Flow reductions would affect reaches of both streams that support much of the bull trout spawning known to occur currently in these streams. Spawning habitat was estimated to decrease up to 9 and 13 percent in the East Fork Rock Creek and East Fork Bull River, respectively (Table 77). The East Fork Bull River supports the highest densities of bull trout in the Bull River drainage (Washington Water Power Company 1996) and is considered a stronghold for bull trout populations in the Lower Clark Fork Core Area.

Decreases in streamflow during low flow conditions could also adversely affect bull trout passage in Libby Creek above the Libby Adit, Rock Creek, and East Fork Bull River watersheds, but the analysis presented in the BA (as summarized in section 3.6.4.3.2, *Water Quantity*) indicates that conservative passage criteria currently indicate that sufficient depths are not present to allow for passage of adult migratory bull trout during low flows in these streams. Increasing stream temperatures or changes to the diurnal temperature ranges that currently exist may also occur in the east and west side streams due to decreased groundwater inflows to streams and lower flows associated with the project, as well as from riparian disturbance in some areas. Discharges from the Water Treatment Plant may also increase stream temperatures downstream of the outfalls, although synoptic temperatures measurements in 2014 and 2015 indicate that the temperature increase would be minimal in most months. Denser canopy cover may be present in some of the higher elevation stream reaches most affected by flow impacts, and, combined with the lower air temperatures at these elevations, may minimize such temperature changes, but the effect of these factors is uncertain, as discussed in section 3.6.4.2.5, *Temperature*. The available data on the percentage of canopy cover in the Rock Creek, East Fork Bull River, and Libby Creek watersheds indicate this parameter varies (Kline Environmental Research and NewFields 2012). A lower amount of disturbance within riparian areas would occur under Alternative 3 compared to the other alternatives.

Mitigation projects in the Kootenai River and Lower Clark Fork River Core Areas are planned to offset the risk of the population declines estimated to occur from the project. As described in more detail in the BA appendix (USDA Forest Service 2013a) and in section 2.5.7.3, *Bull Trout*, these projects are designed to increase resident and migratory bull trout populations in the Kootenai River and Lower Clark Fork River Core Areas. The proposed projects would be in areas where bull trout populations were historically but not currently present, are currently present but only at low population densities, are present but at risk from the presence of non-native fish species, or are present but expected to be detrimentally affected by the project. Proposed mitigation actions for these areas could include creating secure genetic reserves through bull trout transplant or habitat restoration, incorporating actions to correct any limiting factors in streams so that higher abundances of bull trout would be supported, or eradicating non-native fish. The impact analysis provided in the BA was used as a guideline to evaluate effects, but mitigation success for all of these projects would be monitored to determine that the value of the projects actually exceeds any predicted impacts on bull trout populations. All mitigation projects would be evaluated in feasibility assessments completed within 18 months of initiation of the Evaluation Phase. MMC would review recent literature such as that described in section 2.5.7.3, *Bull Trout,* in completing the assessments. The review would improve the effectiveness of the mitigation project.

Within the Kootenai River Core area, mitigation projects would focus on offsetting any decreases in bull trout habitat and populations that may occur in the reach of Libby Creek upstream of Libby Falls where the isolated resident bull trout population currently exists. On-site mitigation within this reach of Libby Creek would be the preferred option, and opportunities include installation of large wood aggregates in the floodplain and riparian areas to improve spawning and rearing habitat for bull trout. Large wood aggregates have been found to create more habitat for other aquatic and semiaquatic biota, and allow establishment of riparian vegetation (Wu *et al.* 2011, He *et al.* 2009). If the on-site mitigation were to fail, the contingency plan would be to locate a mitigation project in Flower Creek. Flower Creek is a historical bull trout stream, but the presence of dams and brook trout complicate the improvement or reestablishment of this species in this stream. Several options for mitigation in Flower Creek would be available, and these would be further prioritized if necessary based on the habitat conditions that were present. Options include establishing a genetic reserve by transferring bull trout from Libby Creek or Bear Creek, implementing a non-native fish eradication plan, and reestablishing upstream passage. The BA estimated the number of bull trout that could be gained by implementing mitigation projects in Flower Creek as 1,010 trout. This estimate is based on reach length and an average of bull trout densities within the analysis area (USDA Forest Service 2013a). The feasibility of the proposed mitigation actions would be evaluated for each analysis area to assess what actions would be likely to succeed.

Within the Lower Clark Fork Area, mitigation projects were proposed to specifically offset decreases in bull trout habitat and populations that may result from the decreased low flows associated with mine dewatering. Possible projects were proposed on West Fork Rock Creek and the mainstem of Rock Creek to account for losses that may occur in East Fork Rock Creek, while Copper Gulch was the location chosen for mitigation of any losses in the East Fork Bull River. Within West Fork Rock Creek, additional habitat and population surveys would be conducted to identify limiting factors for bull trout and to assess the ability of this stream to provide spawning habitat. The BA (USDA Forest Service 2013a) estimated possible gains in bull trout in West Fork Rock Creek as ranging from 148 to 566 trout. Possible gains were estimated using an average of the existing bull trout density data available for the analysis area streams and the length of the reach in which the mitigation projects are planned to occur. The mainstem of Rock Creek would also be assessed to determine if brook trout removal would be feasible, which would further benefit bull trout populations by lowering the risk of hybridization and competition. Bull trout were historically present with in Copper Gulch, but are currently absent. If feasible, habitat within the lower reach of Copper Gulch that currently has intermittent flows seasonally would be restored to improve access for migratory bull trout and allow for the reestablishment of a self-sustaining bull trout population. Brook trout removal may also be included as part of this project. From 126 to 183 bull trout were estimated to be potentially gained as a result of this project. All projects are described further in the BA appendix (USDA Forest Service 2013a).

Effects on Critical Habitat

The locations and structures of the plant and impoundment site in Alternative 3 would decrease disturbance within RHCAs and reduce the potential for brief adverse effects due to short-term sediment reaching streams designated as critical habitat in the Libby Creek watershed. Alternative 3 would affect the same segments in East Fork Rock Creek and Rock Creek as Alternative 2. Effects of streamflow changes on the designated critical habitat in Libby Creek, East Fork Rock Creek, Rock Creek, and the East Fork Bull River would be similar to Alternative 2. The reduced flows would affect designated bull trout critical habitat due to direct effects on springs, seeps, and groundwater sources, and subsurface water connectivity that contribute to water quality and quantity and provide thermal refugia. The adverse effects of the project in critical habitat for bull trout may inhibit the normal reproduction, growth, and survival of these populations. Mitigation would reduce post-mining effects on East Fork Rock Creek streamflow and thus the aquatic habitat. Critical habitat in Bear Creek would not be adversely affected by changes in streamflow.

Sedimentation in critical habitat would be reduced through access changes in the Rock Creek and Libby Creek watersheds and implementation of sediment abatement and instream stabilization measures designed to reduce sediment contribution from the identified sediment sources in the Libby Creek watershed. These measures would decrease sediment delivery in designated critical habitat in Libby Creek and Bear Creek. Increases in nutrient and metal concentration are likely to be similar to, but less than, in Alternative 2 because the LAD Areas would not be used.

The greatest potential effect to designated critical habitat would occur in the event of a tailings pipeline failure. A leak could introduce tailings to Poorman, Ramsey, or Libby creeks reducing food resources and introducing fine sediment, adversely affecting critical habitat. The mitigation options described in the mitigation plan (section 2.5.7.3, *Bull Trout*) would offset the impacts predicted to occur to critical habitat in the Kootenai River and Lower Clark Fork River Core Areas.

3.6.4.3.7 Forest Service Sensitive Species and State Species of Concern

All Phases

Potential effects on the redband trout populations in the Libby Creek drainage would be less in Alternative 3 than in Alternative 2. In Alternative 3, no diversion of Little Cherry Creek would be necessary in the Construction Phase, and the population in Little Cherry Creek would not be adversely affected. A small flow increase in Little Cherry Creek would result in a long-term benefit to the redband trout population in the creek. All wastewater would be treated at the Water Treatment Plant before discharge in all phases, reducing the risk of nutrient and metal concentrations exceeding ALSs. Redband trout in the remainder of the Libby Creek drainage are largely hybridized and effects are expected to be minimal, for the most part less than predicted in Alternative 2. Alternative 3 may impact westslope cutthroat trout populations in the Rock Creek and East Fork Bull River drainages and would be similar to effects described in Alternative 2.

The effects of flow changes and associated changes in redband trout habitat in Libby Creek in the Closure and Post-Closure phases would be similar to Alternative 2. Streamflows would gradually return to pre-mine conditions when all site activities were completed and the groundwater table reached steady state conditions. Surface runoff from the Poorman tailings impoundment at Closure would be directed toward Little Cherry Creek, and may cause brief increases in stream sedimentation during construction of a diversion channel to Libby Creek. Any increased stream sedimentation would have a brief adverse effect on the redband trout population in Little Cherry Creek due to increased sediment in the water column and the substrate. These increases would be temporary, and would be minimized through the use of BMPs. Post-operations, average annual flows would increase in Little Cherry Creek due to the increased watershed size, which would benefit the pure redband trout in this stream in the long term. Effects on westslope cutthroat trout in Rock Creek and the East Fork Bull River would be similar to Alternative 2. Mitigation would reduce post-mining effects on East Fork Rock Creek streamflow.

The primary risk to both the redband and the westslope cutthroat populations would remain hybridization, which is unrelated to mine activities. Little data exist to determine the status of torrent sculpin populations within the analysis area, but potential effects would generally be expected to be less under Alternative 3.

3.6.4.3.8 Effectiveness of Agencies' Proposed Monitoring and Mitigation

Monitoring

As part of a plan to assess project effects, MMC would conduct aquatic biological monitoring before, during, and after project construction and operation at sites within and downstream of the analysis area in the Libby Creek watershed and at benchmark sites upstream of any potential influence of the project (Appendix C). The collection of data at benchmark sites and before any mine construction or activity would provide comparative data to evaluate whether any changes detected in aquatic assemblages were related to impacts from mine activities. The monitoring plan is comprehensive, and includes assessment of fish, macroinvertebrate, and periphyton assemblages, as well as habitat and substrate conditions. This plan would effectively assess the condition of the aquatic communities and habitat within analysis area stream sites in the Libby Creek watershed and detect potential impacts on these populations. Most sampling activities would occur once a year or more frequently, and, over time, would provide sufficient data to detect trends occurring over times within these populations. Monitoring reports discussing the results of the sampling would be submitted annually, and modifications to the plan would be made if necessary.

In addition, as part of the proposed bull trout mitigation plan, MMC would prepare a fisheries monitoring plan that includes all monitoring necessary to document and verify project effects on bull trout populations, including effects of mitigation actions. This plan would include monitoring in the Libby Creek, East Fork Rock Creek, and East Fork Bull River watersheds, as well as in other watersheds proposed as mitigation sites, and thus would provide data to document any effects that may occur to bull trout populations in both Core Areas potentially affected by the project. Monitoring would be initiated before any construction began to provide baseline data. Further details of this plan would be developed before any construction being initiated for the mine, and aspects of the plan would be modified if necessary to effectively detect any changes in bull trout populations and their habitat within the analysis area. Monitoring would continue throughout all phases of the project.

Mitigation

In Alternative 3, potential impacts on aquatic resources would be mitigated through road status changes, projects that would be conducted for waters of the U.S. mitigation, and projects developed specifically to mitigate for impacts on bull trout. Components of all mitigation projects are presented in section 2.5.7.2, *Bull Trout*, and additional discussion of the bull trout mitigation projects was also included in section 3.6.4.3.6, *Threatened and Endangered Species,* with further detail provided in the BA (USDA Forest Service 2013a).

Road status changes would reduce sediment delivery to streams. Benefits to aquatic habitat would begin to occur to occur in the Evaluation Phase before the mine began operating and would continue throughout the project. The effect of these reductions on aquatic habitat would be confirmed through the monitoring data.

The stream mitigation in Alternatives 3 and 4 are also directed in part at decreasing sediment levels as a compensatory mitigation action to offset effects on drainages in the Poorman Impoundment Site. Multiple projects are proposed for this mitigation that would be effective at reducing sediment levels in Little Cherry Creek, which have been documented to be high in some reaches under existing conditions. The removal of culverts in Little Cherry Creek would be included with this mitigation, and would likely improve fish passage in this stream. Some of these projects would occur before the Construction Phase, and would thus offset impacts before they occurred. Other actions are also included in the stream mitigation, such as removal of a bridge on Poorman Creek at closure and habitat restoration on Swamp Creek, a tributary of Libby Creek. These actions would also be expected to improve aquatic habitat and mitigate for the adverse impacts that may occur as a result of mine construction and operation.

The proposed mitigation actions included in the bull trout mitigation plan were selected to identify and address factors that are likely limiting bull trout populations within the analysis area under existing conditions. They include creating genetic reserves through bull trout transplanting, securing genetic reserves through habitat restoration, and eradicating non-native fish species. Creating and securing genetic reserves would mitigate for potential impacts on bull trout populations by effectively lessening the risk of loss of genetic diversity from project impacts or natural events. A non-native salmonid repression program has already been initiated by Avista in the East Fork Bull River and a shift toward more native species has been documented (Horn and Tholl 2011). Similar beneficial effects would be projected under the mitigation plan from removal of non-native fish species, which pose a risk to bull trout populations through hybridization or increased competition under existing conditions.

Mitigation projects would be evaluated for feasibility before being initiated, but would likely be effective in offsetting the effects on bull trout populations from the potential decrease in aquatic habitat resulting from decreased low flows associated with the alternatives. Effectiveness of the projects included in the bull trout mitigation plan would be assured through several steps. Initially, more detailed surveys of the mitigation streams would be conducted to provide additional data on the status of the bull trout populations in these areas and the presence of any factors that could limit success (USDA Forest Service 2013a). These data would be used in a preliminary analysis of the feasibility of each project that would be completed in the Evaluation Phase. Additional mitigation options would be identified if necessary. Mitigation projects would be initiated before the Construction Phase, and a report detailing and quantifying progress toward accomplishment of mitigation objectives would be prepared before construction began to allow MMC and the agencies to determine if and what adaptive management changes would be required to meet all objectives. Additional progress reports completed periodically throughout the mine phases would document project and mitigation effects on bull trout populations.

Beneficial and adverse impacts occurring to the bull trout populations as a result of both the alternatives and the mitigation projects would be verified and confirmed through the monitoring data (USDA Forest Service 2013a). As discussed in section 3.6.2.3, *Impact Analysis,* impacts on the aquatic populations were assessed using the best available methods, but uncertainty as to the extent and magnitude of impacts on aquatic life exists. Based on this uncertainty, use of monitoring data collected before and during the project phases would ensure that the value of the mitigation projects exceeds and precedes documented and predicted impacts for each Core Area. Adaptive management changes would be undertaken if necessary to meet those objectives.

3.6.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Alternative 4 would be similar to Alternative 2, with modifications to MMC's proposed Little Cherry Creek Tailings Impoundment as part of the alternative. All other modifications and mitigations described in Alternative 3, other than those associated with the Poorman Tailings Impoundment Site, would be part of Alternative 4.

3.6.4.4.1 Sediment

Evaluation, Construction, and Operations Phases

In general, potential sediment impacts would be similar to those predicted for Alternative 3. In Alternative 4, the permit and disturbance boundaries for the Little Cherry Creek Tailings Impoundment Site would be modified to reduce effects on RHCAs in this drainage in comparison to Alternative 2. Alternative 4 would affect 236 acres of RHCAs on National Forest System land and 147 acres of other riparian areas on private land (Table 75). Because RHCAs are designed to act as buffers to protect the streams from sediment as well as other impacts, fewer disturbances within these areas would reduce the amount of sediment that would reach the streams.

Mitigation for Alternative 4 regarding sediment reduction would be the same as for Alternative 3. Proposed road BMPs, road closure mitigation, and implementation of sediment abatement and instream stabilization measures designed to reduce sediment contribution from the identified sediment sources would reduce the contribution of sediment to most analysis area streams within the Libby Creek watershed, and would also decrease sediment delivery in the East Fork Rock Creek.

The Diversion Channel in Alternative 4 would be constructed to minimize erosion. Some periodic increases in sediment in the lower channels and Libby Creek may occur during storm events, but the sediment would likely be flushed out of the upper Libby Creek drainage by the high flows. The probability of catastrophic failure of the tailings impoundment for this alternative was not specifically evaluated, but is expected to be similar to Alternative 2 and therefore low. If it were to occur, short- and long-term effects would occur to the aquatic habitat and aquatic life as described in Alternative 2.

Closure and Post-Closure Phases

Minimal increases in stream sediment are expected in Alternative 4 once mine operations ceased. Sedimentation in the tailings impoundment diversion channels may occur as the channels re-established to accommodate runoff from the tailings impoundment. Any sedimentation would adversely affect the transplanted redband trout population in the diverted Little Cherry Creek channel. The increase in sediment in Bear Creek in Alternative 2 from surface runoff from the tailings impoundment would not occur in Alternative 4. All short- and long-term reclamation objectives in Alternative 2 are retained in Alternative 4, and all of the erosion and sediment control measures described in Alternative 2 and 3 also would be implemented. Aquatic habitat and populations within these streams would not be adversely affected in the long-term.

3.6.4.4.2 Water Quantity

All Phases

The effects of Alternative 4 on water quantity and aquatic habitat would be similar to Alternative 2. The mitigated effects on west side streams and lakes would be the same as described for Alternative 3. Alternative 4 post-mining effects would be similar to Alternative 3 except for effects on diverted Little Cherry Creek and former Little Cherry Creek. After the tailings impoundment was reclaimed, surface runoff from the impoundment would be directed to the diverted Little Cherry Creek and Drainage 10, and then into Libby Creek, rather than being directed into Bear Creek as occurs under Alternative 2. Flows in Drainage 10 would be greater than flows during operations. Average flow in the diverted creek would be about 90 percent of the original Little Cherry Creek flows. The higher flows would provide better habitat than during operations, but slightly less than currently exist in Little Cherry Creek.

3.6.4.4.3 Water Quality-Nutrients, Metals, and Temperature

All Phases

As with Alternatives 2 and 3, increased nutrient and metal concentrations may occur in analysis area streams in the Libby Creek watershed. The Water Treatment Plant would be modified to treat nitrogen compounds and phosphorus, and possibly dissolved metals, as in Alternative 3. The effects on aquatic life would be the same as Alternative 3. Temperature increases as a result of riparian disturbance, Water Treatment Plant discharges, and decreased low flows would also potentially occur, but factors such as air temperature, topography, weather, shade, streambed substrate, stream morphology, the amount of subsurface streamflow, and groundwater inflows also affect stream temperature and may make changes in stream temperature due to the project difficult to separate from natural variability. Synoptic temperature data indicates that temperature increases to Libby Creek as a result of the wastewater discharges would be minimal when mixed with the receiving water, with an increase of less than 1°F expected most months. The risk and effects of water collection and treatment system failure would be the same as Alternative 2.

3.6.4.4.4 Metals in Fish

Changes in metal concentrations in fish would be the same as discussed for Alternative 3.

3.6.4.4.5 Fish Passage and Fish Loss

Evaluation, Construction, and Operations Phases

Streams

Many of the same roads would be used for access to mine facilities in Alternative 4 as in Alternative 2. Alternative 4 would require two perennial and one other stream crossing (Table 108. As in Alternative 3, all bridges and other road work would comply with INFS standards and guidelines and Forest Service guidance (USDA Forest Service 2008a, 2015b) and KNF BMPs. The Diversion Channel at the Little Cherry Creek Impoundment would be designed for fish passage, which would provide better fish habitat than Alternative 2. As in Alternative 2, flow in the diverted Little Cherry Creek would be substantially reduced during operations, as the pumpback well system, if implemented, would likely eliminate $7Q_{10}$ flows. The loss of available habitat in the diverted Little Cherry Creek would adversely affect the redband trout population in the diverted creek because the remaining habitat would not support the population at its current numbers, if at all. Changes in fish passage in East Fork Bull River and Rock Creek drainages would be the same as Alternative 3.

Closure and Post-Closure Phases

Flow in the diverted Little Cherry Creek would likely be eliminated as long as the pumpback well system operated. The diverted creek would not be capable of supporting redband trout. Flow from the tailings impoundment at closure would be directed toward diverted Little Cherry Creek, with flow in the diverted Little Cherry Creek estimated to be 10 percent less than existing flow. Reestablishment of the redband trout population in the diverted Little Cherry Creek may be possible in the creek after the pumpback wells ceased operating and flows increased.

3.6.4.4.6 Threatened and Endangered Species

Evaluation, Construction, and Operations Phases

Alternative 4 may affect bull trout populations and would be similar to Alternative 3. The risk of increased stream temperatures due to decreased riparian shading would be greater than in Alternative 3 and similar to Alternative 2. Effects on bull trout populations in the Rock Creek and East Fork River drainages would be the same as Alternative 3.

The Wildlife Mitigation Plan, Waters of the U.S. Mitigation, and Bull Trout Mitigation Plan in Alternative 4 would be the same as Alternative 3 and are anticipated to benefit bull trout populations in the Libby Creek and its tributaries, as well as in the Rock Creek watershed. Success of the bull trout mitigation plan would be determined through monitoring. As in all alternatives, bull trout populations in the Libby Creek watershed would continue to be marginal as a result of non-project impacts such as hybridization and competition with non-native trout present within the drainage.

Closure and Post-Closures

The effects on bull trout populations with mitigation would be the same as Alternative 3.

Effects on Critical Habitat

The effect on designated critical habitat would be the same as Alternative 3.

3.6.4.4.7 Forest Service Sensitive Species and State Species of Concern

All Phases

Alternative 4 may impact redband trout. Effects on the pure redband trout population in Little Cherry Creek and the hybrid populations elsewhere within the Libby Creek drainage in Alternative 4 would be similar to effects described in Alternative 2. The diversion drainage would have higher flow post-mining and be designed for fish passage, which would provide better fish habitat than Alternative 2. As in Alternative 2, flow in the diverted Little Cherry Creek would be substantially reduced during operations, as the pumpback well system, if implemented, would likely eliminate $7Q_{10}$ flows. The loss of available habitat in the diverted Little Cherry Creek would adversely affect the redband trout population in the diverted creek because the remaining habitat would not support the population at its current numbers, if at all. The effects of the proposed mitigation plan would be the same as Alternative 3. Effects on westslope cutthroat trout would be the same in Alternative 4 as in Alternative 3. Data on the torrent sculpin populations within the analysis area are limited, but the effects on this species in Alternative 4 is expected to be similar to those under Alternative 3.

3.6.4.5 Alternative A – No Transmission Line Alternative

In Alternative A, the transmission line, substation and loop line for the Montanore Project would not be built. Possible impacts on aquatic resources due to construction, operations, and maintenance of a new transmission line would not occur.

3.6.4.6 Alternative B – North Miller Creek Transmission Line Alternative

MMC's proposed alignment for the transmission line would be in the Fisher River, Miller Creek, Midas Creek, Libby Creek, and Ramsey Creek watersheds. None of the transmission line alternatives would have any effect on analysis area lakes. All transmission line alternatives include BPA's construction of the Sedlak Park Substation and loop line. With the implementation of BMPs, no effects to aquatic resources and riparian areas would result from the construction of the Sedlak Park Substation and loop line. The effects of the alternative transmission lines and associated access roads on stream habitat and aquatic populations in area streams are discussed in this section. The transmission line would be removed following mine closure and reclamation, resulting in additional effects. Roads and disturbed areas would be contoured and revegetated following closure of the mine; sediment production over time would be minimal, resulting in benefits to the aquatic biota.

3.6.4.6.1 Sediment

This alternative would potentially cause the greatest amount of disturbance close to streams and would increase sediment delivery to area streams. The greatest effect would be in the Fisher River, Miller Creek, and Midas Creek watersheds. Effects of sediment increases on aquatic populations and habitat are discussed in section 3.6.4.2.1, *Sediment*. A Stormwater Pollution Prevention Plan would be finalized and implemented to minimize the discharge of pollutants resulting from Alternative B. Structural and non-structural BMPs would be implemented to minimize stream sedimentation.

The primary sources of sediment during construction of the transmission line would include timber clearing, road construction, and road upgrades. The transmission line would span six streams: Hunter Creek, Fisher River, an unnamed tributary of Miller Creek, Howard Creek, Libby Creek, and Ramsey Creek. In Alternative B, two structures would be located immediately adjacent to the Fisher River. Some minor amounts of sediment would likely reach the river despite BMPs to reduce sediment transport. Implementation of a SWPPP and use of BMPs, Environmental Specifications, and other design criteria would minimize sediment reaching area streams under most conditions, including large runoff-producing weather events, and should likewise minimize effects to the aquatic biota. The access road between the two structures next to the Fisher River could introduce small amounts of sediment to the Fisher River because the road would be located adjacent to the river. Two other structures would be located immediately adjacent to Miller Creek (Figure 84). Construction could introduce small amounts of sediment to Miller Creek. Stream crossings would be constructed to meet KNF and DEQ requirements. Disturbance on active floodplains would be minimized to reduce sedimentation to streams during annual runoff, and construction activities would be curtailed during heavy rains to reduce erosion.

The use of BMPs would result in sediment reductions in analysis area streams. Reductions would occur within the Libby Creek and Fisher River drainages, and would improve aquatic habitat in these areas.

Road Construction and Reconstruction

Alternative B would disturb 8.9 acres for new access roads or roads with high upgrade requirements on soils having severe erosion risk, the majority of which occur along Libby and Miller creeks and Fisher River (see Table 171, p. 910). Most soils with high sediment delivery potential disturbed by access roads occur along Ramsey, Libby, and Miller creeks and Fisher River (Figure 84). Some sediment increases would occur, particularly during periods of high activity or large storm events.

Table 78. Stream Crossings and New Road Requirements by Alternatives and Alternative Combinations.

Alternatives	Number of Stream Crossings by Transmission Line		Number of Stream Crossings by New Roads		Miles of New Road Construction
	Perennial Stream	Other Streams	Perennial Stream	Other Streams	
Transmission Line Alternatives					
B	4	16	0	5	9.9
C-R	5	15	0	0	3.1
D-R	4	18	0	0	5.1
E-R	4	19	0	1	3.2
			Combined Mine and Transmission Line Alternatives		
2 and B	NA	NA	3	6	17.2
3 and C-R	NA	NA	1	1	4.1
3 and D-R	NA	NA	1	1	6.1
3 and E-R	NA	NA	1	2	4.2
4 and C-R	NA	NA	2	1	5.4
4 and D-R	NA	NA	2	1	7.4
4 and E-R	NA	NA	2	2	5.5

Source: GIS analysis by ERO Resources Corp. using KNF data.

All transmission line alternatives would require the construction of new roads, including a short access road for the Sedlak Park Substation and loop line. Alternative B would require 9.9 miles of new road construction (Table 78). Five smaller streams would be crossed by new roads in Alternative B (Table 78). An analysis was made of the combined effects of the mine alternatives with the transmission line alternatives from new road construction. The combination of mine Alternative 2 and transmission line Alternative B would require the most new road construction with 17.2 miles of new roads. New road construction in the other mine and transmission line alternative combinations would be less, ranging from 4.1 miles to 7.4 miles (Table 78). Following MMC's Proposed Environmental Specifications (MMI 2005b) and using BMPs are predicted to reduce sediment delivery from roads used during construction. Similar effects would occur during line decommissioning.

Riparian Areas

Clearing vegetation, constructing new roads, and upgrading roads in Alternative B would disturb 30 acres of RHCAs on National Forest System land and 35 acres of other riparian areas on private land (Table 79). In the event that a large runoff-producing storm occurred during the initial reclamation period, soil losses along roads and road cuts may be locally moderate to severe. The bull trout, redband trout, westslope cutthroat trout, and sculpin populations that inhabit portions of the Fisher River drainage within the analysis area would be adversely affected by brief sediment increases, if they were to occur.

An analysis was made of the combined effects of the mine alternatives with the transmission line alternatives on RHCAs on National Forest System land and other riparian areas on private and State land. Effects on RHCAs on National Forest System land would range from 260 acres with mine Alternative 4 and transmission line Alternative C-R to 296 acres for mine Alternative 2 and transmission line Alternative B (Table 80). Much of the "other private" land affected by combinations with mine Alternatives 2 and 4 is owned by MMC in the Little Cherry Creek Impoundment Site.

Roads opened or constructed for transmission line access would remain open for maintenance and used for removal of the transmission line at mine closure. At that time, the road surface would be reseeded as an interim reclamation activity designed to stabilize the surface. Where soil had been salvaged from new roads, the road surface would be covered with soil and then reseeded. Sediment delivery would decrease following reseeding. Transmission line maintenance may periodically result in brief, minor sediment increases to streams at locations where the transmission line was located adjacent to or crossed streams. Transmission line decommissioning also may result in a brief sediment increases to streams that may temporarily affect aquatic populations and habitat.

3.6.4.6.2 Peak Streamflow

The KNF ECAC storm flow model (Appendix H) indicates that peak streamflow would increase by 12 percent in Ramsey Creek with a combination of Alternative 2 and transmission line Alternative B. All other stream peak flows in the analysis area would not be affected by Alternative B. This small increase would not substantially change fish habitat in Ramsey Creek.

3.6.4.6.3 Threatened, Endangered, or Sensitive Species

Alternative B may affect bull trout and their habitat, designated bull trout critical habitat in Libby Creek and essential excluded habitat in the Fisher River (Figure 55). Vegetation clearing and road construction may result in minor brief increases of sediment in the Fisher River and Libby Creek drainages occupied by bull trout. Alternative B would have 36 structures and 9.6 miles of new road within 1 mile of bull trout habitat. Vegetation clearing would disturb 182 acres in watersheds with occupied bull trout habitat. Following Environmental Specifications and using BMPs are predicted to reduce sediment delivery from roads used during construction. Similar effects would occur during line decommissioning.

Table 79. Effects on RHCAs and Riparian Areas by Transmission Line Alternatives.

Criteria	Alternative B – North Miller Creek	Alternative C-R – Modified North Miller Creek	Alternative D-R – Miller Creek	Alternative E-R – West Fisher Creek
Riparian Areas within Clearing Area [†]				
RHCAs on National Forest System land (ac.)	30	24	35	32
Other riparian areas on private or State land (ac.)	35	13	13	28
Total (ac.)	65	37	48	60
Number of Structures within Riparian Areas [‡]				
RHCAs on National Forest System land	9	4	6	8
Other riparian areas on private or State land	12	3	3	9
Total	21	7	9	17

[†]Acreage is based on a 150-foot clearing width for monopoles (Alternative B) and 200-foot-width for H-frame structures (other alternatives except for a short segment of the West Fisher Creek Alternative that has monopoles). Actual acreage cleared would be less than listed and would depend on tree height, slope, and line clearance above the ground.
New and upgraded roads are included in the acreage.
INFS standards and guidelines apply only to National Forest System land.
[‡]Number and location of structures are based on preliminary design.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Table 80. Effects on Riparian Areas by Combination of Mine and Transmission Line Alternatives.

Combination of Alternatives	RHCAs on National Forest System Land	Other Riparian Areas			Total
		State	Plum Creek	Other Private	
2 and B	296	0	35	152	466
3 and C-R	280	0	13	9	244
3 and D-R	291	0	13	9	255
3 and E-R	291	13	18	9	270
4 and C-R	260	0	13	147	393
4 and D-R	271	0	13	147	404
4 and E-R	269	13	15	147	413

All units are in acres. Acreage is based the disturbance area for mine alternatives and, for transmission line alternatives, on a 150-foot clearing width for monopoles (Alternative B) and 200-foot-width for H-frame structures (other alternatives except for a short segment of the West Fisher Creek Alternative that has monopoles). Actual acreage cleared would be less than listed and would depend on tree height, slope, and line clearance above the ground.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Alternative B may affect the pure and hybrid redband trout and westslope cutthroat trout populations that exist in portions of the Fisher River, Miller Creek, and Libby Creek drainages. Following the agencies' Environmental Specifications and implementing BMPs would likely prevent or minimize adverse effects to due to potential releases of fine sediment that may occur from the land clearing and road construction necessary for transmission line installation.

3.6.4.7 Alternative C-R – Modified North Miller Creek Transmission Line Alternative

The primary modification in Alternative C-R to MMC's proposed North Miller Creek Alternative would be routing the line on an east-facing ridge immediately north of the Sedlak Park Substation. This modification would result in the transmission line crossing less area with soils that are highly erosive soils and those with potential for high sediment delivery and slope failure. H-frame poles, which generally allow for longer spans and fewer structures and access roads, would be used for this alternative. In some locations, a helicopter would be used to place the structures. As in Alternative B, transmission line construction and operation are not expected to have any impact on lakes within the analysis area. The transmission line would be removed following mine closure and access roads and disturbed areas would be contoured and revegetated. Based on road sedimentation analysis, no long-term effect from these activities on the aquatic habitat and populations should occur.

3.6.4.7.1 Sediment

Compared to Alternative B, Alternative C-R has numerous mitigations that would reduce potential effects on aquatic life in streams along the transmission line corridor:

- Fewer structures and access roads in the Fisher River floodplain
- Fewer structures and access roads on highly erodible soils
- Fewer structures and access roads in RHCAs
- Structures farther from Miller Creek
- Placement into intermittent stored service of all new roads on National Forest System land
- Use of helicopter for structure placement and vegetation clearing in some areas
- Implementation of a Vegetation Removal and Disposition Plan to reduce clearing
- Limited use of heavy equipment in RHCAs

The modifications incorporated into Alternative C-R would reduce potential impacts from sedimentation by reducing the clearing necessary to construct new access roads, and decreasing erosion by altering the alignment of the transmission line. This alternative would require 3.1 miles of new road construction (Table 78). Road closure mitigation and BMPs would reduce sediment delivery in the Libby Creek and Fisher River watershed. These reductions would benefit aquatic habitat in these watersheds.

Road Construction and Reconstruction

Stream crossings of the transmission line would have one more perennial stream crossing, and one less other stream crossing than Alternative B (Table 78). No perennial streams or smaller streams would be crossed by new roads in Alternative C-R (Table 78). New access roads and closed roads with high upgrade requirements in Alternative C-R would disturb 3.1 acres of soils having severe erosion risk, and 0.5 acres of soils with high sediment delivery potential (see Table 171, p. 910). Most soils having severe erosion risk along access roads occur along Libby Creek in the extreme western portion of the transmission line, along Miller and West Fisher creeks, and near the Fisher River crossing (Figure 84). Soils having high sediment delivery potential along access roads occur along Libby and Miller creeks and along the Fisher River. Most soils having potential for slope failure along access roads occur just east of Libby Creek, along Miller Creek and east of Fisher River. Some sediment increases may occur, particularly during periods of high activity or large storm events. Following the agencies' Environmental Specifications (Appendix D), implementing access changes, and using BMPs are predicted to reduce sediment delivery from roads used during construction (see (see Table 136, p. 782). Similar effects would occur during line decommissioning. The agencies' proposed stormwater permitting and controls for the transmission line are discussed in Alternative D-R.

Riparian Areas

Alternative C-R would disturb 24 acres of RHCAs on National Forest System land and 13 acres of other riparian areas on private land (Table 79). Based on a preliminary design, four structures would be in a RHCA on National Forest System land and three structures would be in a riparian area on private land. During final design, MMC would locate these structures outside riparian areas if alternative locations were technically and economically feasible. Minimizing structure locations in riparian areas, decommissioning new access roads on National Forest System land after construction and using a helicopter for line stringing, logging, and line decommissioning would reduce potential contributions of sediment to area streams. Some small periodic sediment increases may still occur within the streams, but the likelihood of such occurrences would be substantially less than in Alternative B. MMC would use the same general methods to operate, maintain, and reclaim the line and access roads as in Alternative B. The potential for effects of sediment on fish populations would be less on Howard Creek, Ramsey Creek, West Fisher Creek, and Fisher River than for Alternative B.

3.6.4.7.2 Peak Streamflow

The KNF ECAC storm flow model (Appendix H) indicates that peak streamflow would not measurably increase in any of the streams potentially affected by Alternative C-R. No peak flow-related habitat effects would occur within the analysis area.

3.6.4.7.3 Threatened, Endangered, or Sensitive Species

Alternative C-R may affect bull trout, hybrid redband trout, and hybrid westslope cutthroat trout populations and their habitat in area drainages. Torrent sculpin are also likely present in the Miller Creek drainage and potentially inhabit other streams also, and this species may be affected by Alternative C-R. The measures discussed in section 3.6.4.7.1*, Sediment* would minimize impacts on these populations. Alternative C-R may affect designated bull trout critical habitat in Libby Creek and essential excluded habitat in West Fisher Creek where the line would cross such habitat (Figure 55). Alternative C-R would have 28 structures and 3.9 miles of new road within 1 mile of bull trout habitat. Vegetation clearing would disturb 101 acres in watersheds with occupied bull trout habitat. Following Environmental Specifications, using BMPs and the agencies' road closures for wildlife mitigation are predicted to reduce sediment delivery from roads used during construction. Similar effects would occur during line decommissioning. Fisheries mitigation, including mitigation specific for bull trout as described for mine Alternative 3, are anticipated to offset these effects.

3.6.4.8 Alternative D-R – Miller Creek Transmission Line Alternative

This alternative modifies MMC's proposal using the measures described for Alternative C-R. Instead of routing the line along an unnamed tributary of Miller Creek as in Alternative C-R, the alignment would follow Miller Creek into the Howard Creek drainage. As in Alternative B, transmission line construction and operation would not be expected to have any impact on lakes within the analysis area. New road mileage and disturbed acreage would be less in Alternative D-R than Alternative B. The transmission line would be removed following mine closure and reclamation, and roads and disturbed areas would be contoured and revegetated. Based on the road sedimentation analysis, no long-term effect from these activities on the aquatic habitat and populations should occur.

3.6.4.8.1 Sediment

Before the KNF and DEQ would allow MMC to start construction, MMC would obtain a permit to discharge stormwater from other disturbances associated with transmission line and access road construction. MMC could amend its MPDES permit or obtain coverage under Montana's General Permit for Storm Water Discharges Associated with Construction Activity if the project was eligible for coverage under the General Permit. MMC would monitor all discharges containing sediment, including those associated with the transmission line, and report sediment concentrations annually to the DEQ (see Appendix C). Any failures of the sediment BMPs detected through monitoring would require MMC to implement corrective measures in accordance with the MPDES permit. MMC would modify its SWPPP to include construction activities associated with the transmission line. Proposed instream activities would be subject to three permitting processes: a 310 permit, a 318 authorization, and a 404 permit. Installation of culverts, bridges, or other structures at perennial stream crossings would be specified in accordance with a 310 permit following on-site inspections with DEQ, Forest Service, FWP, landowners, and the local conservation district. Installation or removal of culverts or other structures in a water of the State would be in accordance with DEQ 318 authorization conditions. For activities not covered by a MPDES or general permit, MMC may request and the DEQ may approve a 318 authorization for short-term increases in turbidity and total suspended solids discussed on p. 705. All installation or removal of culverts or other structures in a water of the United States if they resulted in a discharge of fill would be in accordance with the Corps' 404 permit conditions.

It is anticipated that the levels of sediment generated through Alternative D-R would be small in volume and duration based on implementation of the BMPs and design features of the transmission line facilities. Any introduction of limited amounts of additional small gravels and fine sediment from construction of the transmission line would likely have few if any effects on macroinvertebrate and fish populations, and annual snowmelt runoff would likely flush any accumulation of fine sediments downstream each spring. MMC's point source and nonpoint source discharges containing sediment would be a small contribution to the estimated existing sediment load and the estimated future sediment load in the affected watersheds. These factors make it unlikely that effects from Alternative D-R would result in detectable adverse changes in existing levels of sediment, quality of fish habitat, or sustainability of aquatic populations over the long-term. Beginning on the effective date of the MPDES permit, MMC would monitor all discharges to surface water for sediment, and report sediment concentrations to DEQ monthly (see Appendix C). Any failures of the sediment BMPs detected through monitoring would require MMC to implement corrective measures in accordance with the MPDES permit.

Construction of the Sedlak Park Substation and loop line would not affect water quality. The BPA would obtain a general permit from the DEQ for any stormwater discharges. The BPA would prepare and implement a SWPPP during substation and loop line construction to minimize water erosion. The substation site would have a stormwater containment system.

Road Construction and Reconstruction

Alternative D-R would require 5.1 miles of new roads (Table 78). This alignment also would cross less area with soils that are highly erosive soils and those with potential for high sediment delivery and slope failure than Alternative B (see Table 171, p. 910). New access roads and closed roads with high upgrade requirements would disturb 2.6 acres of soils having severe erosion risk, and 0.5 acres of soils with high sediment delivery potential. Most of the soils having severe erosion risk that would be crossed by access roads occur along West Fisher Creek and the Fisher River. The majority of soils with high sediment delivery potential along access roads occur along Libby Creek and the Fisher River (Figure 84). No perennial streams and smaller stream would be crossed by new roads in Alternative D-R (Table 78). Following Environmental Specifications, using BMPs and the agencies' road closures for wildlife mitigation are predicted to reduce sediment delivery from roads used during construction. Similar effects would occur during line decommissioning.

The modifications incorporated into Alternative D-R would reduce potential impacts from sedimentation by reducing the clearing necessary to construct new access roads and decreasing erosion by altering the transmission line alignment. The transmission line would cross four perennial streams and 18 other streams (Table 78). The WEPP:Road Batch analysis results for the existing and proposed transmission line roads for Alternative D-R are provided in Table 136 (p. 782). Existing NFS Road #2316 currently has low traffic, and NFS roads #4724 and #4780 have high traffic. During the 2-year construction and 2-year decommissioning period for the transmission line, traffic would be high. Each individual road would have high traffic for 1 to 3 months during each period. During operations and after decommissioning, traffic levels on the three roads would return to existing conditions. The model estimated that during high use, reducing the contributing road length to 150 feet would reduce sediment leaving the road buffers by 21 percent, and during low use, would reduce sediment leaving the road buffers by an estimated 37 percent. The new transmission line roads would be graveled, and have 40- to 50-foot buffers to eliminate sediment from entering RHCAs and streams. Reducing the contributing road length and adding gravel to roads that currently do not have a gravel surface would also reduce sediment leaving the roads and buffers. When not in use, the roads would be changed to intermittent stored service roads, and would be treated to minimize erosion and sediment movement from the roads. The roads would be monitored throughout the project to ensure that BMPs implemented to minimize sediment from moving from roads to streams were effective.

Riparian Areas

Disturbance within riparian areas would be less than Alternative B, with 35 acres of RHCAs on National Forest System land and 13 acres of other riparian areas on private land (Table 79). Based on a preliminary design, six structures would be in a RHCA on National Forest System land and three structures would be in a riparian area on private or State land. During final design, MMC would locate these structures outside of riparian areas if alternative locations were technically and economically feasible. Minimizing structure locations in riparian areas, and using a helicopter for line stringing and site clearing would minimize contributions of sediment to area streams.

3.6.4.8.2 Peak Streamflow

The KNF ECAC storm flow model (Appendix H) indicates that peak streamflow would not measurably increase in any of the streams potentially affected by Alternative D-R. No peak flow-related habitat effects would occur within the analysis area.

3.6.4.8.3 Threatened, Endangered, or Sensitive Species

Effects on bull trout, bull trout critical habitat, and redband trout would be similar to Alternative C-R. Alternative D-R would have 25 structures and 4 miles of new road within 1 mile of bull trout habitat. Vegetation clearing would disturb 70 acres in watersheds with occupied bull trout habitat. Following Environmental Specifications, using BMPs and the agencies' road closures for wildlife mitigation are predicted to reduce sediment delivery from roads used during construction. Similar effects would occur during line decommissioning. More structures would be near Miller Creek than Alternatives B and C-R, potentially affecting the pure westslope cutthroat trout population in Miller Creek.

3.6.4.9 Alternative E-R – West Fisher Creek Transmission Line Alternative

This alternative modifies MMC's proposed North Miller Creek alignment by routing the line to generally follow West Fisher Creek. H-frame poles, which generally allow for longer spans and fewer structures and access roads, would be used for this alternative. Alternative E-R would include measures described for Alternative C-R. As in Alternative B, transmission line construction and operation are not expected to have any impact on lakes within the analysis area. The transmission line would be removed following mine closure and reclamation, and roads and disturbed areas would be contoured and revegetated. Any long-term effects from these activities on the aquatic habitat and populations would be minor post-operation.

3.6.4.9.1 Sediment

The modifications incorporated into Alternative E-R would reduce potential impacts from sedimentation by reducing the clearing necessary to construct new access roads and decreasing erosion by altering the transmission line alignment. The transmission line would cross four perennial streams and 19 other streams (Table 78).

Road Construction and Reconstruction

Alternative E-R would require the construction of 3.2 miles of new roads (Table 78). New access roads and closed roads with high upgrade requirements would disturb 2.9 acres of soils having severe erosion risk (see Table 171, p. 910), which occur primarily along occur along West Fisher Creek and the Fisher River (Figure 84). This alternative would affect 0.5 acre of soil with high sediment delivery potential. No perennial streams and one smaller stream would be crossed by new roads in Alternative E-R (Table 78). In the event that a large runoff-producing storm occurred during the initial reclamation period, soil losses along roads and road cuts may be locally moderate to severe. Following Environmental Specifications, using BMPs and implementing the agencies' road closures for wildlife mitigation are predicted to reduce sediment delivery from roads used during construction. Similar effects would occur during line decommissioning.

Riparian Areas

Disturbance within riparian areas would be slightly less than Alternative B, with 32 acres of RHCAs on National Forest System land and 28 acres of other riparian areas on private or State land (Table 79). Based on a preliminary design, eight structures would be in a RHCA on National

Forest System land and nine structures would be in a riparian area on private or State land. During final design, MMC would locate these structures outside of riparian areas if alternative locations were technically and economically feasible. Minimizing structure locations in riparian areas and using a helicopter for line stringing and site clearing would help minimize the potential for sediment movement to area streams.

3.6.4.9.2 Peak Streamflow

The KNF ECAC storm flow model (Appendix H) indicates that peak streamflow would not measurably increase in any of the streams potentially affected by Alternative E-R. No peak flow-related habitat effects would occur within the analysis area.

3.6.4.9.3 Threatened, Endangered, or Sensitive Species

Alternative E-R may affect bull trout, redband trout, and their habitat, and could also affect torrent sculpin if they are present in these streams. Effects on redband trout would be similar to Alternatives C-R and D-R. Alternative E-R would have more effect on bull trout than the other alternatives. About 6 miles of line and 1.5 miles of new or upgraded access roads would be in the Fisher River and West Fisher Creek watersheds, which provide occupied bull trout habitat. Vegetation clearing would disturb 177 acres in watersheds with occupied bull trout habitat. It would have the same crossings at West Fisher Creek and Libby Creek as Alternative D-R. With the exception of the modifications along Miller Creek, measures described for Alternative C-R (section 3.6.4.7.1*, Sediment*) would be used in this alternative as well and would minimize effects.

Alternative E-R would follow West Fisher Creek for about 5 miles; two segments of designated bull trout critical habitat are located in the creek (Figure 55). Alternative E-R would have 67 structures and 7.4 miles of new road within 1 mile of bull trout habitat. Following Environmental Specifications, using BMPs and the agencies' road closures for wildlife mitigation are predicted to reduce sediment delivery from roads. Similar effects would occur during line decommissioning. Effects of Alternative E-R on the critical habitat downstream of the Libby Creek and Howard Creek confluence would be the same as Alternative D-R (section 3.6.4.8.3*, Threatened, Endangered, or Sensitive Species*). Road closures and reconstruction, as well as fisheries mitigation as described for Alternative 3, are anticipated to offset these effects.

3.6.4.10 Cumulative Effects

Cumulative effects in the analysis area include past and current actions that are likely to continue in the future and reasonably foreseeable actions that could affect aquatic biota. There are ongoing and planned mine reclamation activities. Other activities that could affect the aquatic biota include timber harvesting, land clearing, home construction, road construction, septic field installation, water well drilling, livestock grazing, and stream channel and bank stabilization or restoration projects. These activities can either have adverse or beneficial effects on the aquatic biota.

3.6.4.10.1 Past Actions

Native fish populations in the Libby Creek and Fisher River drainages were first exposed to significant human-caused impacts in the late 1800s. Timber harvest and road construction affected most spawning tributaries and cumulatively impacted rearing habitats in the mainstem Kootenai River. Numerous smaller scale impacts to native fish, such as logging and road development, gradually occurred throughout the analysis area in the middle part of the 20th

century. The 1950s to the 1980s saw a rapid expansion of road construction and logging, especially on the upper watersheds of the analysis area. This period of management and heavy road construction also resulted in fragmentation of bull trout populations at undersized culvert crossings in some areas. Most of these barriers have been addressed in recent years and connectivity is not a significant issue. In recent years, some past impacts, such as culvert barriers, have been reduced or eliminated, and therefore some stressors on the population no longer play as large of a role as they did historically. Logging and road construction have decreased considerably and hundreds of road miles have been removed from the landscape in key watersheds.

Changes in fish species composition, brought about by intentional and illegal stocking programs, have created an additional impact to the system. Brook trout are the main non-native species threat; they exist in numerous tributary streams that contain bull trout. For bull trout, construction of Libby Dam in 1974 was the single-most significant impact to bull trout in the Kootenai River core area. Construction of the Thompson Falls Dam (1916), Cabinet Gorge Dam (1952), and the Noxon Dam (1958) had similar effect on bull trout in the Lower Clark Fork River core area.

Avista owns and operates the Cabinet Gorge Dam and the Noxon Dam. Avista relicensed these two dams in 1999 and, as part of the relicensing, entered into the Clark Fork Settlement Agreement, which addressed fisheries management and mitigation, including an evaluation of methods for accomplishing fish passage. Upstream passage efforts for adult bull trout began in 2001. Fish were captured downstream of the Cabinet Gorge dam in the Clark Fork River and transported to Cabinet Gorge Reservoir beginning in 2001 and to their region of origin based on genetic or previous capture history criteria beginning in 2005 (USFWS 2014c). The juvenile trap and transport program, which began in 2000, traps out-migrating juvenile bull trout from tributaries, including East Fork Bull River and Rock Creek, and transports them below Cabinet Gorge Dam. In 2014, Avista transported 63 individual adult bull trout captured in the lower Clark Fork River below Cabinet Gorge Dam to Montana, and transported 340 juvenile bull trout captured in the tributaries of Noxon and Cabinet Gorge reservoirs downstream of Cabinet Gorge Dam. These activities contributed to the ongoing effort to re-establish connectivity between Lake Pend Oreille and spawning and rearing habitat in Montana streams (Avista 2015).

Avista initiated a non-native salmonid suppression program in 2007, with non-native fish removed from the lower 2 miles of the East Fork Bull River from 2007 through 2009 using electrofishing methods. While brown trout and other non-native fish were still present in the lower reaches following this effort, monitoring in 2009 and 2010 indicated a shift toward native species was occurring in this reach (Horn and Tholl 2011).

3.6.4.10.2 Rock Creek Project

The groundwater numerical model was used to predict low flow changes to streams due to implementing both the Montanore and Rock Creek Projects. Assuming the Montanore and Rock Creek projects occur concurrently, they would cumulatively reduce streamflow and aquatic habitat in the Rock Creek, East Fork Bull River, and Bull River watersheds. Maximum effects within the analysis area would occur after both mines ceased operations, assuming they operated and closed simultaneously. The Montanore Project would not affect sediment in Rock Creek and would not contribute to a cumulative effect. No other cumulative effects would occur within these watersheds that would affect aquatic resources. Effects on streamflow would remain the same for Libby, Poorman and Ramsey creeks.

In Rock Creek, cumulative flow reductions from both projects would be 0.03 cfs greater at the mouth during low flows than reductions predicted to occur with only the Montanore Project (Table 118). The cumulative reduction in the wetted perimeter at RC-3 on East Fork Rock Creek would be 18 percent. The functioning of the core area population may be adversely affected due to additional reductions in flow at the mouth of Rock Creek, which may exacerbate the intermittency over what currently exists and would exist under the Montanore Project alone. Therefore, access to Rock Creek by migratory fish may be excluded for longer periods of time. Additionally, resident bull trout populations in Rock Creek would have longer periods of time with restricted movement, making them more susceptible to environmental changes. Recovery efforts are continuing with fish passage and habitat restoration activities addressing the main threats to the core area population. If current efforts to recover the adfluvial component under the Avista program are successful, they may negate the potential loss, and the recovery rate of the core area may not be affected (USFWS 2007a). The cumulative reductions in streamflow and wetted perimeter in East Fork Rock Creek would result in more substantial decreases in habitat availability for bull trout, westslope cutthroat trout, and macroinvertebrates than with the Montanore Project alone. With mitigation, the cumulative effect on the East Fork Rock Creek and Rock Creek would be the same as discussed if only the Montanore Project were to occur.

In the East Fork Bull River, decreased low flow would be 0.03 cfs greater in the East Fork Bull River at the mouth, and 0.08 cfs greater at EFBR-500 at the CMW boundary. The cumulative decrease at EFBR-500 would be a 13 percent reduction in low flow. Wetted perimeter was estimated to decrease by 30 percent as a result of the cumulative impacts of the projects on streamflow. For the Bull River at the mouth, the impacts of both projects would decrease estimated low flows by 1 percent. When placed into the context of a likely loss of habitat under Montanore alternatives, the cumulative effects would result in additional habitat loss downstream of St. Paul Lake including during the bull trout spawning period. It is difficult to determine with certainty whether a risk to bull trout would exist under project implementation because of the lack of data or pertinent scientific information on the relationship of underground mining effects on aquatic species (USFWS 2007a). During high flow periods, reductions in streamflow and the associated effects on aquatic habitat from the two projects would be negligible at the Bull River near the mouth.

As the mine void filled and groundwater levels above the mines and adits reached steady state conditions, effects on aquatic habitat and populations in the Rock Creek and East Fork Bull River watersheds would decrease. Cumulative effects on streamflow at steady state conditions were not quantified.

3.6.4.10.3 Other Reasonably Foreseeable Actions

The proposed Wayup Mine in upper West Fisher Creek and the Libby Creek Ventures drilling plan adjacent to Upper Libby Creek Road would have negligible effects on streamflows and water quality, and thus would not affect aquatic resources.

The Miller-West Fisher Vegetation Project would occur in the Montanore transmission line analysis area. The project would include access changes on 1.92 miles of road; 3.29 miles of new temporary road construction, and 19.2 miles of road storage, and 1.43 miles of road decommissioning; improvement, construction; reconstruction of 5.9 miles of trail tread; and removal of 17 culverts. Access changes in the Miller Creek and Fisher Creek drainages would cumulatively decrease water routing and sediment input from roads into stream channels. By removing culverts and reconstructing the stream channels where these culverts were located, the stream channel and fish habitat would begin to be restored at those crossings. Removing those culverts could also restore connectivity by reconnecting aquatic habitat. Short-term adverse effects from watershed restoration would be addressed and mitigated through timing restrictions and BMP implementation. None of the other reasonably foreseeable actions described in section 3.3 would cumulatively affect aquatic habitat adversely.

3.6.4.11 Regulatory/Forest Plan Consistency

3.6.4.11.1 Organic Administration Act and Forest Service Locatable Minerals Regulations

36 CFR 228.8 requires that mining operators minimize, where feasible, adverse environmental impacts on National Forest surface resources; comply with applicable state and federal water quality standards including the Clean Water Act; take all practicable measures to maintain and protect fisheries and wildlife habitat that may be affected by the operations; and construct and maintain all roads so as to assure adequate drainage and to minimize or, where practicable, eliminate damage to soil, water, and other resource values.

Minimize Adverse Environmental Impact (36 CFR 228.8)

Mine Alternative 2 and Transmission Line Alternative B would not fully comply with 36 CFR 228.8. In these alternative, MMC did not propose to implement feasible measures to minimize changes in streamflow or all practicable measures to maintain and protect fisheries and to minimize effect from road usage. The agencies' alternatives (Mine Alternatives 3 and 4 and Transmission Line Alternatives C-R, D-R, and E-R) would incorporate additional feasible and practicable measures to minimize adverse environmental impacts on surface water quality and fisheries habitat. These measures would include minimizing the disturbance area; developing and implementing a final Road Management Plan and a Vegetation Removal and Disposition Plan; decommissioning unused roads or placing them into intermittent stored service; constructing all stream crossings in compliance with INFS standards and guidelines; and implementing measures such as increased buffer zones and using multiple, site-specifically designed adit plugs at closure to minimize changes in streamflow. The agencies' mine and transmission line alternatives would have less disturbance in RHCAs and other riparian areas, minimizing effect on bull trout and other aquatic life. The agencies' transmission line alternatives would have few structures and new roads within 1 mile of bull trout critical habitat and less vegetation clearing in watersheds with occupied bull trout habitat.

Fisheries and Wildlife Habitat (36 CFR 228.8(e))

Compliance with state and federal water quality standards, specifically changes in streamflow and floodplains are discussed in section 3.11.4.10, *Regulatory/Forest Plan Consistency* in the subsequent *Surface Water Hydrology* section (p. 683). Section 3.13.4.11, *Regulatory/Forest Plan Consistency* in the subsequent *Water Quality* section discusses compliance with water quality laws and regulations (p. 785).

Alternative 2 would have a disturbance area of 2,582 acres. The disturbance area of Alternative 4, which would have a tailings impoundment at the same location as Alternative 2, would be smaller than Alternative 2 by 658 acres by eliminating the LAD disturbance area and minimizing the disturbance area around the tailings impoundment. The disturbance area of Mine Alternative 3 would be the smallest. Because the clearing width for Transmission Line Alternative B would be narrower than the agencies' transmission line alternatives, the maximum clearing width for Alternative B would be less than the agencies' alternatives. Clearing associated with the agencies' transmission line alternatives would be minimized through the development and implementation of a Vegetation Removal and Disposition Plan. The agencies' transmission line alternatives would have less clearing and new road development in the watersheds of impaired streams, in watersheds of Class 1 streams, and on soils with severe erosion risk, high sediment delivery, and slope failure. Sediment delivery to analysis area streams from roads in the agencies' mine and transmission line alternatives would be less than in MMC's alternatives. The agencies' mine and transmission line alternatives would have less disturbance in RHCAs and other riparian areas, minimizing effect on bull trout and other aquatic life. The agencies' transmission line alternatives would have few structures and new roads within 1 mile of bull trout critical habitat and less vegetation clearing in watersheds with occupied bull trout habitat. All mine and transmission line alternatives would include the use of BMPs to minimize erosion and effects on surface water quality. The agencies' alternatives would include more frequent BMP monitoring than MMC's alternatives. In summary, Mine Alternative 2 and Transmission Line Alternative B would not fully comply with 36 CFR 228.8 because MMC did not propose to implement feasible measures to minimize the disturbance area and adverse environmental impacts on surface water quality. Mine Alternatives 3 and 4 Transmission Line Alternatives C-R, D-R, and E-R would comply with 36 CFR 228.8 because the modifications to the disturbance area are feasible and would minimize adverse environmental impacts on fisheries habitat.

MMC's mitigation plans contained limited measures to protect fisheries habitat from changes in streamflow. The agencies' alternatives would create or secure genetic reserves through bull trout transplanting or habitat restoration; rectify factors that are limiting the potential of streams to support increased production of bull trout; and eradicate non-native fish species, especially brook trout that are a hybridization threat to bull trout.

Roads (36 CFR 228.8(f))

In all mine and transmission line alternatives, roads would be constructed and maintained to ensure adequate drainage and to minimize or, where practicable, eliminate damage to soil, water, and other resource values. The Environmental Specifications describe how transmission line roads would be constructed and maintained to ensure adequate drainage and to minimize or eliminate damage to resource values. The agencies' transmission line alternatives would have less new road development in the watersheds of impaired streams, in watersheds of Class 1 streams, and on soils with severe erosion risk, high sediment delivery, and slope failure. Sediment delivery from roads to streams in the agencies' mine and transmission line alternatives would be less than in MMC's alternatives. At the end of operations, all mine and transmission line alternatives would have roads no longer needed for operations. The agencies' mitigation provides more specificity regarding management of roads no longer needed for operations. Such roads would be placed either in intermittent stored service or decommissioned. Mine Alternative 2 and Transmission Line Alternative B would not fully comply with 36 CFR 228.8(f) as it relates to water quality because MMC did not propose to implement all practicable measures to minimize adverse environmental impacts on surface water quality and fisheries habitat. Mine Alternatives 3 and 4 Transmission Line Alternatives C-R, D-R, and E-R would comply with 36 CFR 228.8(f) as it relates to surface water quality and fisheries habitat. Additional discussion regarding compliance with 36 CFR 228.8(f) is in the *Kootenai Forest Plan* section regarding roads management (RF-2 through RF-5), beginning on page 477.

3.6.4.11.2 Endangered Species Act

All action alternatives may affect and are likely to adversely affect the bull trout and designated bull trout critical habitat. These effects were summarized in section 3.6.4.3.6, *Threatened and*

Endangered Species. The KNF submitted a BA to the USFWS that describes the potential effect on threatened and endangered species that may be present in the area (USDA Forest Service 2013a). Implementation of any of the alternatives may affect, and is likely to adversely affect threatened bull trout, may affect, and is likely to adversely affect designated bull trout critical habitat, and would have no effect on endangered white sturgeon. After review of the BA and consultation, the USFWS issued a Biological Opinion for the proposed Montanore Project in 2014.

In its 2014 Biological Opinion on the bull trout, the USFWS indicated that it was the USFWS' biological opinion that the project as proposed in the KNF's preferred Mine Alternative 3 and the agencies' preferred Transmission Line Alternative D-R is not likely to jeopardize the bull trout, and is not likely to destroy or adversely modify bull trout critical habitat (USFWS 2014c). The Service does not review or provide concurrence on no effect determinations but acknowledged the KNF's analysis that the project would have no effect on the Kootenai River white sturgeon (USFWS 2014b).

3.6.4.11.3 Wilderness Act

All mine alternatives have the potential to indirectly affect wilderness qualities. Alternatives 3 and 4 would be conducted to protect the surface resources, including aquatic resources. All alternatives would be in accordance with the general purpose of maintaining the wilderness unimpaired for future use and enjoyment as wilderness and to preserve the wilderness character consistent with the use of the land for mineral development and production in compliance with 36 CFR 228.15 and the Wilderness Act.

3.6.4.11.4 National Forest Management Act/Kootenai Forest Plan

Riparian Habitat Conservation Areas

This section discusses consistency wit2015 KFP riparian standards and guidelines relevant to the Montanore Project, as listed below.

INFS standards for RHCAs:

- Minerals management (MM-3)
- General riparian area management (RA-4)

Two additional standards for RHCAs:

- General riparian area management (FW-STD-RIP-01)
- General riparian area management (FW-STD-RIP-02)

INFS guidelines for RHCAs:

- Roads management (RF-1 through RF-5)
- Minerals management (MM-1, MM-2, and MM-6)
- Lands (LH-3 and LH-4)
- General riparian area management (RA-2 through RA-4)
- Watershed and habitat restoration (WR-1 and WR-2)
- Fisheries and wildlife restoration (FW-1 and FW-4)

Road Management Guideline RF-1

Cooperate with federal, tribal, state, and county agencies, and cost-share partners to achieve consistency in road design, operation, and maintenance necessary to attain RMOs.

All alternatives would meet the intent of this guideline. The KNF has cooperated with the DEQ and Lincoln County regarding road design, operation, and maintenance. All alternatives would include implementation of meeting both state and national BMPs for the road construction and reconstruction to contribute to the attainment of RMOs.

Road Management Guideline (RF-2)

For each existing or planned road, meet the Riparian Management Objectives and avoid adverse effects to inland native fish by:

a. completing watershed analyses prior to construction of new roads or landings in Riparian Habitat Conservation Areas within priority watersheds.

b. minimizing road and landing locations in Riparian Habitat Conservation Areas.

c. initiating development and implementation of a Road Management Plan or a Transportation Management Plan. At a minimum, address the following items in the plan:

> *1. Road design criteria, elements, and standards that govern construction and reconstruction.*
>
> *2. Road management objectives for each road.*
>
> *3. Criteria that govern road operation, maintenance, and management.*
>
> *4. Requirements for pre-, during-, and post-storm inspections and maintenance.*
>
> *5. Regulation of traffic during wet periods to minimize erosion and sediment delivery and accomplish other objectives.*
>
> *6. Implementation and effectiveness monitoring plans for road stability, drainage, and erosion control.*
>
> *7. Mitigation plans for road failures.*

d. avoiding sediment delivery to streams from the road surface.

> *1. Outsloping of the roadway surface is preferred, except in cases where outsloping would increase sediment delivery to streams or where outsloping is infeasible or unsafe.*
>
> *2. Route road drainage away from potentially unstable stream channels, fills, and hillslopes.*

e. avoiding disruption of natural hydrologic flow paths.

f. avoiding sidecasting of soils or snow. Sidecasting of road material is prohibited on road segments within or abutting RHCAs in priority watersheds.

Road width in all new and reconstructed roads would be the minimum necessary to provide for safe and efficient use. The KNF has implemented several actions independent of the Montanore Project to meet RMOs associated with road management. The Libby Ranger District completed a Roads Analysis Report for the Libby Ranger District that established road design criteria, elements, and standards that govern construction and reconstruction and developed management objectives for existing roads. The report provided a descriptive ranking of the problems and risk associated with the current road system, and a list of prioritized opportunities for addressing identified problems and risk (KNF 2005).

Mine Alternatives

Alternative 2. MMC would minimize road crossings in RHCAs and would implement BMPs to minimize sediment delivery to crossed streams. All debris removed from the road surfaces except snow and ice would be deposited away from the stream channels. Snow removal would be conducted in a manner to minimize damage to travelways, prevent erosion damage, and preserve water quality. No side casting near stream crossings and bridges would occur, or be implemented as directed by the agencies. Alternative 2 would not be in compliance with RF-2c because MMC's Plan of Operations does not address all items required by RF-2c. MMC's Plan of Operations also does not address the Libby Creek Road (NFS road #231) that would be used during the Evaluation Phase, and while the Bear Creek Road was reconstructed.

Alternatives 3 and 4. Alternatives 3 and 4 would comply with RF-2 because they provide for the development and implementation of a final Road Management Plan. MMC would develop for the lead agencies' approval, and implement a final Road Management Plan that would describe the following for all new and reconstructed roads:

- Criteria that govern road operation, maintenance, and management
- Requirements of pre-, during-, and post-storm inspection and maintenance
- Regulation of traffic during wet periods to minimize erosion and sediment delivery and accomplish other objectives
- Implementation and effectiveness monitoring plans for road stability, drainage, and erosion control
- Mitigation plans for road failures
- Analysis of any new road constructed in a RHCA, documenting it was the minimum necessary for the approved mineral activity

The plan would describe management of road surface materials during plowing, such as snow and methods to control road ice. Sidecasting of soils or snow would be avoided. Sidecasting of road material would be prohibited on road segments within or abutting RHCAs in priority bull trout watersheds. Culverts along the Bear Creek Road (NFS road #278) or the Libby Creek Road (NFS road #231) that pose a substantial risk to riparian conditions would be replaced as necessary to comply with INFS standards and guidelines and Forest Service guidance, such as fish passage or conveyance of adequate flows (USDA Forest Service 2008a, 2015b).

Transmission Line Alternatives

Alternative B. Compliance with RF-2 would be the same as Alternative 2 (see previous discussion in this section). Alternative B would not in compliance with RF-2c because MMC's Plan of Operations does not address all items required by RF-2c.

Alternatives C-R, D-R, and E-R. Compliance with RF-2 would be the same as Alternatives 3 and 4 (see previous discussion in this section). Alternatives C-R, D-R, and E-R would in compliance with RF-2 because they provide for the development and implementation of a Road Management Plan, as discussed under Alternatives 3 and 4.

Road Management Guideline (RF-3)

Determine the influence of each road on the Riparian Management Objectives. Meet Riparian Management Objectives and avoid adverse effects on inland native fish by:

a. reconstructing road and drainage features that do not meet design criteria or operation and maintenance standards, or that have been shown to be less effective than designed for controlling sediment delivery, or that retard attainment of Riparian Management Objectives, or do not protect priority watersheds from increased sedimentation.

b. prioritizing reconstruction based on the current and potential damage to inland native fish and their priority watersheds, the ecological value of the riparian resources affected, and the feasibility of options such as helicopter logging and road relocation out of Riparian Habitat Conservation Areas.

c. closing and stabilizing or obliterating, and stabilizing roads not needed for future management activities. Prioritize these actions based on the current and potential damage to inland native fish in priority watersheds, and the ecological value of the riparian resources affected.

Mine Alternative 2 and Transmission Line Alternative B. Compliance with RF-3 would be achieved by controlling sediment delivery through BMPs on new roads, reconstructing drainage features on existing roads if necessary, and obliterating and stabilizing roads not needed in the active mining phase or after mine closure and removal of the transmission line. Road design features and BMPs designed to INFS riparian goals include chip-sealing of the main access road; regular maintenance of unimproved roads; construction of bridges on main stream crossings versus culverts; placement of the tailings pipeline outside any RHCAs; installation of sediment traps and other structures as part of the stormwater and surface water runoff plan; and minimization of any stream activities during road construction (MMI 2008). MMC's Plan of Operations did not address drainage features along the Libby Creek Road (NFS road #231) that would be used during the Evaluation Phase and while the Bear Creek Road was reconstructed.

Mine Alternatives 3 and 4, and Transmission Line Alternatives C-R, D-R, and E-R. In mine Alternatives 3 and 4, compliance with RF-3 would be the same as Alternative 2 (see previous paragraph) except as follows. Culverts along the Libby Creek Road (NFS road #231) that pose a substantial risk to riparian conditions would be replaced as necessary to comply with INFS standards and guidelines and Forest Service guidance, such as fish passage or conveyance of adequate flows (USDA Forest Service 2008a, 2015b). In addition, MMC would be responsible for developing, for lead agencies' approval, a final Road and Management Plan that meets standards for RF-3. The Final Road Management Plan would address all roads all new and reconstructed roads affected by the Construction and Operations Phases of the mine and transmission line, including all roads with proposed access change, and would be incorporated into an amended Plan of Operations for the KNF.

In transmission line Alternatives C-R, D-R, and E-R, compliance with RF-3 would be the same as Alternative B (see previous discussion in this section) except as follows. The status of the transmission line roads on National Forest System land would be changed to intermittent stored service after line installation was completed. Intermittent stored service roads would be closed to traffic and would be treated so they would cause little resource risk if maintenance were not performed on them during the operation period of the mine and prior to their future need. Intermittent stored service roads would require some work to return them to a drivable condition. A culvert on roads used for maintenance access would be installed on any stream flowing at the time of use, if a culvert were not already in place. Intermittent stored service road treatments would include:

- Conducting noxious weed surveys and performing necessary weed treatments before storage activities
- Blocking entrance to road prism
- Removing culverts determined by the KNF to be high risk for blockage or failure; laying back streambanks at a width and angle to allow flows to pass without scouring or ponding so that revegetation has a strong chance of success
- Installing cross drains so the road surface and inside ditch would not route any intercepted flow to ditch-relief or stream-crossing culverts
- Removing and placing unstable material at a stable location where stored material would not present a future risk to watershed function
- Replacing salvaged soil and revegetating with grasses in treated areas and unstable roadway segments to stabilize reduce erosion potential.

Transmission line roads on National Forest System land would be decommissioned after closure of the mine and removal of the transmission line. Decommissioned roads would be removed from service and would receive a variety of treatments to minimize the effects on other resources. In addition to all of the intermittent stored service road treatments, a decommissioned road would be treated by one or more of the following measures:

- Conducting noxious weed surveys and performing necessary weed treatments before decommissioning
- Removing any remaining culverts and removing or bypassing relief pipes as necessary
- Stabilizing fill slopes
- Obliterating road prism by restoring natural slope and contour; restoring all watercourses to natural channels and floodplains
- Revegetating road prism
- Installing water bars or outsloping the road prism
- Removing unstable fills.

Road Management Guideline (RF-4)

Construct new, and improve existing, culverts, bridges, and other stream crossings to accommodate a 100-year flood, including associated bedload and debris, where those improvements would/do pose a substantial risk to riparian conditions. Substantial risk improvements include those that do not meet design and operation maintenance criteria, or that have been shown to be less effective than designed for controlling erosion, or that retard attainment of Riparian Management Objectives, or that do not protect priority watersheds from increased sedimentation. Base priority for upgrading on risk in priority watersheds and the ecological value of the riparian resources affected. Construct and maintain crossings to prevent diversion of streamflow out of the channel and down the road in the event of crossing failure.

Mine Alternative 2 and Transmission Line Alternative B. Mine Alternative 2 and Transmission Line Alternative B would not comply with RF-4. MMC would construct all new bridges on stream crossings to accommodate the 100-year flood, including associated bedload and debris. Crossings would be maintained to prevent diversion of streamflow out of the channel and down the road in the event of crossing failure. Culverts on the Bear Creek Road would be installed or extended as necessary. MMC's Plan of Operations did not address drainage features along the Libby Creek Road (NFS road #231) that would be used during the Libby Adit evaluation program, and while the Bear Creek Road was reconstructed. On roads for the transmission line, MMC anticipates that no drainage would be provided, but would follow the agencies' guidance if installation of culverts were required.

Mine Alternatives 3 and 4, and Transmission Line Alternatives C-R, D-R, and E-R. Mine Alternatives 3 and 4, Transmission Line Alternatives C-R, D-R, and E-R would comply with RF-4. In mine Alternatives 3 and 4, compliance with RF-3 would be the same as Alternative 2 except as follows. Along the Bear Creek Road (NFS road #278) and the Libby Creek Road (NFS road #231), culverts that pose a substantial risk to riparian conditions would be replaced as necessary to comply with INFS standards and guidelines and Forest Service guidance, such as fish passage or conveyance of adequate flows (USDA Forest Service 2008a, 2015b). The development and implementation of a final Road Management Plan in mine Alternatives 3 and 4, and transmission line Alternatives C-R, D-R, and E-R, would include a mitigation plan for road failures at stream crossings. For transmission line roads, culverts on roads would be installed on any stream where channel scour was present, if a culvert were not already in place. Culverts would be sized generally to convey the 100-year storm, but culvert sizing would be determined on a case-by-case basis with the lead agencies' approval of final sizing. When transmission line roads were placed into intermittent stored service, culverts would remain in place unless determined by the KNF to be high-risk for blockage or failure. All culverts would be removed when roads were decommissioned.

Road Management Guideline (RF-5)

Provide and maintain fish passage at all road crossings of existing and potential fish-bearing streams.

Minerals Management Guideline (MM-1)

Minimize adverse effects to inland native fish species from mineral operations. If a Notice of Intent indicates that a mineral operation would be located in a Riparian Habitat Conservation Area, consider the effects of the activity on inland native fish in the determination of significant surface disturbance pursuant to 36 CFR 228.4. For operations in a Riparian Habitat Conservation Area ensure operators take all practicable measures to maintain, protect, and rehabilitate fish and wildlife habitat which may be affected by the operations. When bonding is required, consider (in the estimation of bond amount) the cost of stabilizing, rehabilitating, and reclaiming the area of operations.

All Action Alternatives. All mine alternatives would have facilities located in RHCAs. This EIS considers the effects of all alternatives on inland native fish in the determination of significant surface disturbance pursuant to 36 CFR 228.4. The KNF would share responsibility with the DEQ to monitor and inspect the Montanore Project, and has authority to approve a Plan of Operations that includes all the necessary modifications to ensure that impacts on surface resources would be minimized. These modifications are incorporated into mine Alternatives 3 and 4, and transmission line Alternatives C-R, D-R, and E-R. The KNF and the DEQ would collect a reclamation bond from MMC to ensure that the land affected by the mining operation was properly reclaimed. The joint reclamation bond would be held by the DEQ to ensure compliance with the reclamation plan associated with the DEQ Operating Permit and the Plan of Operations. The KNF may require an additional bond if it determined that the bond held by the DEQ was not adequate to reclaim National Forest System land or was administratively unavailable to meet KNF requirements. The KNF and the DEQ would collect a reclamation bond for National Forest System land affected by the transmission line; the DEQ would collect a reclamation bond for private land affected by the transmission line.

Minerals Management Guideline (MM-2)

Locate structures, support facilities, and roads outside Riparian Habitat Conservation Areas. Where no alternative to siting facilities in Riparian Habitat Conservation Areas exists, locate and construct the facilities in ways that avoid impacts on Riparian Habitat Conservation Areas and streams and adverse effects on inland native fish. Where no alternative to road construction exists, keep roads to the minimum necessary for the approved mineral activity. Close, obliterate and revegetate roads no longer required for mineral or land management activities.

Mine Alternative 2 and Transmission Line Alternative B. MMC's Alternative 2 and Alternative B would not comply with MM-2. The Ramsey Plant Site would be located in a RHCA. The lead agencies identified that the Libby Plant Site, proposed in mine Alternatives 3 and 4, is a practicable alternative to the Ramsey Plant Site. The disturbance areas for LAD Area 2 would disturb the RHCA along Ramsey Creek. The LAD Areas would not be used in Alternatives 3 and 4. No alternative to road construction in RHCAs was identified for roads associated with the mine facilities. In all mine alternatives, road construction in RHCAs would be kept the minimum necessary for the approved mineral activity. MMC would avoid or minimize, to the extent practicable, locating facilities, such as the Seepage Collection Pond, in RHCAs. MMC's Alternative B would locate roads and transmission line structures in RHCAs. The lead agencies' modifications to MMC's proposed alignment and structure placement incorporated into Alternative C-R, which would reduce the number of roads and transmission line structures in RHCAs, is a practicable alternative. In Alternative 2 and Alternative B, MMC would close, obliterate and revegetate roads no longer required for mineral or land management activities.

Mine Alternatives 3 and 4, and Transmission Line Alternative C-R-R, D-R, and E-R. These alternatives incorporate modifications and mitigations to MMC's proposals that are alternatives to siting facilities in RHCAs. The LAD Areas would not be used in Alternatives 3 and 4. These alternatives would reduce the number of facilities located in RHCAs. During final design, MMC would locate these structures outside of riparian areas if alternative locations were technically and economically feasible. No alternatives exist that eliminate the need to site facilities in RHCAs. These alternatives would minimize effects on RHCAs and inland native fish. Because no alternative to road construction existed, MMC would develop a Road Management Plan that analyzed any new road constructed in a RHCA, documenting it was the minimum necessary for the approved mineral activity. Roads no longer required for mineral or land management activities would be placed into intermittent stored service or decommissioned (see INFS standard RF-3).

Minerals Management Standard (MM-3)

Prohibit solid and sanitary waste facilities in Riparian Habitat Conservation Areas. If no alternative to locating mine waste (waste rock, spent ore, tailings) facilities in Riparian Habitat Conservation Areas exists, and releases can be prevented and stability can be ensured, then:

a. analyze the waste material using the best conventional sampling methods and analytic techniques to determine its chemical and physical stability characteristics.

b. locate and design the waste facilities using the best conventional techniques to ensure mass stability and prevent the release of acid or toxic materials. If the best conventional technology is not sufficient to prevent such releases and ensure stability over the long term, prohibit such facilities in Riparian Habitat Conservation Areas.

c. monitor waste and waste facilities to confirm predictions of chemical and physical stability, and make adjustments to operations as needed to avoid adverse effects to inland native fish and to attain Riparian Management Objectives.

d. reclaim and monitor waste facilities to assure chemical and physical stability and revegetation to avoid adverse effects to inland native fish, and to attain the Riparian Management Objectives.

e. require reclamation bonds adequate to ensure long-term chemical and physical stability and successful revegetation of mine waste facilities.

Mine Alternatives-Plant Site. The Ramsey Plant Site in Alternative 2 would not comply with MM-3. The Ramsey Plant Site would be located in a RHCA and would be constructed with waste rock. The lead agencies identified that the Libby Plant Site, proposed in mine Alternatives 3 and 4, is a practicable alternative to the Ramsey Plant Site. Preliminary evaluation indicates the Libby Plant Site could be built of fill material from the large cut on the west side of the plant site. The cut and fill materials would be balanced, and waste rock would not be used in plant site construction.

Mine Alternatives-Tailings Impoundment. The tailings impoundment in all mine alternatives would comply with MM-3. Sections 2.13.4 and 2.13.5 discuss the lead agencies' analysis of alternative tailings disposal methods and locations. Compliance with INFS was a key criterion in the alternatives analysis. The lead agencies developed Alternatives 3 and 4 to minimize the extent to which RHCAs would be affected. Alternatives that would eliminate all effects on RHCAs were not identified during the agencies' analysis.

The waste material (tailings) has been analyzed using the best conventional sampling methods and analytic techniques to determine its chemical and physical stability characteristics. The waste analysis results are discussed in section 3.9, *Geology and Geochemistry*. In Alternative 2, during operations MMC would collect representative rock samples from the adits, ore zones, above, below, and between the ore zones, and tailings for static and kinetic testing. In Alternatives 3 and 4, MMC also would collect samples of the lead barren zone, altered waste zones within the lower Revett, and portions of the Burke and Wallace Formations for static and kinetic testing, assess potential for trace metal release from waste rock, and conduct operational verification sampling within the Prichard Formation during development of the new adits. Appendix C provides the agencies' Geochemical Sampling and Analysis Plan.

Potential acid-generating materials would be segregated for special handling as they were mined and would be placed under sufficient cover to minimize direct exposure to the atmosphere and precipitation. Such locations could include the inner portions of the tailings dam and inside the mine workings. No rock material would be used for construction before determination of its acid-producing potential. In addition, waste rock generated from the underground barren zone would be minimized, to the extent possible, due to higher lead concentrations present in this rock zone, and the greater potential for acid generation. Barren zone waste rock would be segregated from other waste rock and disposed underground.

All waste rock would be evaluated with water quality monitoring data to determine whether any changes in water quality were the result of acid or sulfate production. Annual reports documenting sample location, sample methods, detection limits, and testing results would be submitted to the lead agencies. Acid-base accounting results would be correlated with lithology and total sulfur analyses.

The tailings impoundment in all mine alternatives would be located and designed using the best conventional techniques to ensure mass stability and prevent the release of acid or toxic materials. Acid generation of the tailings would be unlikely, but tests of metal mobility and monitoring at the Troy Mine suggest that some metals would be mobile in tailings effluent at a near-neutral pH.

Seepage from the impoundment would be minimized by a seepage collection system. In the 1992 and 1993 RODs and the DEQ Operating Permit #00150, the lead agencies required Noranda to modify the impoundment design to minimize seepage from the tailings impoundment to the underlying groundwater. As this section discusses, MMC incorporated this requirement into the current tailings impoundment design. A seepage collection system would collect seepage from in and around the tailings impoundment. The collection system would consist of a Seepage Collection Dam and Pond, underdrains beneath the dams and impoundment, blanket drains beneath the dams, and a HDPE geomembrane liner beneath portions of the tailings impoundment (Figure 8 and Figure 25). Pumpback wells would be used to collect tailings impoundment seepage that reached groundwater. Tailings seepage would not reach any RHCAs or surface water.

MMC has addressed the stability of the tailings impoundment dams through a series of minimum allowable safety factors against failure for static and dynamic loading conditions of the facilities (Klohn Crippen 2005). MMC's design criteria are industry design standards for dam design and construction and have been established as measures of certainty for the design of safe earth and rock fill dams.

MMC's reclamation goal is to establish a post-mining environment compatible with existing and proposed land uses and consistent with the 2015 KFP. Specific objectives are: 1) long-term site stability, 2) protection of surface water and groundwater, 3) establishment of a self-sustaining native plant community where applicable and possible, 4) wildlife habitat enhancement, 5) protection of the public health and safety, and 6) attaining post-mining land use. The reclamation plan would be revised periodically to incorporate new reclamation techniques and update bond calculations. Before temporary or final closure, MMC would submit a revised reclamation plan to the lead agencies for approval.

MMC expects all stockpiled waste rock to be used in various construction activities. It is anticipated that no waste rock would remain at the LAD Area 1 stockpile after cessation of mining operations. Soil removed from this area before its use would be replaced and the area revegetated. Waste rock characterization testing would be conducted during mine operations in the event that unanticipated modifications to the reclamation plan were required.

The KNF and the DEQ would require a reclamation bond adequate to ensure long-term chemical and physical stability and successful revegetation of mine waste facilities (see discussion of INFS standard MM-1).

Minerals Management Guideline (MM-6)

Develop inspection, monitoring, and reporting requirements for mineral activities. Evaluate and apply the results of inspection and monitoring to modify mineral plans, leases, or permits as *needed to eliminate impacts that prevent attainment of Riparian Management Objectives and avoid adverse effects on inland native fish.*

All Action Alternatives. All action alternatives would comply with MM-6. In Alternative 2 and Alternative B, MMC would follow all inspection, monitoring, and reporting requirements for mineral activities developed by the agencies. MMC would evaluate and apply the results of inspection and monitoring to modify mineral plans, leases, or permits as needed to eliminate impacts that prevent attainment of RMOs and avoid adverse effects on inland native fish. In the other action alternatives, the lead agencies have modified the monitoring and reporting requirements to better assess the effects of the proposed project (see Appendix C).

Lands Guideline (LH-3)

Issue leases, permits, rights-of-way, and easements to avoid effects that would retard or prevent attainment of the Riparian Management Objectives and avoid adverse effects on inland native fish. Where the authority to do so was retained, adjust existing leases, permits, rights-of-way, and easements to eliminate effects that would retard or prevent attainment of the Riparian Management Objectives or adversely affect inland native fish. If adjustments are not effective, eliminate the activity. Where the authority to adjust was not retained, negotiate to make changes in existing leases, permits, rights-of-way, and easements to eliminate effects that would prevent attainment of the Riparian Management Objectives or adversely affect inland native fish. Priority for modifying existing leases, permits, rights-of-way, and easements would be based on the current and potential adverse effects on inland native fish and the ecological value of the riparian resources affected.

All Mine Alternatives. All mine alternatives would comply with LH-3. The KNF issuance of any permit or approval associated with the Montanore Project would avoid effects that would retard or prevent attainment of the RMOs and avoid adverse effects on inland native fish.

Alternative B. Alternative B would comply with LH-3. Compliance with LH-3 would be achieved through minimizing vegetation clearing and adverse effects in RHCAs through the use of steel monopoles, which would require a clearing area up to 150 feet. Clearing associated with Alternative B would occur outside RHCAs, if possible. If clearing were necessary in an RHCA, effects would be minimized through use of appropriate BMPs.

Other Transmission Line Alternatives. The other transmission line alternatives would comply with LH-3. Structure type in Alternatives C-R, D-R, and E-R would be H-frame wooden poles (except for a short segment on Alternative E-R), which would require a clearing area up to 200 feet. Wooden H-frame structures generally allow for longer spans and require fewer structures and access roads in RHCAs. Some structures would be installed using a helicopter to minimize road construction and vegetation clearing in RHCAs. Disturbance and vegetation clearing in RHCAs at stream crossings would be minimized through implementation of a Vegetation Clearing and Disposal Plan. As mitigation, MMC would leave large woody material for small mammals and other wildlife species within the cleared transmission line corridor on National Forest System land.

Lands Guideline LH-4

Use land acquisition, exchange, and conservation easements to meet RMOs and facilitate restoration of fish stocks and other species at risk of extinction.

All alternatives would be consistent with LH-4. None of the alternatives would use land acquisition, exchange, and conservation easements specifically to meet RMOs and facilitate restoration of fish stocks and other species at risk of extinction. All alternatives include land acquisition and conservation easements that may contribute to the recovery of the bull trout.

General Riparian Area Management Guideline (RA-2)

Trees may be felled in Riparian Habitat Conservation Areas when they pose a safety risk. Keep felled trees on site when needed to meet woody debris objectives.

All Action Alternatives. Timber harvest in RHCAs in LAD Area 2 in Alternative 2 is discussed in the previous INFS standard TM-1. Trees cleared in RHCAs for the transmission line would be limited to those that pose a safety risk. Developing and implementing a Vegetation Removal and Disposition Plan, minimizing heavy equipment use in RHCAs (Environmental Specifications, Appendix D), and using helicopters for structure placement and vegetation clearing in Alternatives C-R, D-R, and E-R would minimize clearing and disturbance in RHCAs. Alternatives C-R, D-R, and E-R would comply with RA-2.

General Riparian Area Management Guideline (RA-3)

Apply herbicides, pesticides, and other toxicants, and other chemicals in a manner that does not retard or prevent attainment of Riparian Management Objectives and avoids adverse effects on inland native fish.

All Action Alternatives. All action alternatives would comply with RA-3. In Alternative 2 and Alternative B, measures outlined in MMC's Weed Control Plan approved by the Lincoln County Weed Control District would be followed during operations and reclamation. All herbicides used in the analysis area would be approved for use in the KNF, and would be applied according to the labeled rates and recommendations to ensure the protection of surface water, ecological integrity, and public health and safety. In the other action alternatives, MMC also would implement all weed BMPs identified in Appendix A of the KNF Invasive Plant Management Final EIS (KNF 2007a) for all weed-control measures. These measures would ensure that herbicides, pesticides, and other toxicants, and other chemicals were used in a manner that would not retard or prevent attainment of RMOs and would avoid adverse effects on inland native fish.

General Riparian Area Management Standard (RA-4)

Prohibit storage of fuels and other toxicants within Riparian Habitat Conservation Areas. Prohibit refueling within Riparian Habitat Conservation Areas unless there are no other alternatives. Refueling sites within a Riparian Habitat Conservation Area must be approved by the Forest Service or Bureau of Land Management and have an approved spill containment plan.

Mine Alternatives. MMC's Alternative 2 would not comply with RA-4. Fuel storage at the Ramsey Plant Site would be about 150 feet from Ramsey Creek, within the Ramsey Creek RHCA. The lead agencies identified that the Libby Plant Site, proposed in mine Alternatives 3 and 4, is a practicable alternative to the Ramsey Plant Site. Fuel storage at the Libby Plant site would not be within a RHCA. MMC's Spill Response Plan provides a spill containment and response plan. Alternatives 3 and 4 would comply with RA-4.

Watershed and Habitat Restoration Guideline (WR-1)

Design and implement watershed restoration projects in a manner that promotes the long-term ecological integrity of ecosystems, conserves the genetic integrity of native species and contributes to attainment of Riparian Management Objectives.

All Action Alternatives. Alternative 2 and B would not comply with WR-1. The fisheries mitigation proposed in Alternative 2 was developed in 1993 during the permitting of the original Montanore Project, and did not focus on bull trout or designated bull trout critical habitat. The agencies' mitigation plans for the agencies' alternatives would promote the long-term ecological integrity of ecosystems, conserve the genetic integrity of native species, and contribute to attainment of the RMOs. About 52 miles of proposed access changes and either placing roads into intermittent stored service or decommissioning them would reduce sediment to area creeks and contribute to attainment of the RMOs.

Watershed and Habitat Restoration Guideline WR-2

Cooperate with federal, state, local, and tribal agencies, and private landowners to develop watershed-based Coordinated Resource Management Plans (CRMPS) or other cooperative agreements to meet RMOs.

All alternatives would be consistent with WR-2 for the reasons described above for RF-1.

Fisheries and Wildlife Restoration Guideline (FW-1)

Design and implement watershed fish and wildlife habitat restoration and enhancement actions in a manner that contributes to attainment of the Riparian Management Objectives.

All Action Alternatives. Alternative 2 and B would not comply with FW-1. The fisheries mitigation proposed in Alternative 2 was developed in 1993 during the permitting of the original Montanore Project, and did not focus on bull trout or designated bull trout critical habitat. The agencies' mitigation plans for the agencies' alternatives would contribute to attainment of the RMOs. About 52 miles of proposed access changes and either placing roads into intermittent stored service or decommissioning them would reduce sediment to area creeks and contribute to attainment of the RMOs.

Fisheries and Wildlife Restoration Guideline (FW-4)

Cooperate with federal, tribal, and state fish management agencies to identify and eliminate adverse effects on inland native fish associated with habitat manipulation, fish stocking, fish harvest, and poaching.

All alternatives would be consistent with FW-4 for the reasons described above for RF-1.

Riparian Standard (FW-STD-RIP-01)

When RHCAs are intact and functioning at desired condition, then management activities shall maintain or improve that condition. Short-term effects (effects that occur during, or immediately following, implementation of activity) from activities in the RHCAs may be acceptable when those activities support long-term benefits (benefits that occur following completion of the activity) to the RHCAs and aquatic resources.

Riparian Standard (FW-STD-RIP-02)

When RHCAs are not intact and not functioning at desired condition, management activities shall include restoration components that compensate for project effects to promote a trend toward desired conditions. Large-scale restoration plans or projects that address other cumulative effects within the same watershed may be considered as compensatory components and shall be described during site-specific project analyses.

None of the alternatives would comply with these standards. MMC did not propose practicable and feasible measures to minimize effects on bull trout, RHCAs, wetlands, and streams. In addition, MMC's alternatives would not adequately mitigate for adverse effects on bull trout, RHCAs, wetlands, and streams. Compliance with INFS was a key criterion in the alternatives analysis. To be consistent with INFS standard MM-3, the agencies developed Alternatives 3 and 4 to minimize the extent to which RHCAs would be affected. Alternatives that would eliminate all effects on RHCAs were not identified.

Section 2.12, *Forest Plan Amendment*, describes the project-specific amendments to the 2015 KFP that the KNF would adopt in all mine and transmission line alternatives. The amendments would allow all mine and transmission line alternatives to adversely affect RHCAs. Design features cannot be applied to the project to maintain or improve RHCAs. The amendment would apply to National Forest System lands affected by the Montanore Project facilities, and would not apply to State or private lands. No riparian standards apply to BPA's Sedlak Park Substation and loop line, which would be on private land and avoid effects on riparian areas. A significance determination of the amendments will be in the ROD and is available in the project record.

Standard Hellgate Treaty of 1855

The Hellgate Treaty of 1855 reserved for the Kootenai Nation, among other rights, "the right to fish at all usual and accustomed places…on open and unclaimed lands." The 2015 KFP recognizes these treaty rights, and allows the Flathead/Kootenai-Salish Indian tribes to fish within the KNF. Ongoing consultation with the CSKT ensures that tribal treaty rights are protected. Section 3.5*, American Indian Consultation* discusses American Indian rights.

Forest Service Sensitive Species Statement of Findings

This analysis serves as the biological evaluation for effects on Forest Service sensitive aquatic species associated with the various alternatives for implementing the Montanore Project. Implementing the action alternatives ***may impact westslope cutthroat trout individuals or habitat within the analysis area, but would not likely contribute to a trend toward federal listing or cause a loss of viability to the population or species***. Alternatives 2 and 4 ***may impact individual redband trout and habitat within the analysis area, but would not contribute to a trend toward federal listing or cause a loss of viability to the population or species***. The action alternatives would have ***no impact on the western pearlshell***.

Transmission line construction and decommissioning, as well as some road status changes, may briefly increase sediment delivery to streams, but longer-term decreases would occur under all alternatives, and would benefit aquatic habitat in analysis area streams. The reductions in low flows would result in decreased aquatic habitat for redband trout in some tributary reaches within the Libby Creek watershed. Increases in flows as a result of the Water Treatment Plant discharges would increase available habitat within the reaches of Libby Creek in which redband trout are present and likely offset the decreased habitat available in the tributaries to some extent. Most subpopulations in the analysis area are currently hybridized to some extent, and this would continue to be a risk to the redband trout populations.

The reduction in habitat and decreased flows in Little Cherry Creek in Alternatives 2 and 4 from construction and use of the tailings impoundment would adversely affect the pure interior redband trout population in this stream. The population would be unlikely to re-establish after mine closure and reclamation, and would represent a loss of these redband trout and of genetic diversity. These losses would affect interior redband trout individuals or habitat within the analysis area, but would not likely contribute to a trend toward federal listing or cause a loss of viability to the population or species. The reduced habitat and flows would not occur under

Alternative 3. The 2014 Conservation Agreement entered into by the Forest Service, USFWS, FWP, and other parties would remain in effect.

The streamflow reductions in East Fork Rock Creek and the East Fork Bull River during the low flow period of the year would reduce habitat availability for westslope cutthroat trout, but would not likely contribute to a trend toward federal listing or cause a loss of viability to the population or species. As with redband trout, hybridization would remain a threat to these populations. In summary, this effects analysis demonstrates that the effects of implementing Mine Alternatives 2, 3, or 4 and Transmission Line Alternatives B, C-R, D-R, and E-R may impact westslope cutthroat trout or interior redband trout and their habitat, but would not likely contribute to a trend toward federal listing of the population of westslope cutthroat trout or interior redband trout. The 2007 Conservation Agreement entered into by the DEQ, FWP, and other parties would remain in effect.

3.6.4.12 Short- and Long-Term Effects

Short-term effects of construction and operation of the project in all alternatives would include increases in sediment in streams as a result of construction in or near streams within the Libby Creek and West Fisher Creek watersheds. The potential for increases in sediment to streams in these watersheds in Alternatives 3 and 4 would be less. While all of the transmission line alternatives pose some risk of brief increased sedimentation in analysis area streams, Alternative C-R represents the lowest risk of adverse effects from the transmission line and access roads. There would be few, if any, adverse effects on fish populations because increases in stream sediment below construction sites would be brief, and BMPs would be implemented to minimize instream sediment increases. BMPs and road closures under Alternative 3 and 4 would greatly reduce sediment delivery to analysis area streams compared to existing conditions, resulting in long-term benefits for aquatic biota.

Long-term effects of the project would include a permanent loss of 15,600 feet of the pure redband trout habitat in Little Cherry Creek due to the construction of the tailings impoundment and diversion channel in Alternative 2, and a similar loss of habitat in Alternative 4. No pure redband trout habitat in Little Cherry Creek would be lost in Alternative 3. This loss of habitat would adversely affect the pure redband trout population that currently exists in Little Cherry Creek. Although not specifically aimed at mitigation for pure redband trout populations, habitat improvement and mitigation measures included (to varying extent) in Alternatives 2, 3, and 4 would result in restoration of stream habitat and recreational access lost due to the development of the diversion channel and other mine facilities.

Long-term decreases in flow in the Libby Creek, Rock Creek, and the East Fork Bull River watersheds are predicted to occur for all action alternatives during and after mine operations. After groundwater levels reached steady state conditions, flow in these streams would be higher than during and after mine operations, but flows in some streams would not return to pre-mine conditions. Mitigation would reduce effects to streamflows and Rock Lake, and would result in flows in most streams returning nearly to existing conditions at steady state. Streamflow in Little Cherry Creek would permanently increase compared to existing conditions with mitigation in Alternative 3. Although some of the predicted flow changes may not be detectable or separable from natural flow variability, any decrease in flow could have adverse long-term effects on the bull trout, redband trout, and westslope cutthroat trout populations by decreasing available habitat in these streams during certain times of the year. Bull trout may be particularly affected by these decreases because the habitat loss would occur during their spawning period. The East Fork Bull River is considered one of the most important bull trout spawning streams in the lower Clark Fork River drainage. Changes would likely not be detectable once steady state conditions are reached in this stream, but decreased low flows would affect habitat availability for these trout in the Operations, Closure, and Post-Closure phases. The Little Cherry Creek Diversion Channel would reduce the available habitat by 15,600 feet for the pure redband populations in Little Cherry Creek using Alternatives 2 and 4.

Mitigation projects would be included in Alternatives 2, 3, and 4, and, if successful, would benefit aquatic habitat and salmonid populations in analysis area streams. The bull trout mitigation plan in Alternative 3 would include multiple projects that are projected to account for the impacts predicted to occur to bull trout populations and critical habitat in the Kootenai River and Lower Clark Fork River Core Areas. The Waters of the U.S. mitigation would increase flows in Little Cherry Creek and restore aspects of the stream habitat in this stream and in Swamp Creek.

3.6.4.13 Irretrievable and Irreversible Commitments

The Little Cherry Creek diversion would reduce available habitat by 15,600 feet for the small, pure redband population in Little Cherry Creek in Alternatives 2 and 4. These alternatives would irreversible loss of genetic diversity from the redband trout population found in Little Cherry Creek if proposed efforts to collect and transfer fish from the affected segment of Little Cherry Creek to the diversion drainage were not entirely successful or if flow was not adequate to support the population, as expected. Even if flows were sufficient to support some trout, the loss of habitat in Little Cherry Creek would result in a decrease in redband populations in that stream with these alternatives. The loss of habitat would not occur under Alternative 3.

Hybridization of the pure redband trout population in Little Cherry Creek is unlikely to occur in Alternative 3, but may occur in Alternatives 2 and 4 if barriers did not develop in the diversion drainage as predicted, and the redband trout were to come in contact with non-native trout in the Libby Creek drainage. Habitat restoration efforts would be included in Alternative 2, and to a greater extent in Alternatives 3 and 4, and would provide mitigation for the loss of trout habitat in Little Cherry Creek by restoring portions of Libby Creek or other streams within the drainage.

Alternatives 2, 3, and 4 could irreversibly reduce bull trout and westslope cutthroat trout habitat in Rock Creek and East Fork Bull River drainages due to decreases in flow. Mitigation would slightly reduce effects on streamflows and aquatic habitat in both streams in Alternatives 3 and 4. Loss of bull trout habitat in the East Fork Bull River in all alternatives could be detrimental to bull trout populations in the lower Clark Fork River because this stream is considered a primary spawning location in this system. The planned mitigation projects for bull trout are projected to mitigate for the impacts predicted to occur to bull trout populations and critical habitat in the Kootenai River and Lower Clark Fork River Core Areas.

3.6.4.14 Unavoidable Adverse Environmental Effects

Mining of the ore body would unavoidably reduce streamflow and spring flows, and affect lake levels in Rock and St. Paul lakes. Decreased streamflows would result in the loss of aquatic habitat in the Libby Creek, Rock Creek, and East Fork Bull River watersheds. Water levels are predicted to reach steady state conditions 1,150 to 1,300 years after mining ceased. The actual time to reach steady state conditions may be shorter or longer and would be reevaluated using the 3D model after additional data were collected during the Evaluation Phase.